The Exoplanet Handbook

Second Edition

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Appendixes C–F

Updated to the exoplanet content at the NASA Exoplanet Archive,
and associated primary references, as of the end of 2019

Version 1, 29 January 2020

Note that:
(1) host star names (bold) are hyperlinked to the NASA Exoplanet Archive 'Planet Host Overview' page
(2) citations are hyperlinked to the relevant Reference page
(3) each ⊳ symbol following the citation is hyperlinked to the associated SAO/NASA ADS Abstract page
(4) reference keys are not (necessarily) congruent with those given in the published Second Edition
(5) I would be pleased to receive notification of errors/major omissions: mac.perryman(at)gmail.com

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Appendix C. Radial velocity exoplanets

This (updated) appendix includes objects appearing in the online NASA Exoplanet Archive as of 31 December 2019, along with a small number of other candidates or retracted systems (the published Second Edition was complete to end 2017).

These notes list some key attributes of the system to underline its particular interest, give some indication of the attention the object has received (through the length of the bibliography), and provide a concise note on each paper to serve as a guide to the literature and a narrative of the progress in understanding the system. It makes no claim for completeness, and CDS–SIMBAD should be consulted for more details.

It includes only cross-identifications which are relevant in context, e.g., as used in the early discovery literature. CDS–SIMBAD or the NASA Exoplanet Archive should be consulted for other aliases. If a different alias was used in the NASA archive, this is explicitly noted.

The electronic version includes three classes of hyperlink: the object identifier (in bold) is linked to the host star page of the NASA Exoplanet Archive (it will be invalid if their syntax changes); each citation is linked to the bibliography; and the ▷ icon following the citation links to the relevant ADS page.

Radial velocity planets which transit: A small number of planets discovered through radial velocity measurements have been subsequently found to transit (such as HD 189733 and HD 209458). Since the majority of the corresponding literature relates to the transits, a cross-reference is made to the appendix on transiting planets, where the full bibliography is listed.

Transiting systems with radial velocity discoveries: Similarly, for systems discovered through transit photometry, where other planets were subsequently discovered by radial velocity measurements, the radial velocity discoveries are noted explicitly here, but also cross-referenced to the more complete bibliography in the appendix on transiting planets.

Notes on individual systems

Constellation identifiers

υ **And** ≡ HR 458; 3-planet system with planets c and d in eccentric orbits; planet e unconfirmed; discovery of planet b, and evidence for planet c (Butler et al., 1997)▷ stellar properties (Baliunas et al., 1997)▷ stellar properties (Fuhrmann et al., 1998)▷ discovery of planets c and d (Butler et al., 1999)▷ line profile variations (François et al., 1999)▷ orbit stability in the 3-planet system (Laughlin & Adams, 1999)▷ mass limits from Hipparcos astrometry (Mazeh et al., 1999)▷ **2000:** search for radio emission (Bastian et al., 2000)▷ models of the spacing of planetary systems (Laskar, 2000)▷ orbit stability (Rivera & Lissauer, 2000)▷ orbit stability (Stepinski et al., 2000)▷ tidal constraints on mass (Trilling, 2000)▷ orbit stability and planet eccentricities (Barnes & Quinn, 2001)▷ apsidal alignment in planets c and d (Chiang et al., 2001)▷ orbit stability (Ito & Miyama, 2001)▷ orbit stability (Jiang & Ip, 2001)▷ orbit stability and planet inclinations (Lissauer & Rivera, 2001)▷ eccentricity excitation and apsidal resonance capture (Chiang & Murray, 2002)▷ limits on reflected light from planet b (Collier Cameron et al., 2002)▷ imaging of co-moving stellar companion (Lowrance et al., 2002)▷ tidal, spin, and dynamical evolution (Mardling & Lin, 2002)▷ expectation of apsidal oscillation (Michtchenko & Malhotra, 2004)▷ ELODIE observations (Naef et al., 2004)▷ **2005:** planet–planet scattering and coupled orbit evolution (Ford et al., 2005)▷ dynamical survival of planet b (Nagasawa & Lin, 2005)▷ orbit dependence of chromospheric activity and magnetic interaction (Shkolnik et al., 2005)▷ phase-dependent infrared brightness variations from Spitzer (Harrington et al., 2006)▷ orbit stability (Michtchenko et al., 2006)▷ magnetic communication in hot Jupiters (Preusse et al., 2006)▷ proximity to 5:1 resonance (Libert & Henrard, 2007)▷ orbit stability (Rivera & Haghighipour, 2007)▷ enhanced stellar magnetic activity due to close-in planet (Lanza, 2008)▷ consistency with a stable Kozai-resonant state (Libert & Tsiganis, 2009)▷ **2010:** phase-dependent infrared brightness variations from Spitzer, and atmospheric circulation (Crossfield et al., 2010)▷ 30° relative inclination of planets c and d from HST–FGS (McArthur et al., 2010)▷ origin of the mutually inclined orbits of planets c and d (Barnes et al., 2011b)▷ planet e inferred from Keplerian fit (Curiel et al., 2011)▷ magnetic interaction with host star (Kopp et al., 2011)▷ limits on X-ray variability due to star–planet interaction (Poppenhaeger et al., 2011)▷ improved mass limits from Hipparcos astrometry (Reffert & Quirrenbach, 2011)▷ Bayesian modeling (Tuomi et al., 2011)▷ stellar parameters from interferometry with CHARA–VEGA (Ligi et al., 2012)▷ secular evolution in second-order Hamiltonian expansion (Libert & Sansottera, 2013)▷ **2015:** 3d dynamical stability analysis (Deitrick et al., 2015)▷ detection of H_2O-vapour from planet radial velocity from Keck–NIRSPEC (Piskorz et al., 2017)▷ hot Jupiter migration attributed to disk interactions (Wang et al., 2017a)▷

14 And discovery (Sato et al., 2008b)▷ interferometry (Ligi et al., 2012)▷

ξ **Aql** discovery (Sato et al., 2008a)▷

91 Aqr ≡ HD 219449; discovery (Mitchell et al., 2013)▷

μ **Ara** ≡ HD 160691 (as listed in NASA); 4-planet system; discovery of planet b (Butler et al., 2001)▷ evidence for planet c (Jones et al., 2002a)▷ dynamical constraints on planet c (Kiseleva-Eggleton et al., 2002)▷ dynamical stability (Bois et al., 2003)▷ dynamical stability (Goździewski et al., 2003)▷ discovery/confirmation of planet c (McCarthy et al., 2004)▷ discovery/confirmation of planet c (Santos et al., 2004)▷ asteroseismology (Bouchy et al., 2005a)▷ asteroseismology (Bazot et al., 2005)▷ dynamical constraints on the 2-planet system (Goździewski et al., 2005)▷ orbital stability (Goździewski et al., 2007)▷ discovery of planets d and e (Pepe et al., 2007)▷ dynamical constraints on the 4-planet system (Short et al., 2008)▷ asteroseismology (Soriano & Vauclair, 2008)▷ asteroseismology (Soriano & Vauclair, 2010)▷ effects of oscillation and stellar granulation (Dumusque et al., 2011b)▷ mass constraints from Hipparcos astrometry (Reffert & Quirrenbach, 2011)▷ habitability of hypothetical exomoon (Hinkel & Kane, 2013a)▷ gravitational quantisation of orbits (Geroyannis, 2015)▷

α **Ari** discovery and unstable acoustic pulsations (Lee et al., 2011a)▷ see also earlier observations (Kim et al., 2006)▷

30 Ari B see transiting systems

τ **Boo** ≡ HR 5185 ≡ HD 120136; discovery (Butler et al., 1997)▷ stellar properties (Baliunas et al., 1997)▷ line profiles (Brown et al., 1998b)▷ line profiles (Brown et al., 1998a)▷ stellar properties (Fuhrmann et al.,

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1998)▷ limits on reflected light (Charbonneau et al., 1999)▷ claimed detection of reflected light (Collier Cameron et al., 1999)▷ search for radio emission (Bastian et al., 2000)▷ limits on CH_4 (Wiedemann et al., 2001)▷ search for stellar companions (Patience et al., 2002)▷ limits on reflected light (Leigh et al., 2003a)▷ dynamical stability (Musielak et al., 2005)▷ stellar magnetic field and spin–orbit synchronisation (Catala et al., 2007)▷ search for radio emission (Lazio & Farrell, 2007)▷ stellar magnetic field and differential rotation (Donati et al., 2008)▷ enhanced stellar magnetic activity due to close-in planet (Lanza, 2008)▷ stellar variability induced by planet orbit (Walker et al., 2008)▷ limits on polarisation variability (Fares et al., 2009)▷ polarisation (Lucas et al., 2009)▷ magnetic field and radio emission (Reiners & Christensen, 2010)▷ CO absorption and orbit inclination (Brogi et al., 2012b)▷ X-ray studies (Poppenhaeger et al., 2012b)▷ stellar variability induced by planet orbit (Ruban & Arkharov, 2012)▷ CO absorption and orbit inclination (Rodler et al., 2012)▷ search for radio emission (Stroe et al., 2012)▷ models of stellar wind and planetary radio emission (Vidotto et al., 2012)▷ stellar magnetic field topology (Fares et al., 2013)▷ search for radio emission (Hallinan et al., 2013)▷ CO absorption and orbit inclination (Rodler et al., 2013b)▷ detection of H_2O from high-resolution L-band spectroscopy (Lockwood et al., 2014)▷ magnetic activity and asteroseismology from HARPS–N (Borsa et al., 2015)▷ time scales of radio emission variability (See et al., 2015)▷ evolving magnetic topology (Mengel et al., 2016)▷ temporal variability of the stellar wind (Nicholson et al., 2016)▷ four-month stellar chromospheric and coronal activity cycle (Mittag et al., 2017)▷ sub-year magnetic chromospheric activity cycle and activity phase jumps (Schmitt & Mittag, 2017)▷ orbit orientation from rotation period and magnetic field (Bychkov et al., 2018)▷ limits on reflected light from UVES, ESPaDOnS, NARVAL–UES and HARPS-N spectroscopy 1998–2013 (Hoeijmakers et al., 2018c)▷ radio emission from supermassive hot Jupiters via cyclotron maser instability (Weber et al., 2018)▷

24 Boo short-period planet around an evolved star; discovery (Takarada et al., 2018)▷

α Cen A/B not in NASA archive; unconfirmed Earth-mass planet in 3-d orbit around component B of a close stellar binary (Dumusque et al., 2012)▷ feasibility of probing by radar (Rzhiga, 1985)▷ as an example of the elliptic restricted problem (Benest, 1988)▷ Li abundance (King et al., 1997b)▷ ^{9}Be abundance of stellar components (King et al., 1997a)▷ analysis of planetary stability (Wiegert & Holman, 1997)▷ **2000:** theoretical stellar models (Guenther & Demarque, 2000)▷ gravitational lenses (Maccone, 2000)▷ planetary limits from ESO Coudé search (Endl et al., 2001)▷ as an example of formation of terrestrial planets in close binary systems (Barbieri et al., 2002)▷ terrestrial planet formation (Quintana et al., 2002)▷ asteroseismology (Thévenin et al., 2002)▷ asteroseismology (Thoul et al., 2003)▷ oscillation frequencies and mode lifetimes (Bedding et al., 2004)▷ theoretical stellar models including seismology (Eggenberger et al., 2004)▷ **2005:** solar-like oscillations of host star (Kjeldsen et al., 2005)▷ seismology (Miglio & Montalbán, 2005)▷ formation and detectability of terrestrial planets (Guedes et al., 2008)▷ difficulties of accretion (Thébault et al., 2008)▷ planet formation in habitable zone (Thébault et al., 2009)▷ **2010:** planetesimal accretion in binaries (Xie et al., 2010b)▷ role of snowball growth (Xie et al., 2010a)▷ planetary detection limits with stellar noise (Dumusque et al., 2011b)▷ Bayesian analysis of stellar parameters (Bazot et al., 2012)▷ discovery of planet b (Dumusque et al., 2012)▷ oscillation in the habitable zone (Forgan, 2012)▷ models of circumstellar disk (Müller & Kley, 2012)▷ dynamical stability of planets (Popova & Shevchenko, 2012)▷ detectability with ELTs (Crossfield, 2013)▷ habitable zone (Eggl et al., 2013)▷ effects of noise in the radial velocity signal (Hatzes, 2013b)▷ suggestion of planet around α Cen A from abundance analysis (Hinkel & Kane, 2013b)▷ habitable zone (Kaltenegger & Haghighipour, 2013)▷ detectability of polarisation with SPHERE–ZIMPOL (Milli et al., 2013)▷ planet formation in small separation binaries (Rafikov, 2013)▷ dynamical stability of terrestrial planets (Andrade-Ines & Michtchenko, 2014)▷ probing by interstellar radar (Scheffer, 2014)▷ **2015:** improved accuracy from scattered light analysis (Bergmann et al., 2015)▷ HST transit search (Demory et al., 2015)▷ radial velocities from Mt John–HERCULES (Endl et al., 2015)▷ planet mass from dynamical stability (Plavchan et al., 2015)▷ planet formation in stellar binaries (Rafikov & Silsbee, 2015)▷ Milankovitch cycles in eccentricity, obliquity, and precession (Forgan, 2016)▷ simulation of Gaia astrometric data for α Cen A (Huang & Ji, 2016)▷ possible circumbinary configurations (Popova & Shevchenko, 2016)▷ long-term stability (Quarles & Lissauer, 2016)▷ planetary signal attributed to window function (Rajpaul et al., 2016)▷ effects of Proxima Cen on planet formation (Worth & Sigurdsson, 2016)▷ imaging search from the VISTA–VVV near-infrared survey (Beamín et al., 2017)▷ stability regions for S-type planets in Lidov–Kozai resonance (Giuppone & Correia, 2017)▷ deceleration of interstellar photon sails into bound orbits (Heller & Hippke, 2017)▷ astrometric planet detection with Gaia around α Cen A (Huang & Ji, 2017)▷ orbit of Proxima Cen (Kervella et al., 2017)▷ capture rate of interstellar objects via 3-body gravitational interactions (Lingam & Loeb, 2018)▷ long-term stability of circumstellar and circumbinary orbits (Quarles et al., 2018)▷ long-term stability of tightly packed multi-planet systems in prograde, coplanar, circumstellar orbits (Quarles & Lissauer, 2018)▷ planet constraints from HARPS radial velocity measurements over 10 years (Zhao et al., 2018a)▷

Proxima Cen discovery (Anglada-Escudé et al., 2016a)▷ earlier considerations of habitable zone (Endl & Kürster, 2008)▷ **2016:** possible structure and composition (Brugger et al., 2016)▷ space weather (Garraffo et al., 2016)▷ prospects for characterising atmosphere (Kreidberg & Loeb, 2016)▷ habitability: irradiation, rotation and volatile inventory (Ribas et al., 2016)▷ habitability: climates and observability (Turbet et al., 2016)▷ effects on planet formation in α Cen (Worth & Sigurdsson, 2016)▷ **2017:** ALMA discovery of dust belts at 1–4 au, with a compact emission source (Anglada et al., 2017)▷ simulations of resolved surface imaging from reflected light (Berdyugina & Kuhn, 2017)▷ probabilistic constraints on mass, radius and composition (Bixel & Apai, 2017)▷ climate simulations using the UK Meteorological Office Unified Model (Boutle et al., 2017)▷ orbit eccentricity from radial velocity data of $e = 0.25$ (Brown, 2017)▷ constraint on super-Earth interiors from stellar abundances (Brugger et al., 2017)▷ predicted radio detectability of 100 mJy at 0.02–3 MHz (Burkhart & Loeb, 2017)▷ predicted system multiplicity as a function of formation scenario (Coleman et al., 2017)▷ stellar noise in the radial velocity data (Damasso & Del Sordo, 2017)▷ habitability dependence on ion escape rates and intrinsic magnetic dipole field (Dong et al., 2017)▷ atmospheric escape time scale due to high stellar extreme ultraviolet flux (Garcia-Sage et al., 2017)▷ variable incident flux due to obliquity and eccentricity (Kane & Torres, 2017)▷ orbit and habitability as a function of orbit inclination (Kane et al., 2017a)▷ orbital motion with respect to α Cen (Kervella et al., 2017)▷ no conclusive evidence for transits in MOST photometry (Kipping et al., 2017)▷ reduced diversity of life around M dwarfs from atmospheric erosion (Lingam & Loeb, 2017b)▷ planet detection by coupling VLT–SPHERE imager with ESPRESSO spectrograph (Lovis et al., 2017)▷ characterisation through detection of auroral emission (Luger et al., 2017b)▷ upper limits on mass and radius from VLT–SPHERE imaging (Mesa et al., 2017)▷ stellar X-ray to mid-infrared spectral energy distribution, with evidence for warm dust (Ribas et al., 2017)▷ atmospheric detection prospects with JWST–MIRI (Snellen et al., 2017)▷ hydrodynamic thermal atmospheric escape (Zahnle & Catling, 2017)▷ **2018:** multi-year search for transits (Blank et al., 2018)▷ stratospheric circulation and O_3 production under tidally locking (Carone et al., 2018)▷ bright superflare observed with Evryscope (Howard et al., 2018)▷ transit search and tentative detection with BSST at Antarctica, and evidence for outer planet (Liu et al., 2018b)▷ habitability and observational discriminants (Meadows et al., 2018)▷ habitability: estimates of stellar wind velocity, cosmic ray fluxes, and flares (Sadovski et al., 2018)▷ exocomets and their importance for water transport (Schwarz et al., 2018)▷ predicted exoplanet-induced radio emission (Turnpenney et al., 2018)▷ magnetic dynamos predicted from formation models (Zuluaga & Bustamante, 2018)▷ gravitational mass of host star from microlensing measured with VLT–SPHERE (Zurlo et al., 2018)▷ **2019:** surface imaging (Berdyugina & Kuhn, 2019)▷ habitable climate scenarios (Del Genio et al., 2019)▷ imaging and spectroscopy with E–ELT (Hawker & Parry, 2019)▷ possible superflare (Kielkopf et al., 2019)▷ not transiting (Jenkins et al., 2019a)▷ dynamical evolution and stability maps (Meng et al., 2019)▷ flaring from TESS (Vida et al., 2019)▷

γ Cep proposed as a 2.7-yr period exoplanet candidate in binary system (Campbell et al., 1988)▷ data over 11 yr give $P = 2.52$ yr (Walker et al., 1992)▷ dynamical stability (Dvorak et al., 2003a)▷ confirmation (Hatzes et al., 2003)▷ dynamical stability (Dvorak et al., 2004)▷ dynamical stability (Haghighipour, 2004)▷ formation (Thébault et al., 2004)▷ dynamical stability of habitable zone (Haghighipour, 2006)▷ dynamical stability of habitable zone (Verrier & Evans, 2006)▷ imaging of binary companion γ Cep B (Neuhäuser et al., 2007)▷ 3d orbit

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of stellar binary (Torres, 2007a)⊳ disk truncation and planet formation (Jang-Condell et al., 2008)⊳ planet formation in presence of disk perturbations from secondary (Kley & Nelson, 2008)⊳ planetesimal dynamics due to gas drag from an eccentric precessing disk (Beaugé et al., 2010)⊳ planetesimal collisions (Paardekooper & Leinhardt, 2010)⊳ secular dynamics of planetesimals (Giuppone et al., 2011)⊳ circumstellar disks in binary systems (Müller & Kley, 2012)⊳ orbit properties resulting from stellar scattering (Martí & Beaugé, 2012)⊳ planet formation in small separation binaries (Rafikov, 2013)⊳ application of chaos indicators (Satyal et al., 2013)⊳ habitable terrestrial planets in tight binary systems (Funk et al., 2015)⊳ planet formation in stellar binaries (Rafikov & Silsbee, 2015)⊳

τ **Cet** ≡ HD 10700; 4-planet system (planets e, f, g, h listed in NASA); massive debris disk (Greaves et al., 2004)⊳ detection limits from HARPS (Dumusque et al., 2011b)⊳ companion search with VLTI–PIONIER (Absil et al., 2011)⊳ proposed 5-planet system (Tuomi et al., 2013b)⊳ high-contrast imaging characterisation (Crossfield, 2013)⊳ Herschel observations of the debris disk (Lawler et al., 2014)⊳ effect of chemical composition on terrestrial planets (Pagano et al., 2015)⊳ ALMA debris disk observations (MacGregor et al., 2016)⊳ four planet candidates from HARPS and Keck data after removal of wavelength-dependent noise (Feng et al., 2017c)⊳

75 Cet discovery (Sato et al., 2012b)⊳

81 Cet discovery (Sato et al., 2008b)⊳

YZ Cet 3-planet system, with planets of $0.002-0.003\,M_{\rm J}$ ($0.6-0.9\,M_{\oplus}$, $P_{\rm orb}=2-5$ d) orbiting a $0.13\,M_{\odot}$ ($d=3.6$ pc) M dwarf; discovery (Astudillo-Defru et al., 2017a)⊳ ultra-short period for planet c implied by aliasing (Robertson, 2018)⊳

7 CMa 2-planet system in 4:3 resonance; discovery of planet b (Wittenmyer et al., 2011)⊳ discovery of planet c (Luque et al., 2019c)⊳

β **Cnc** discovery (Lee et al., 2014a)⊳

55 Cnc see transiting systems

11 Com ≡ HD 107383; discovery (Liu et al., 2008b)⊳ stellar diameter and temperature (von Braun et al., 2014)⊳

ϵ **CrB** discovery (Lee et al., 2012a)⊳

κ **CrB** discovery (Johnson et al., 2008a)⊳ interferometric observations with NPOI (Baines et al., 2013)⊳ spatially-resolved dust belts and evidence for a second planet (Bonsor et al., 2013)⊳

o **CrB** discovery (Sato et al., 2012b)⊳

ρ **CrB** 2-planet system; discovery of planet b (Noyes et al., 1997)⊳ stellar properties (Fuhrmann et al., 1998)⊳ circumstellar dust disk (Trilling et al., 2000)⊳ photometric study (Gatewood et al., 2001)⊳ limit on 1.6 μm flux ratio (Bender et al., 2005)⊳ stellar diameter and temperature (von Braun et al., 2014)⊳ discovery of planet c (Fulton et al., 2016)⊳

16 Cyg B high eccentricity planet ($e=0.63$) around component B of a stellar binary; discovery (Cochran et al., 1997)⊳ origin of high eccentricity (Holman et al., 1997)⊳ Li abundance (King et al., 1997b)⊳ origin of high eccentricity (Mazeh et al., 1997)⊳ stellar parameters (Fuhrmann et al., 1998)⊳ Be abundance (Garcia Lopez & Perez de Taoro, 1998)⊳ origin of high eccentricity (Hauser & Marcy, 1999)⊳ Be and Fe abundances (Deliyannis et al., 2000)⊳ Be and Fe abundances (Laws & Gonzalez, 2001)⊳ stellar companions from imaging (Patience et al., 2002)⊳ chemical abundances (Ramírez et al., 2011)⊳ abundances of 16 Cyg A and B and planet formation (Schuler et al., 2011)⊳ asteroseismology of 16 Cyg A and B from Kepler (Metcalfe et al., 2012)⊳ orbital analysis (Plávalová & Solovaya, 2013)⊳ rocky core inferred from spectroscopic abundances (Tucci Maia et al., 2014)⊳ asteroseismic inference on rotation, gyrochronology and system dynamics (Davies et al., 2015)⊳ asteroseismology from full Kepler data (Metcalfe et al., 2015)⊳ asteroseismology compared with Kepler Asteroseismic Legacy project (Roxburgh, 2017)⊳

18 Del discovery (Sato et al., 2008a)⊳ constraints on co-moving companion from Subaru–HiCIAO (Ryu et al., 2016)⊳

ι **Dra** ≡ HIP 75458; discovery (Frink et al., 2002)⊳ effect of stellar pulsations (Hekker et al., 2006)⊳ favourable transit potential (Kane et al., 2010)⊳ mass constraints from Hipparcos (Reffert & Quirrenbach, 2011)⊳ monitoring (Quirrenbach et al., 2011)⊳ stellar parameters from CHARA interferometry (Baines et al., 2011)⊳ constraints on co-moving companion from Subaru–HiCIAO (Ryu et al., 2016)⊳ constraints on radio emission from LOFAR (O'Gorman et al., 2018)⊳

ψ **Dra B** discovery (Endl et al., 2016)⊳

42 Dra discovery (Döllinger et al., 2009a)⊳ interferometry of host star (Ligi et al., 2012)⊳

ϵ **Eri** dust ring (Greaves et al., 1998)⊳ discovery, and magnetic activity cycles (Hatzes et al., 2000)⊳ morphology of dust ring due to planet (Quillen & Thorndike, 2002)⊳ adaptive optics imaging of dust ring (Macintosh et al., 2003)⊳ structure of dust disk due to planet and comets (Moran et al., 2004)⊳ optical studies of disk from HST–STIS (Proffitt et al., 2004)⊳ circumstellar dust disk from SEST–SIMBA (Schütz et al., 2004)⊳ debris disk structure (Greaves et al., 2005)⊳ orbit from radial velocity and HST astrometry (Benedict et al., 2006)⊳ differential rotation of host star from MOST and star spots (Croll et al., 2006)⊳ rotation of the debris disk from SCUBA (Poulton et al., 2006)⊳ null results from optical imaging (Janson et al., 2007)⊳ optical imaging (Heinze et al., 2008)⊳ optical imaging (Janson et al., 2008)⊳ structure of disk due to planet (Brogi et al., 2009)⊳ disk structure (Backman et al., 2009)⊳ null results from imaging with Spitzer–IRAC (Marengo et al., 2009)⊳ H_2O and silicates from disk spectral modelling (Reidemeister et al., 2011)⊳ angular diameter of host star from NOI (Baines & Armstrong, 2012)⊳ candidate for radio emission generated by magnetosphere–ionosphere coupling (Nichols, 2012)⊳ magnetic activity cycle (Metcalfe et al., 2013)⊳ extreme ultraviolet-driven mass-loss (Chadney et al., 2015)⊳ detection of exomoons from Io-type radio emission (Noyola et al., 2014)⊳ high-contrast imaging with Spitzer (Janson et al., 2015)⊳ limits on radio emission at 154 MHz from the Murchison Widefield Array (Murphy et al., 2015)⊳ unsuccessful sounding rocket coronagraphic imaging mission, PICTURE–B (Chakrabarti et al., 2016)⊳ spectroscopic and photometric stellar activity study (Giguere et al., 2016)⊳ high-contrast imaging (Mizuki et al., 2016)⊳ apocentre glow in eccentric debris disks (Pan et al., 2016)⊳ northern arc of debris disk observed by ALMA has a width of 11–13 au (Booth et al., 2017)⊳ collisional parameters of planetesimal belt (Marzari & Dell'Oro, 2017)⊳ inner 25 au disk resolved by SOFIA (Su et al., 2017a)⊳ implications of radio emission observed by VLA at 2–4 GHz, 4–8 GHz, 8–12 GHz and 12–18 GHz (Bastian et al., 2018)⊳ detection of H_2O-maser emission (Cosmovici & Pogrebenko, 2018)⊳

τ **Gem** discovery (Mitchell et al., 2013)⊳

14 Her ≡ HD 145675 ≡ GJ 614; host star properties (Gonzalez et al., 1999)⊳ discovery of planet b (Butler et al., 2003)⊳ dynamical stability (Asghari et al., 2004)⊳ evidence for planet c (Naef et al., 2004)⊳ orbit stability (Goździewski et al., 2006)⊳ discovery/confirmation of planet c (Wittenmyer et al., 2007)⊳ dynamical studies (Goździewski et al., 2008b)⊳ imaging constraints on planet c (Rodigas et al., 2011)⊳ stellar diameter and temperature (von Braun et al., 2014)⊳

ι **Hor** see HR 810

ϵ **Ind A** nearby Jupiter analogue; discovery and detection of astrometric shift from Hipparcos–Gaia (Feng et al., 2019a)⊳

γ^1 **Leo** discovery (Han et al., 2010)⊳

μ **Leo** discovery (Lee et al., 2014a)⊳

γ **Lib** 2-planet system in a possible 7:3 mean-motion resonance; discovery (Takarada et al., 2018)⊳

6 Lyn discovery (Sato et al., 2008b)⊳

ν **Oct** not in NASA archive; binary star ($P=1050$ d, $a=2.6$ au) with a suggested but unconfirmed retrograde circumprimary planet ($P=415$ d); spectroscopic orbit from Mt John–HERCULES (Ramm et al., 2009)⊳ stability analysis (Eberle & Cuntz, 2010)⊳ attributed to precession in a tertiary system (Morais & Correia, 2012)⊳ confirmed stability of retrograde orbit (Quarles et al., 2012a)⊳ confirmed stability of retrograde orbit and problems of origin (Goździewski et al., 2013)⊳ star spots and pulsations considered unlikely causes (Ramm, 2015)⊳ supporting planetary evidence from 2009–13 monitoring (Ramm et al., 2016)⊳

ν **Oph** 2-planet system; Lick–CAT pre-discovery monitoring (Quirrenbach et al., 2011)⊳ discovery of planets b and c (Sato et al., 2012b)⊳ Bayesian analysis (Brewer & Donovan, 2015)⊳

51 Peg first generally-accepted planet discovered around a main-sequence star; discovery (Mayor & Queloz, 1995)⊳ orbit explained by inward migration (Lin et al., 1996)⊳ distance and mass limits from Hipparcos astrometry (Perryman et al., 1996)⊳ low X-ray luminosity supports planet hypothesis (Pravdo et al., 1996)⊳ stellar parameters (Fuhrmann et al., 1997)⊳ non-radial oscillations considered to exclude the planet hypothesis (Gray & Hatzes, 1997)⊳ non-radial oscillations considered to exclude the planet hypothesis (Gray, 1997)⊳ search for spectral-line shape variations (Hatzes et al., 1997)⊳ further radial velocity measures and support for planet hypothesis (Marcy et al., 1997)⊳ consideration of tidally-excited oscillations (Willems

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et al., 1997)▷ non-radial oscillations excluded (Brown et al., 1998b)▷ non-radial oscillations excluded (Brown et al., 1998a)▷ non-radial oscillations excluded (Gray, 1998)▷ non-radial oscillations excluded (Hatzes et al., 1998b)▷ non-radial oscillations excluded (Hatzes et al., 1998a)▷ non-radial oscillations excluded (François et al., 1999)▷ search for radio emission (Bastian et al., 2000)▷ transit constraints (Bundy & Marcy, 2000)▷ infrared constraints on transits from ISO (Rauer et al., 2000)▷ tidal constraints on mass (Trilling, 2000)▷ atmospheric modeling and tidal effects (Guillot & Showman, 2002)▷ atmospheric circulation and tides (Showman & Guillot, 2002)▷ limits on co-moving companions (Greaves, 2006)▷ limits on co-moving companions (Mamajek, 2010)▷ discovery retrospective (Mayor & Queloz, 2012)▷ photometric microvariability attributed to orbit perturbations (Ruban & Arkharov, 2012)▷ limits from 2-yr BVRI polarimetric monitoring (Antonyuk et al., 2013)▷ possible molecular absorption from VLT–CRIRES (Brogi et al., 2013)▷ simulated spectroscopic direct detection of reflected light (Martins et al., 2013)▷ discovery retrospective (Cenadelli & Bernagozzi, 2015)▷ marginal spectroscopic direct detection of reflected light (Martins et al., 2015)▷ reflected light not explained by ring system (Santos et al., 2015b)▷ discovery of atmospheric H_2O at high-spectral resolution with VLT–CRIRES (Birkby et al., 2017)▷

β **Pic** see imaging systems for radial velocity discovery of planet c

ω **Ser** discovery (Sato et al., 2013a)▷

24 Sex 2-planet system; discovery of planets b and c (Johnson et al., 2011b)▷ ages of resonance systems (Koriski & Zucker, 2011)▷ dynamical analysis (Wittenmyer et al., 2012a)▷ lucky imaging of host star (Ginski et al., 2012)▷ orbital evolution of a pair of giant planets in mean motion resonance (André & Papaloizou, 2016)▷

α **Tau** Aldeberan; discovery (Hatzes et al., 2015)▷ long-period radial velocity variations previously noted (Hatzes & Cochran, 1993)▷

ϵ **Tau** first open cluster planet (Hyades); discovery (Sato et al., 2007)▷ asteroseismology (Arentoft et al., 2019)▷

CI Tau 2 Myr old classical T Tauri star with a protoplanetary disk; claimed discovery (Johns-Krull et al., 2016a)▷ eccentricity ($e = 0.3$) excited by the disk or 2-planet scattering (Rosotti et al., 2017)▷ pulsed accretion (Biddle et al., 2018)▷ CO detection (Flagg et al., 2019)▷

V830 Tau evidence for hot Jupiter (Donati et al., 2015)▷ confirmed discovery (Donati et al., 2016)▷ variable stellar radio emission (Bower et al., 2016)▷ spectropolarimetric and photometric monitoring (Donati et al., 2017)▷ predicted radio emission from planet and stellar wind (Vidotto & Donati, 2017)▷ upper limits on radio emission from GMRT (Lynch et al., 2018)▷

o **UMa** discovery of planet b, and evidence for planet c (Sato et al., 2012b)▷

4 UMa discovery (Döllinger et al., 2007)▷

47 UMa 3-planet system; discovery of planet b (Butler & Marcy, 1996)▷ distance and mass limits from Hipparcos astrometry (Perryman et al., 1996)▷ stellar parameters (Fuhrmann et al., 1997)▷ search for radio emission (Bastian et al., 2000)▷ discovery of planet c (Fischer et al., 2002b)▷ orbit stability and the habitable zone (Goździewski, 2002)▷ orbit stability (Jones & Sleep, 2002)▷ dynamical analysis (Laughlin et al., 2002)▷ possibility of Earth-like habitable planets (Cuntz et al., 2003)▷ habitable zone (Franck et al., 2003)▷ apsidal alignment and locking (Ji et al., 2003c)▷ orbit stability and habitable zone (Asghari et al., 2004)▷ new radial velocities (Naef et al., 2004)▷ similarity with solar system (Ji et al., 2005)▷ orbit stability (Rivera & Haghighipour, 2007)▷ long-period orbit fitting (Wittenmyer et al., 2007)▷ evidence for planet d (Gregory & Fischer, 2010)▷ Bayesian analysis (Feroz et al., 2011b)▷ mass constraints from Hipparcos (Reffert & Quirrenbach, 2011)▷ exocomets and water transport (Cuntz et al., 2018)▷

β **UMi** discovery (Lee et al., 2014a)▷ constraints on radio emission from LOFAR (O'Gorman et al., 2018)▷

8 UMi discovery (Lee et al., 2015a)▷

11 UMi discovery (Döllinger et al., 2009b)▷

61 Vir 3-planet system; discovery of planets b, c, d (Vogt et al., 2010b)▷ inclination constraints from tidal dissipation models (Batygin & Laughlin, 2011)▷ aligned major axes without tidal evolution (Greenberg & van Laerhoven, 2012)▷ possible radio detection with GMRT (Sirothia et al., 2014)▷ stellar diameter and temperature (von Braun et al., 2014)▷ Kuiper belt structure around nearby super-Earth hosts (Kennedy et al., 2015)▷ limits on radio emission at 154 MHz from the Murchison Widefield Array (Murphy et al., 2015)▷ dynamical constraints on additional planets (Read & Wyatt, 2016)▷ resolved 0.86-mm debris observations with ALMA (Marino et al., 2017)▷ exospheric Na escape due to stellar wind sputtering and micrometeorite impacts (Yoneda et al., 2017)▷

70 Vir discovery (Marcy & Butler, 1996)▷ distance and mass limits from Hipparcos astrometry (Perryman et al., 1996)▷ search for radio emission (Bastian et al., 2000)▷ confirmation of orbit (Naef et al., 2004)▷ characterisation from 59 new Keck–HIRES data with 169 previous from ELODIE, Hamilton, and HIRES (Kane et al., 2015b)▷

Star names

Barnard's star not in NASA archive; candidate 3.2$M_\oplus$ planet near the snow-line; discovery (Ribas et al., 2018)▷ stellar wind environment Alvarado-Gómez et al. (2019)▷

Kapteyn's star 1-planet system in NASA (planet c); discovery of planets b and c (Anglada-Escudé et al., 2014)▷ stellar activity as explanation for planet b (Robertson et al., 2015c)▷ rotation and X-ray and ultraviolet properties of host star (Guinan et al., 2016)▷ no activity correlation in radial velocities (Anglada-Escudé et al., 2016b)▷

Lalande 21185 not in NASA archive; candidate planet suggested (Butler et al., 2017)▷ detection of H_2O-maser emission (Cosmovici & Pogrebenko, 2018)▷

Ross 128 ≡ GJ 447; nearby star (3.4 pc); discovery (Bonfils et al., 2018b)▷ stellar and planetary characterisation from APOGEE spectra (Souto et al., 2018)▷

Teegarden's star 2-planet system; discovery (Zechmeister et al., 2019)▷

Wolf 1061 ≡ GJ 628; 3-planet system; discovery (Wright et al., 2016a)▷ further radial velocity observations (Astudillo-Defru et al., 2017b)▷ stellar radius from CHARA, stellar rotation from 7 yr of photometry, and no indication of transits (Kane et al., 2017b)▷

BD

BD–06 1339 2-planet system; discovery of planets b and c (Lo Curto et al., 2013)▷

BD–08 2823 2-planet system; discovery of planets b and c (Hébrard et al., 2010c)▷

BD–10 3166 discovery and transit search (Butler et al., 2000)▷

BD–11 4672 discovery (Moutou et al., 2015)▷

BD–13 2130 discovery (Lovis & Mayor, 2007)▷

BD–17 63 discovery (Moutou et al., 2009b)▷

BD+03 2562 discovery (Villaver et al., 2017)▷

BD+14 4559 discovery (Niedzielski et al., 2009b)▷ habitability of hypothetical exomoon (Hinkel & Kane, 2013a)▷

BD+15 2375 discovery (Niedzielski et al., 2016a)▷

BD+15 2940 planet orbiting at 0.5 au from K0 giant host, in engulfment zone; discovery (Nowak et al., 2013)▷

BD+20 274 discovery (Gettel et al., 2012a)▷

BD+20 1790 not in NASA archive; claimed discovery (Hernán-Obispo et al., 2010)▷ CORALIE radial velocities imply variations are photospheric (Figueira et al., 2010)▷ revised analysis supports planet interpretation (Hernán-Obispo et al., 2015)▷ multi-band high resolution spectroscopy rules out planet explanation (Carleo et al., 2018)▷

BD+20 2457 2-planet system; discovery of planets b and c (Niedzielski et al., 2009b)▷ dynamical investigation (Horner et al., 2014)▷

BD+48 738 discovery (Gettel et al., 2012b)▷

BD+48 740 Li-rich giant reported as a potential planet host (Adamów et al., 2012)▷ confirmation (Adamów et al., 2018)▷

BD+49 828 discovery (Niedzielski et al., 2015b)▷

CoRoT

CoRoT–7 c see transiting systems

CoRoT–20 c see transiting systems

GJ

GJ 15A 2-planet system; discovery (Howard et al., 2014)▷ not confirmed by CARMENES (Trifonov et al., 2018a)▷ 5 yr of HARPS–N and 15 yr of Keck–HIRES supports multi-planet interpretation (Pinamonti et al., 2018)▷

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GJ 27.1 discovery (Tuomi et al., 2014)⊳

GJ 49 discovery (Perger et al., 2019)⊳

GJ 86 discovery of planet b, and evidence for planet c (Queloz et al., 2000b)⊳ imaging of co-moving (white dwarf/brown dwarf) companion GJ 86 B (Els et al., 2001)⊳ orbit stability (Musielak et al., 2005)⊳ imaging (Mugrauer et al., 2005a)⊳ coronagraphic imaging resolves orbit motion of GJ 86 B (Lagrange et al., 2006)⊳ stellar multiplicity (Raghavan et al., 2006)⊳ observations with VLT–AMBER and MIDI (Matter et al., 2010)⊳ constraints from simultaneous optical/infrared monitoring (Crockett et al., 2012)⊳ imaging and white dwarf confirmation using HST–WFC3/STIS (Farihi et al., 2013)⊳ habitable terrestrial planets in tight binary systems (Funk et al., 2015)⊳ limits on radio emission at 154 MHz from the Murchison Widefield Array (Murphy et al., 2015)⊳

GJ 96 eccentric planet ($e = 0.44$) orbiting an M star; discovery (Hobson et al., 2018)⊳

GJ 160.2 discovery (Tuomi et al., 2014)⊳

GJ 163 3-planet system; discovery of planets b, c, d (Bonfils et al., 2013b)⊳ possible planet e (Tuomi & Anglada-Escudé, 2013)⊳ variable incident flux due to obliquity and eccentricity (Kane & Torres, 2017)⊳

GJ 176 see HD 285968

GJ 179 discovery (Howard et al., 2010)⊳

GJ 180 2-planet system; discovery (Tuomi et al., 2014)⊳

GJ 221 not in NASA archive; claimed but not confirmed; 2- or 3-planet system; discovery of planets b and c (Arriagada et al., 2013); discovery of planet d (Tuomi, 2014)

GJ 229 discovery (Tuomi et al., 2014)⊳

GJ 273 2-planet system at 3.8 pc, with one in the habitable zone; discovery (Astudillo-Defru et al., 2017b)⊳

GJ 317 2-planet system; discovery, and evidence for planet c (Johnson et al., 2007a)⊳ mass limits from astrometry, and support for planet c (Anglada-Escudé et al., 2012b)⊳ astrometric search with RECONS (Lurie et al., 2014)⊳

GJ 328 discovery, and long-period activity cycle (Robertson et al., 2013)⊳

GJ 357 3-planet system; discovery (Luque et al., 2019b)⊳ precision radial velocities and dynamical simulations (Jenkins et al., 2019b)⊳ habitability (Kaltenegger et al., 2019)⊳

GJ 378 discovery (Hobson et al., 2019)⊳

GJ 411 discovery (Díaz et al., 2019)⊳

GJ 420 discovery (Tuomi et al., 2014)⊳

GJ 433 2-planet system; discovery of planets b and c (Delfosse et al., 2013)⊳ Bayesian analysis (Tuomi et al., 2014)⊳

GJ 436 see transiting systems

GJ 536 discovery (Suárez Mascareño et al., 2017a)⊳ confirmation from CARMENES (Trifonov et al., 2018a)⊳ host star age from kinematics and α-element enrichment (Veyette & Muirhead, 2018)⊳

GJ 581 3-planet system (with f, g, and possibly d subsequently questioned); M dwarf with hot Neptune (planet b), super-Earth in/near the habitable zone (c), an inner Earth-mass (e); discovery of planet b (Bonfils et al., 2005)⊳ transit constraints (López-Morales et al., 2006)⊳ possibility of habitable planets (Selsis et al., 2007)⊳ confirmation of planets c and d (Udry et al., 2007)⊳ planet c non-habitable, planet d tidally locked near outer habitability edge (von Bloh et al., 2007)⊳ 3-planet system chaotic but dynamically stable (Beust et al., 2008)⊳ discovery of inner Earth-mass planet e (Mayor et al., 2009a)⊳ stability of undetected low-mass habitable-zone planets between planets c and d (Zollinger & Armstrong, 2009)⊳ **2010:** habitability of planet d (von Paris et al., 2010)⊳ discovery of planet f and (habitable zone) planet g (Vogt et al., 2010a)⊳ habitability of planet d dependent on CO_2 content (Wordsworth et al., 2010)⊳ additional HARPS data does not confirm planets f and g (Forveille et al., 2011a)⊳ Bayesian analysis (Gregory, 2011)⊳ habitability of planet g (Heng & Vogt, 2011)⊳ habitability of planets c and d (Hu & Ding, 2011)⊳ model spectra of planet d (Kaltenegger et al., 2011)⊳ habitability of planet g (Pierrehumbert, 2011)⊳ tidal interactions in multi-planet systems (Papaloizou, 2011)⊳ Bayesian analysis does not confirm planets f and g (Tuomi, 2011)⊳ Bayesian modeling (Tuomi et al., 2011)⊳ habitability of planet g (von Bloh et al., 2011)⊳ atmospheric studies of habitability (von Paris et al., 2011b)⊳ astrophysical parameters and habitable zone (von Braun et al., 2011a)⊳ improved stellar parameters from interferometry, and habitability of planets d and g (von Paris et al., 2011a)⊳ habitability of planet d (Wordsworth et al., 2011)⊳ constraints on transits of planet e by MOST (Dragomir et al., 2012c)⊳ spatially-resolved debris disk from Herschel–PACS (Lestrade et al., 2012)⊳ dynamical evolution and spin-orbit resonances of planet d (Makarov et al., 2012)⊳ dynamical stability (Tadeu dos Santos et al., 2012)⊳ this conclusion contested (Vogt et al., 2012)⊳ red noise questions reality of planets f, g and possibly d (Baluev, 2013)⊳ 3d climate modeling of close-in land planets (Leconte et al., 2013)⊳ model atmosphere for planet g (Carone et al., 2014)⊳ ultraviolet radiation environment (France et al., 2013)⊳ debris disk model (Heng & Malik, 2013)⊳ HARPS and Keck–HIRES supports four planets (Hatzes, 2013a)⊳ influence of thermal evolution in the magnetic protection of terrestrial planets (Zuluaga et al., 2013)⊳ stability analysis of 4- and 5-planet systems (Joiner et al., 2014)⊳ astrometric search with RECONS (Lurie et al., 2014)⊳ debris disk radius and grain sizes from Herschel (Pawellek et al., 2014)⊳ planet d an artefact of stellar activity (Robertson et al., 2014)⊳ dynamical stability (Tóth & Nagy, 2014)⊳ **2015:** effects of activity-induced variability (Anglada-Escudé & Tuomi, 2015)⊳ 7–15 planets suggested from Bayesian inference (Brewer & Donovan, 2015)⊳ stellar activity as an explanation for some claimed planets (Robertson et al., 2015b)⊳ ultraviolet flux models (Rugheimer et al., 2015)⊳ confirmation from CARMENES (Trifonov et al., 2018a)⊳ detection of H_2O-maser emission (Cosmovici & Pogrebenko, 2018)⊳

GJ 617 see HD 147379

GJ 625 discovery (Suárez Mascareño et al., 2017b)⊳

GJ 628 see Wolf 1061

GJ 649 discovery of planet b (Johnson et al., 2010c)⊳ high eccentricity as an artefact of unidentified multiple planets (Wittenmyer et al., 2013)⊳ stellar diameter and temperature (von Braun et al., 2014)⊳

GJ 667C 5-planet system; GJ 667 C is common proper motion companion to binary GJ 667 AB; discovery of planets b and c (Bonfils et al., 2013a)⊳ 3 additional candidates from combined data (Anglada-Escudé et al., 2012a)⊳ dynamical packing in a 6- or 7-planet system (Anglada-Escudé et al., 2013b)⊳ effect of tidal heating on habitability (Barnes et al., 2013b)⊳ additional HARPS data and improved orbits (Delfosse et al., 2013)⊳ ultraviolet radiation environment (France et al., 2013)⊳ influence of thermal evolution in the magnetic protection of terrestrial planets (Zuluaga et al., 2013)⊳ Bayesian analysis of radial velocity data (Feroz & Hobson, 2014)⊳ astrometric search with RECONS (Lurie et al., 2014)⊳ dynamical stability (Makarov & Berghea, 2014)⊳ effects of activity-induced variability (Robertson & Mahadevan, 2014)⊳ spin–orbit evolution (Cuartas-Restrepo et al., 2016)⊳ stratospheric circulation and O_3 production in tidally locked planets (Carone et al., 2018)⊳

GJ 674 discovery (Bonfils et al., 2007)⊳ effects of stellar activity (Boisse et al., 2011)⊳ limits on radio emission at 154 MHz from the Murchison Widefield Array (Murphy et al., 2015)⊳

GJ 676A 4-planet system; discovery of planet b, and evidence for planet c (Forveille et al., 2011b)⊳ discovery/confirmation of planet c, and suggested d and e being close-in orbits with super-Earth mass (Anglada-Escudé & Tuomi, 2012)⊳ mass of planet b from ground-based astrometry with VLT–FORS2 (Sahlmann et al., 2016)⊳ system is hierarchically AMD-stable (Laskar & Petit, 2017)⊳

GJ 682 discovery (Tuomi et al., 2014)⊳

GJ 685 discovery (Pinamonti et al., 2019)⊳

GJ 686 discovery (Affer et al., 2019)⊳

GJ 687 discovery (Burt et al., 2014)⊳

GJ 785 see HD 192310

GJ 832 2-planet system; discovery of planet b (Bailey et al., 2009)⊳ ultraviolet radiation environment (France et al., 2013)⊳ discovery of planet c (Wittenmyer et al., 2014c)⊳ limits on radio emission at 154 MHz from the Murchison Widefield Array (Murphy et al., 2015)⊳ dynamical analysis and evidence for a third planet (Satyal et al., 2017)⊳

GJ 849 discovery of planet b (Butler et al., 2006a)⊳ astrometric search with RECONS (Lurie et al., 2014)⊳ new radial velocities (Feng et al., 2015)⊳

GJ 876 4-planet system; independent discovery of planet b (Delfosse et al., 1998)⊳ independent discovery of planet b (Marcy et al., 1998)⊳ **2000:** constraints on debris disk (Trilling et al., 2000)⊳ dynamical stability (Kinoshita & Nakai, 2001)⊳ dynamical interaction between planets c and d (Laughlin & Chambers, 2001)⊳ discovery of planet c

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in 2:1 resonance (Marcy et al., 2001a)▷ dynamical stability (Rivera & Lissauer, 2001)▷ disk-driven inward migration and resonant trapping (Snellgrove et al., 2001)▷ inclination and mass of planet b from HST–FGS (Benedict et al., 2002)▷ dynamical stability (Goździewski et al., 2002)▷ dynamical stability (Ji et al., 2002a)▷ dynamics and origin of the 2:1 resonance (Lee & Peale, 2002)▷ tidal, spin, and dynamical evolution (Mardling & Lin, 2002)▷ origin, evolution, and properties of resonances (Beaugé & Michtchenko, 2003)▷ libration (Ji et al., 2003c)▷ evolution of systems in resonance (Kley et al., 2004)▷ diversity and origin of the 2:1 resonance (Lee, 2004)▷ **2005:** dynamical models (Kley et al., 2005)▷ analysis of the system (Laughlin et al., 2005a)▷ dynamics of 2:1 resonance systems (Psychoyos & Hadjidemetriou, 2005)▷ discovery of planet d, and stellar rotation (Rivera et al., 2005)▷ planetary migration (Beaugé et al., 2006)▷ constraints on transits of planets b and c (Shankland et al., 2006)▷ atmospheric evaporation of planet d (Lecavelier des Etangs, 2007)▷ orbit stability (Rivera & Haghighipour, 2007)▷ effect of protoplanetary disk on resonances (Veras, 2007)▷ improved constraints on debris disk from VLA and ACTA (Shankland et al., 2008)▷ mutual inclination of planets b and c from dynamics (Bean & Seifahrt, 2009)▷ atmospheric constraints on planet d from Spitzer–IRAC (Seager & Deming, 2009)▷ **2010:** improved HARPS radial velocities, architecture, and constraints on putative planet e (Correia et al., 2010)▷ evaporation rates (Lecavelier des Etangs, 2010)▷ improved Keck–HIRES radial velocities, discovery of planet e in a 'chaotic' Laplace resonance (Rivera et al., 2010b)▷ orbit configuration (Baluev, 2011)▷ dynamical processes in late stages of gas and dust disks (Emelyanenko, 2011)▷ distinguishing true and alias periods using the Vuong test (Baluev, 2012)▷ time-resolved ultraviolet spectroscopy from HST–COS/STIS, and emission from hot H_2 (France et al., 2012)▷ dynamical packing (Gerlach & Haghighipour, 2012)▷ outward migration of a super-Earth in a disk with outward-propagating density waves (Podlewska-Gaca et al., 2012)▷ detectability with ELTs (Crossfield, 2013)▷ ultraviolet radiation environment (France et al., 2013)▷ stability analysis of the Laplace resonance (Martí et al., 2013)▷ suggestion of two additional planets from Keck/HARPS data (Jenkins et al., 2014)▷ no evidence of transits from Spitzer (Kammer et al., 2014)▷ astrometric search with RECONS (Lurie et al., 2014)▷ detecting exomoons from Io-type radio emission (Noyola et al., 2014)▷ stellar diameter and temperature (von Braun et al., 2014)▷ **2015:** formation of multi-resonant structure with turbulent forcing (Batygin et al., 2015)▷ limits on radio emission at 154 MHz from the Murchison Widefield Array (Murphy et al., 2015)▷ simulation of Gaia astrometric data (Huang & Ji, 2016)▷ chaotic diffusion and orbital stability (Martí et al., 2016)▷ evidence for 3d Laplace resonance (Nelson et al., 2016)▷ formation by stellar perturbations (Shara et al., 2016)▷ detection of organic haze with JWST (Arney et al., 2017)▷ planet search utilising compressed sensing techniques (Hara et al., 2017)▷ astrometric planet detection with Gaia (Huang & Ji, 2017)▷ Laplace resonance formation through migration in an eccentric disk (Cimerman et al., 2018)▷ hydrodynamical modeling of Laplace resonance formation (Dempsey & Nelson, 2018)▷ dynamical models suggest a low-energy, quasi-regular double apsidal corotation resonance (Millholland et al., 2018)▷ eccentricity of planet d suggests $Q \sim 10^4 - 10^5$ (Puranam & Batygin, 2018)▷ penetrative convection in planet d as a consequences of $MgSiO_3$ post-perovskite dissociation transition (Shahnas et al., 2018)▷ confirmation of planets from CARMENES (Trifonov et al., 2018a)▷ host star age from kinematics and α-element enrichment (Veyette & Muirhead, 2018)▷

GJ 1148 ≡ HIP 57050; 2-planet system; discovery, and location within habitable zone (Haghighipour et al., 2010)▷ confirmation of planet b and discovery of planet c from CARMENES (Trifonov et al., 2018a)▷

GJ 1265 discovery (Luque et al., 2018)▷

GJ 3021 discovery (Naef et al., 2001b)▷ infrared spectra of co-moving M dwarf GJ 3021 B (Mugrauer et al., 2007)▷

GJ 3138 3-planet system; discovery (Astudillo-Defru et al., 2017b)▷

GJ 3293 4-planet system; discovery of planets b and c from HARPS (Astudillo-Defru et al., 2015)▷ discovery of planets d and e from further HARPS observations (Astudillo-Defru et al., 2017b)▷

GJ 3323 2-planet system; discovery (Astudillo-Defru et al., 2017b)▷

GJ 3341 discovery from HARPS (Astudillo-Defru et al., 2015)▷

GJ 3470 see transiting systems

GJ 3512 giant planet orbiting very low mass star; discovery (Morales et al., 2019)▷

GJ 3634 discovery, and transit search by Spitzer–IRAC (Bonfils et al., 2011)▷ distinguishing true and alias periods using the Vuong test (Baluev, 2012)▷ capture into spin–orbit resonance (Rodríguez et al., 2012)▷

GJ 3779 discovery (Luque et al., 2018)▷

GJ 3942 discovery, and possible evidence for planet c (Perger et al., 2017)▷

GJ 3998 2-planet super-Earth system; discovery (Affer et al., 2016)▷

GJ 4276 eccentric planet or two planets in 2:1 resonance; discovery (Nagel et al., 2019)▷ dynamical interactions (Horrobin & Rein, 2019)▷

HAT/HATS

HAT–P–11 c see transiting systems

HAT–P–13 c see transiting systems

HAT–P–17 c see transiting systems

HAT–P–44 c see transiting systems

HATS–59 c see transiting systems

HD

HD 142 2-planet system; discovery of planet b (Tinney et al., 2002)▷ discovery of planet c (Wittenmyer et al., 2012b)▷

HD 564 discovery (Moutou et al., 2015)▷

HD 1461 2-planet super-Earth system; discovery of planet b and evidence for two additional planets (Rivera et al., 2010a)▷ Spitzer transit search (Kammer et al., 2014)▷ stellar diameter and temperature (von Braun et al., 2014)▷ confirmation of planet c (Díaz et al., 2016b)▷

HD 1502 discovery (Johnson et al., 2011a)▷

HD 1605 2-planet system; discovery (Harakawa et al., 2015)▷

HD 1666 discovery (Harakawa et al., 2015)▷

HD 1690 discovery (Moutou et al., 2011b)▷ limits on stellar companion (Kane et al., 2014)▷

HD 2039 metal-enriched star; discovery (Tinney et al., 2003)▷ measurement of ^{9}Be depletion (Delgado Mena et al., 2011)▷

HD 2638 discovery (Moutou et al., 2005)▷ stellar companion (Roberts et al., 2015c)▷ confirmed stellar companion from lucky imaging (Ginski et al., 2016) ▷ stellar companion (Wittrock et al., 2016)▷

HD 2952 discovery (Sato et al., 2013a)▷

HD 3167 see transiting systems (K2 96)

HD 3651 discovery of planet b with $e = 0.6$ (Fischer et al., 2003a)▷ imaging of brown dwarf companion HD 3651 B (Mugrauer et al., 2006)▷ infrared spectroscopy of HD 3651 B (Burgasser, 2007)▷ properties of the late-T dwarf companion (Liu et al., 2007)▷ Bayesian analysis (Tuomi & Jones, 2012)▷ high eccentricity as artefact of unidentified multiple planets (Wittenmyer et al., 2013)▷ long-term stability (Antoniadou & Voyatzis, 2016)▷

HD 4113 high eccentricity ($e = 0.90$); discovery (Tamuz et al., 2008)▷ direct imaging of a host star substellar companion from VLT–SPHERE (Cheetham et al., 2018)▷

HD 4203 2-planet system; discovery of planet b (Vogt et al., 2002)▷ measurement of ^{9}Be depletion (Delgado Mena et al., 2011)▷ compositional diversity due to giant planet migration (Carter-Bond et al., 2012)▷ discovery of planet c (Kane et al., 2014)▷

HD 4208 discovery (Vogt et al., 2002)▷ dynamics and stability (Hinse et al., 2008)▷ stability of terrestrial planets in habitable zone (Alonso et al., 2009a)▷

HD 4308 discovery (Udry et al., 2006)▷

HD 4313 discovery (Johnson et al., 2010b)▷

HD 4732 2-planet system; discovery (Sato et al., 2013b)▷

HD 4917 possible 3-planet system; discovery (Luhn et al., 2019)▷

HD 5319 2-planet system; discovery of planet b (Robinson et al., 2007)▷ discovery of planet c (Giguere et al., 2015)▷ dynamical stability (Kane, 2016)▷

HD 5388 not in NASA archive; claimed discovery, unconfirmed (Santos et al., 2010)▷

HD 5583 discovery (Niedzielski et al., 2016a)▷

HD 5608 discovery (Sato et al., 2012b)▷ co-moving companion from Subaru–HiCIAO (Ryu et al., 2016)▷

HD 5891 discovery (Johnson et al., 2011a)▷

HD 6434 discovery (Mayor et al., 2004)▷ ephemeris refinement, transit probability, and absence of transits (Hinkel et al., 2015b)▷

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HD 6718 discovery (Naef et al., 2010)⊳

HD 7199 discovery, and long-term stellar activity (Dumusque et al., 2011a)⊳

HD 7449 discovery of planet b, high eccentricity ($e = 0.8$), and evidence for planet c (Dumusque et al., 2011a)⊳ high eccentricity as artefact of unidentified multiple planets (Wittenmyer et al., 2013)⊳ long-term stability (Antoniadou & Voyatzis, 2016)⊳ M dwarf companion from MagAO imaging (Rodigas et al., 2016)⊳ stellar multiplicity from VLT–SPHERE (Moutou et al., 2017)⊳

HD 7924 3-planet system; discovery of planet b (Howard et al., 2009)⊳ no Spitzer transits (Kammer et al., 2014)⊳ stellar diameter and temperature (von Braun et al., 2014)⊳ discovery of planets c and d (Fulton et al., 2015b)⊳ dynamical stability (Kane, 2016)⊳

HD 8326 discovery (Feng et al., 2019b)⊳

HD 8535 discovery (Naef et al., 2010)⊳

HD 8574 discovery (Perrier et al., 2003)⊳

HD 8673 discovery (Hartmann et al., 2010)⊳ stellar M dwarf companion from imaging may explain high eccentricity (Roberts et al., 2015a)⊳

HD 9174 discovery (Jenkins et al., 2017)⊳

HD 9446 2-planet system; discovery of planets b and c (Hébrard et al., 2010a)⊳ secular evolution in second-order Hamiltonian expansion (Libert & Sansottera, 2013)⊳

HD 10180 6-planet system (planets c–h); discovery of at least 6 planets from HARPS (Lovis et al., 2011)⊳ tidal interactions in multi-planet systems (Papaloizou, 2011)⊳ Bayesian analysis (Feroz et al., 2011b)⊳ constraints on eccentricity from tidal dissipation (Laskar et al., 2012)⊳ evidence for 9 planets in published data (Tuomi, 2012)⊳ dynamical stability as a function of eccentricity, and planet g within habitable zone (Kane & Gelino, 2014)⊳ planet search utilising compressed sensing techniques (Hara et al., 2017)⊳ system is hierarchically AMD-stable (Laskar & Petit, 2017)⊳ dynamics of possible exocomets (Loibnegger et al., 2017)⊳ prediction of 4 missing planets from Titius–Bode law (Aschwanden, 2018)⊳

HD 10442 discovery (Giguere et al., 2015)⊳

HD 10647 $\equiv q^1$ Eri; unpublished discovery of planet b (quoted by Butler et al., 2006b)⊳ planet b not confirmed (Jones et al., 2004)⊳ planet b confirmed (Butler et al., 2006b)⊳ infrared to sub-mm spectral energy distribution of debris disk (Liseau et al., 2008)⊳ cold debris disk resolved by Herschel–PACS (Liseau et al., 2010)⊳ mass constraints from Hipparcos (Reffert & Quirrenbach, 2011)⊳ debris disk radius and grain sizes from Herschel (Pawellek et al., 2014)⊳

HD 10697 discovery (Vogt et al., 2000)⊳ Hipparcos astrometry suggests brown dwarf, $38 M_J$ (Zucker & Mazeh, 2000)⊳ stellar diameter (Boyajian et al., 2013)⊳

HD 11506 2-planet system; discovery of planet b (Fischer et al., 2007)⊳ discovery of planet c from published data (Tuomi & Kotiranta, 2009)⊳ secular evolution in second-order Hamiltonian expansion (Libert & Sansottera, 2013)⊳ confirmation of planet c from N2K (Giguere et al., 2015)⊳

HD 11755 discovery (Lee et al., 2015a)⊳

HD 11964 2-planet system; discovery of planet b (Butler et al., 2006b)⊳ evidence for planet d (Gregory, 2007b)⊳ discovery of planet c (Wright et al., 2009b)⊳ secular orbital dynamics (Veras & Ford, 2010)⊳ tidal evolution (Correia et al., 2011)⊳ stellar diameter (Boyajian et al., 2013)⊳ dynamical stability (Elser et al., 2013)⊳ secular evolution in second-order Hamiltonian expansion (Libert & Sansottera, 2013)⊳

HD 11977 discovery (Setiawan et al., 2005)⊳

HD 12484 discovery (Hébrard et al., 2016)⊳

HD 12648 discovery (Lee et al., 2015a)⊳

HD 12661 2-planet system; discovery of planet b (Fischer et al., 2001)⊳ system stability (Kiseleva-Eggleton et al., 2002)⊳ discovery of planet c (Fischer et al., 2003b)⊳ system stability (Goździewski, 2003b)⊳ system stability (Goździewski & Maciejewski, 2003)⊳ resonant motion, and apsidal (anti-)alignment (Ji et al., 2003c)⊳ dynamics and stability (Rodríguez & Gallardo, 2005)⊳ orbit migration and stability (Zhang & Zhou, 2006)⊳ proximity to resonance (Libert & Henrard, 2007)⊳ consistency with a stable Kozai-resonant state (Libert & Tsiganis, 2009)⊳ higher time-averaged eccentricity for planet c (Veras & Ford, 2009)⊳ secular evolution in second-order Hamiltonian expansion (Libert & Sansottera, 2013)⊳

HD 13167 discovery (Luhn et al., 2019)⊳

HD 13189 discovery (Hatzes et al., 2005)⊳ stellar abundances (Schuler et al., 2005)⊳

HD 13724 discovery (Rickman et al., 2019)⊳

HD 13908 2-planet system; discovery of planets b and c (Moutou et al., 2014b)⊳

HD 13931 discovery (Howard et al., 2010)⊳

HD 14067 discovery (Wang et al., 2014b)⊳ constraints on co-moving companion from Subaru–HiCIAO (Ryu et al., 2016)⊳

HD 14787 discovery (Luhn et al., 2019)⊳

HD 16141 discovery (Marcy et al., 2000)⊳ imaging of co-moving stellar companion (Mugrauer et al., 2005b)⊳

HD 16175 discovery (Peek et al., 2009)⊳ combined ELODIE and Lick constraints (Díaz et al., 2016a)⊳

HD 16417 discovery (O'Toole et al., 2009)⊳

HD 17092 discovery (Niedzielski et al., 2007)⊳

HD 17156 see transiting systems

HD 17674 discovery (Rey et al., 2017)⊳

HD 18015 discovery (Luhn et al., 2019)⊳

HD 18742 discovery (Johnson et al., 2011a)⊳

HD 19994 provisional discovery announced in 2000 (Queloz et al., 2004)⊳ stellar abundances (Smith et al., 2001)⊳ published orbit (Mayor et al., 2004)⊳ compositional diversity due to giant planet migration (Carter-Bond et al., 2012)⊳ orbital analysis (Plávalová & Solovaya, 2013)⊳ asteroseismology and impact of atomic diffusion on stellar parameters (Deal et al., 2017)⊳

HD 20003 2-planet system; discovery (Udry et al., 2019)⊳

HD 20781 4-planet system; discovery (Udry et al., 2019)⊳

HD 20782 largest known eccentricity discovered by radial velocity ($e = 0.956$); wide stellar binary with HD 20781; discovery (Jones et al., 2006)⊳ ejection of putative Earth-mass planets from habitable zone (Yeager et al., 2011)⊳ prospects for direct imaging of tidally-powered systems (Dong et al., 2013)⊳ abundance analysis of wide stellar binary and evidence for planet accretion (Mack et al., 2014)⊳ evidence for reflected light from MOST (Kane et al., 2016b)⊳

HD 20794 4-planet system; discovery of planets b, c, d (Pepe et al., 2011)⊳ Kuiper belt structure around nearby super-Earth hosts (Kennedy et al., 2015)⊳ discovery of planet e (Feng et al., 2017b)⊳

HD 20868 discovery (Moutou et al., 2009b)⊳

HD 21411 discovery (Feng et al., 2019b)⊳

HD 21693 2-planet system; discovery (Udry et al., 2019)⊳

HD 22781 discovery (Díaz et al., 2011)⊳ discovery (Díaz et al., 2012)⊳

HD 23079 discovery (Tinney et al., 2002)⊳ possibility of habitable Trojans (Eberle et al., 2011)⊳ orbit stability, and possibility of habitable exomoons (Cuntz et al., 2013)⊳

HD 23127 discovery (O'Toole et al., 2007)⊳

HD 23596 discovery (Perrier et al., 2003)⊳ discovery (Udry et al., 2003b)⊳

HD 24040 discovery (Wright et al., 2007)⊳ orbit from SOPHIE, and evidence for planet c (Boisse et al., 2012)⊳ new radial velocities (Feng et al., 2015)⊳

HD 24064 discovery (Lee et al., 2015a)⊳

HD 21411 discovery (Feng et al., 2019b)⊳

HD 24085 discovery (Moutou et al., 2011b)⊳

HD 25015 discovery (Rickman et al., 2019)⊳

HD 26965 discovery (Ma et al., 2018)⊳

HD 27442 $\equiv \epsilon$ Ret; wide binary; discovery (Butler et al., 2001)⊳ spectroscopy of HD 27442 B (Chauvin et al., 2007)⊳ imaging of co-moving companion HD 27442 B (Mugrauer et al., 2007)⊳ evolutionary constraints the white dwarf companion (Farihi et al., 2011)⊳ mass constraints from Hipparcos intermediate astrometry (Reffert & Quirrenbach, 2011)⊳

HD 27631 discovery (Marmier et al., 2013);

HD 27894 3-planet system, close-in pair with 2:1 period ratio and an eccentric Jovian planet at 5.4 au; discovery of planet b (Moutou et al., 2005)⊳ disentangling eccentric versus 2:1 resonant radial velocity orbits, and evidence for second planet (Kürster et al., 2015)⊳ discovery of planets b and c (Trifonov et al., 2017)⊳

HD 28185 discovery (Santos et al., 2001)⊳ confirmation from Magellan–MIKE (Minniti et al., 2009)⊳ habitability of hypothetical exomoon (Hinkel & Kane, 2013a)⊳

HD 28254 discovery (Naef et al., 2010)⊳

HD 28678 discovery (Johnson et al., 2011a)⊳

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HD 29021 discovery (Rey et al., 2017)⊳

HD 30177 2-planet system, metal-enriched star; discovery of planet b with AAT (Tinney et al., 2003)⊳ discovery of planet c with AAT (Wittenmyer et al., 2017a)⊳

HD 30562 discovery (Fischer et al., 2009)⊳

HD 30669 discovery (Moutou et al., 2015)⊳

HD 30856 discovery (Johnson et al., 2011a)⊳ stellar multiplicity (Ngo et al., 2017)⊳

HD 31253 discovery (Meschiari et al., 2011)⊳

HD 31527 3-planet system; discovery (Udry et al., 2019)⊳

HD 32518 discovery (Döllinger et al., 2009b)⊳

HD 32963 discovery (Rowan et al., 2016)⊳

HD 33142 2-planet system; discovery of planet b (Johnson et al., 2011a)⊳ confirmation of planet c (Bryan et al., 2016b)⊳

HD 33283 discovery (Johnson et al., 2006b)⊳ thermal detection of long-period eccentric planets during pericentre passage with Spitzer and JWST (Kane & Gelino, 2011)⊳

HD 33564 discovery (Galland et al., 2005)⊳ stellar diameter and temperature (von Braun et al., 2014)⊳

HD 33844 2-planet system in 3:5 resonance; discovery and dynamical stability (Wittenmyer et al., 2016b)⊳

HD 34445 6-planet system; discovery of planet b from Keck/HET (Howard et al., 2010)⊳ discovery of planets b–g from 18 yr of data with Keck, Magellan, APF (Vogt et al., 2017)⊳ system stability (Georgakarakos & Dobbs-Dixon, 2019)⊳

HD 35759 discovery (Hébrard et al., 2016)⊳

HD 37124 3-planet system; discovery of planet b (Vogt et al., 2000)⊳ dynamical stability and apsidal motion (Kiseleva-Eggleton et al., 2002)⊳ discovery of planet c (Butler et al., 2003)⊳ dynamical stability (Goździewski, 2003a)⊳ dynamical stability (Ji et al., 2003c)⊳ unexpected position in HR diagram (Laws et al., 2003)⊳ stellar models (Fernandes & Santos, 2004)⊳ provisional discovery of planet d (Vogt et al., 2005)⊳ dynamical stability (Goździewski et al., 2006)⊳ dynamical stability and possible resonances (Baluev, 2008)⊳ dynamical stability (Goździewski et al., 2008a)⊳ Bayesian analysis (Feroz et al., 2011b)⊳ confirmation of planet d, and 2:1 resonance (Wright et al., 2011b)⊳ dynamical stability (Elser et al., 2013)⊳ reversibility error method applied to orbital dynamics (Panichi et al., 2017)⊳

HD 37605 2-planet system; discovery of planet b with $e = 0.7$ (Cochran et al., 2004)⊳ persistent circumpolar vortices resulting from variable atmospheric forcing (Langton & Laughlin, 2008)⊳ photometric phase variations of long-period eccentric planets (Kane & Gelino, 2010)⊳ thermal detection of long-period eccentric planets during pericentre passage with Spitzer and JWST (Kane & Gelino, 2011)⊳ discovery of planet c, and transit constraints on planet b (Wang et al., 2012b)⊳ dynamics of eccentric systems (Kane & Raymond, 2014)⊳ limits on radio emission at 154 MHz from the Murchison Widefield Array (Murphy et al., 2015)⊳

HD 38283 gas giant orbiting a circumpolar star with $P = 363$ d and $e = 0.4$; discovery (Tinney et al., 2011b)⊳

HD 38529 2-planet system; discovery of planet b and evidence for planet c (Fischer et al., 2001)⊳ dynamical stability (Kiseleva-Eggleton et al., 2002)⊳ confirmation/discovery of planet c (Fischer et al., 2003b)⊳ dynamical stability of the habitable zone (Érdi et al., 2004)⊳ planet c mass ($37 M_J$) from Hipparcos astrometry (Reffert & Quirrenbach, 2006)⊳ proximity to resonance (Libert & Henrard, 2007)⊳ distribution of dust-producing planetesimals from Spitzer (Moro-Martín et al., 2007)⊳ planet c mass ($18 M_J$) from HST–FGS astrometry (Benedict et al., 2010)⊳ secular orbital dynamics (Veras & Ford, 2010)⊳ host star properties and transit exclusion (Henry et al., 2013)⊳ collisional parameters of planetesimal belt (Marzari & Dell'Oro, 2017)⊳

HD 38801 discovery (Harakawa et al., 2010)⊳

HD 39091 see transiting systems

HD 39855 discovery (Feng et al., 2019b)⊳

HD 40307 5-planet system; discovery of super-Earth planets b, c, d (Mayor et al., 2009b)⊳ higher planet masses suggested by dynamical and tidal studies (Barnes et al., 2009)⊳ transit limits for planet b from Spitzer–IRAC (Gillon et al., 2010a)⊳ dynamical evolution (Papaloizou & Terquem, 2010)⊳ mean motion resonances and migration (Wang, 2011)⊳ planets e, f, g suggested from Bayesian analysis of HARPS data (Tuomi et al., 2013a)⊳ influence of thermal evolution in the magnetic protection of terrestrial planets (Zuluaga et al., 2013)⊳ dynamical study of habitability of super-Earth planet g (Brasser et al., 2014)⊳ formation of close period ratios (Chen, 2015)⊳ gravitational quantisation of orbits (Geroyannis, 2015)⊳ confirmation and characterisation of planets b–e (Díaz et al., 2016b)⊳

HD 40956 long-period planet ($P = 579$ d) orbiting a K giant; discovery (Jeong et al., 2018)⊳

HD 40979 discovery (Fischer et al., 2003b)⊳

HD 41004A and HD 41004B hierarchical system with one planet orbiting binary component A, and a brown dwarf orbiting fainter component B; discovery of planet b orbiting HD 41004 A, and complex radial velocity signature due to proximity of binary star components (Santos et al., 2002)⊳ discovery of planet b orbiting HD 41004 B (Zucker et al., 2003)⊳ nature of hierarchical system (Zucker et al., 2004)⊳ stellar multiplicity (Raghavan et al., 2006)⊳ measurement of ^{9}Be depletion (Delgado Mena et al., 2011)⊳ radial velocity contribution from tides (Arras et al., 2012)⊳ habitable terrestrial planets in tight binary systems (Funk et al., 2015)⊳ limits on radio emission at 154 MHz from the Murchison Widefield Array (Murphy et al., 2015)⊳ identification of secular resonances in multi-planet systems with a binary companion (Pilat-Lohinger et al., 2016)⊳ dynamical stability (Satyal & Musielak, 2016)⊳

HD 41248 not in NASA archive; claimed 2-planet system with periods 18.3 and 25.6 d, subsequently retracted; planet with $P = 13.4$ d subsequently proposed; claimed discovery of planets b and c, in possible 7:5 resonance, from re-analysis of HARPS data (Jenkins et al., 2013b)⊳ nature of the planetary signals (Jenkins & Tuomi, 2014)⊳ signals attributed to stellar activity (Santos et al., 2014)⊳ discovery of $7.1 M_\oplus$ planet with $P = 13.4$ d (Feng et al., 2017a)⊳

HD 42012 discovery (Rey et al., 2017)⊳

HD 42618 discovery (Fulton et al., 2016)⊳

HD 43197 discovery (Naef et al., 2010), thermal detection of long-period eccentric planets during pericentre passage with Spitzer and JWST (Kane & Gelino, 2011)⊳ possible radio detection with VLA NVSS (Sirothia et al., 2014)⊳

HD 43691 discovery (da Silva et al., 2007)⊳ stellar multiplicity (Ngo et al., 2017)⊳

HD 44219 discovery (Naef et al., 2010)⊳ stellar companion constraints from VLT–NACO imaging (Ginski et al., 2013)⊳

HD 45184 2-planet system; discovery (Udry et al., 2019)⊳

HD 45350 discovery (Marcy et al., 2005)⊳ confirmation (Endl et al., 2006)⊳

HD 45364 2-planet system, first discovery of a 3:2 resonance; discovery of planets b and c in 3:2 resonance (Correia et al., 2009)⊳ possible origin of 3:2 resonance (Rein et al., 2010)⊳ alternative formation via migration (Correa-Otto et al., 2013)⊳ chaotically evolving eccentricities and inclinations with mutual inclinations (Barnes et al., 2015b)⊳

HD 45652 discovery (Santos et al., 2008)⊳

HD 46375 discovery (Marcy et al., 2000)⊳ constraints on transits (Henry, 2000)⊳ unexpected position in HR diagram (Laws et al., 2003)⊳ stellar models (Fernandes & Santos, 2004)⊳ possible detection of reflected light from CoRoT (Gaulme et al., 2010b)⊳ spectrometry and asteroseismology (Gaulme et al., 2010a)⊳ stellar magnetic field topology (Fares et al., 2013)⊳ stellar wind properties, magnetic fields, bow shocks and radio emission (Vidotto et al., 2015)⊳

HD 47186 2-planet system; discovery of planets b and c (Bouchy et al., 2009)⊳ dynamical stability of putative planet in habitable zone (Kopparapu et al., 2009)⊳ dynamical stability (Elser et al., 2013)⊳

HD 47366 2-planet system, possibly mutually retrograde; discovery (Sato et al., 2016)⊳ reanalysis of dynamical stability (Marshall et al., 2019)⊳

HD 47536 discovery (Setiawan et al., 2003)⊳

HD 48265 discovery (Minniti et al., 2009)⊳ improved orbit (Jenkins et al., 2017)⊳

HD 49674 discovery (Butler et al., 2003)⊳

HD 50499 2-planet system; discovery of planet b, and evidence for planet c (Vogt et al., 2005)⊳ confirmation of planet c (Rickman et al., 2019)⊳

HD 50554 discovery (Fischer et al., 2002a)⊳ orbit formalising original discovery (Perrier et al., 2003)⊳ debris disk observations with Herschel–PACS (Dodson-Robinson et al., 2016)⊳

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HD 51608 2-planet system; discovery (Udry et al., 2019)⊳

HD 52265 discovery (Butler et al., 2000)⊳ independent discovery (Naef et al., 2001b)⊳ stellar composition (Santos et al., 2000a)⊳ asteroseismology from CoRoT (Soriano et al., 2007)⊳ asteroseismology from CoRoT (Ballot et al., 2011)⊳ asteroseismology from CoRoT (Escobar et al., 2012)⊳ high eccentricity as artefact of unidentified multiple planets (Wittenmyer et al., 2013)⊳ seismic constraints on rotation (Gizon et al., 2013)⊳ stellar mass and age from CoRoT asteroseismology (Lebreton & Goupil, 2014)⊳ debris disk observations with Herschel–PACS (Dodson-Robinson et al., 2016)⊳

HD 55696 discovery (Ment et al., 2018)⊳

HD 59686A discovery (Ortiz et al., 2016)⊳ dynamical models indicate stable orbital solutions locked in a secular apsidal alignment (Trifonov et al., 2018b)⊳

HD 60532 2-planet system; discovery of planets b and c in possible 3:1 resonance (Desort et al., 2008)⊳ discovery and radial velocity (Desort et al., 2009)⊳ confirmation of the 3:1 resonance from dynamical studies, and determination of $i = 20°$ (Laskar & Correia, 2009)⊳ origin of 3:1 resonance via resonance capture for high-mass planets (Sándor & Kley, 2010)⊳ chaotically evolving eccentricities and inclinations with mutual inclinations (Barnes et al., 2015b)⊳ phase space structure of the 3:1 resonance (Alves et al., 2016)⊳ orbital evolution of a pair of giant planets in mean motion resonance (André & Papaloizou, 2016)⊳

HD 62509 ≡ β Gem ≡ Pollux; discovery (Hatzes & Cochran, 1993)⊳ confirmation from Lick radial velocities (Reffert et al., 2006)⊳ planet engulfment by red giant branch evolution (Kunitomo et al., 2011)⊳ simulation of Gaia astrometric data (Huang & Ji, 2016)⊳ astrometric planet detection with Gaia (Huang & Ji, 2017)⊳ constraints on radio emission from LOFAR (O'Gorman et al., 2018)⊳

HD 63454 discovery (Moutou et al., 2005)⊳ revised transit ephemeris and transit constraints (Kane et al., 2011a)⊳ constraints on stellar variability (Kane et al., 2011a)⊳

HD 63765 discovery (Ségransan et al., 2011)⊳

HD 64114 discovery (Feng et al., 2019b)⊳

HD 65216 2-planet system; discovery of planets b and c (Mayor et al., 2004)⊳ high eccentricity as artefact of unidentified multiple planets (Wittenmyer et al., 2013)⊳

HD 66141 discovery (Lee et al., 2012b)⊳

HD 66428 discovery (Butler et al., 2006b)⊳ new radial velocities (Feng et al., 2015)⊳

HD 67087 2-planet system; discovery (Harakawa et al., 2015)⊳

HD 68402 discovery (Jenkins et al., 2017)⊳

HD 68988 discovery (Vogt et al., 2002)⊳ models of planet radius (Bodenheimer et al., 2003)⊳ evidence for planet c (Wright et al., 2007)⊳ post-Newtonian effects (Li, 2012)⊳ chromospheric activity (Kuznyetsova et al., 2014)⊳

HD 69830 3-planet system of Neptune masses and asteroid belt; asteroid or cometary debris from Spitzer photometry (Beichman et al., 2005)⊳ discovery of planets b, c, d (Lovis et al., 2006)⊳ formation scenario via extended core accretion (Alibert et al., 2006)⊳ system stability (Ji et al., 2007)⊳ atmospheric evaporation (Lecavelier des Etangs, 2007)⊳ dynamical simulations and constraints on e and i (Payne et al., 2009)⊳ resolved imaging of debris disk using VLT–MIDI/VISIR (Smith et al., 2009b)⊳ limits on photometric variability of debris disk (Beichman et al., 2011)⊳ debris disk mass estimates (Heng, 2011)⊳ Kuiper belt structure around nearby super-Earth hosts (Kennedy et al., 2015)⊳ stellar parameters from CHARA interferometry (Tanner et al., 2015)⊳ planet search utilising compressed sensing techniques (Hara et al., 2017)⊳

HD 70573 discovery (Setiawan et al., 2007)⊳

HD 70642 discovery (Carter et al., 2003)⊳ dynamical stability of putative Earth-like planet in habitable zone (Hinse et al., 2008)⊳ detection of stellar magnetic field (Fossati et al., 2013b)⊳

HD 72490 discovery (Luhn et al., 2019)⊳

HD 72659 discovery (Butler et al., 2003)⊳ dynamical stability of putative Earth-like planet in habitable zone (Asghari et al., 2004)⊳

HD 72892 discovery (Jenkins et al., 2017)⊳

HD 73256 not in NASA archive; claimed discovery (Udry et al., 2003a)⊳ chromospheric activity related to stellar rotation and planet orbit (Shkolnik et al., 2005)⊳ stellar magnetic field topology (Fares et al., 2013)⊳ stellar wind properties, magnetic fields, bow shocks and radio emission (Vidotto et al., 2015)⊳

HD 73267 discovery (Moutou et al., 2009b)⊳

HD 73526 2-planet system around metal-enriched star; discovery of planet b (Tinney et al., 2003)⊳ alternative orbits for planet b (Gregory, 2005)⊳ discovery of planet c in 2:1 resonance with planet b (Tinney et al., 2006)⊳ stability and formation of resonant system (Sándor et al., 2007)⊳ analysis of radial velocity variations (Pál, 2010)⊳ stability (Zhang et al., 2010)⊳ measurement of ^{9}Be depletion (Delgado Mena et al., 2011)⊳ dynamical stability from 6 yr of radial velocities from AAT and Magellan (Wittenmyer et al., 2014b)⊳ chaotically evolving eccentricities and inclinations with mutual inclinations (Barnes et al., 2015b)⊳

HD 73534 discovery (Valenti et al., 2009)⊳ habitability of hypothetical exomoon (Hinkel & Kane, 2013a)⊳

HD 74156 2-planet system; discovery of planets b and c (Naef et al., 2004)⊳ dynamical stability and habitable zone (Dvorak et al., 2003b)⊳ proximity to resonance (Libert & Henrard, 2007)⊳ discovery of planet d (Bean et al., 2008b)⊳ dynamical prediction of planet d (Barnes et al., 2008b)⊳ ^{6}Li/^{7}Li ratio (Ghezzi et al., 2009)⊳ consistency with a stable Kozai-resonant state (Libert & Tsiganis, 2009)⊳ additional Keck–HIRES data does not confirm planet d (Meschiari et al., 2011)⊳ favourable for tests of solar spin–orbit coupling (Perryman & Schulze-Hartung, 2011)⊳ secular evolution in second-order Hamiltonian expansion (Libert & Sansottera, 2013)⊳ dynamics of eccentric systems (Kane & Raymond, 2014)⊳ new radial velocities (Feng et al., 2015)⊳

HD 75289 discovery (Udry et al., 2000)⊳ stellar abundances (Gonzalez & Laws, 2000)⊳ stellar abundances (Santos et al., 2000a)⊳ tidal constraints on mass of planet b (Trilling, 2000)⊳ constraints on stellar reflected light from VLT–UVES (Leigh et al., 2003b)⊳ imaging of comoving stellar companion (Mugrauer et al., 2004b)⊳ constraints on stellar reflected light from Gemini–Phoenix (Barnes et al., 2007b)⊳ constraints on stellar reflected light (Rodler et al., 2008)⊳ wavelength calibration using laser frequency comb (Wilken et al., 2012)⊳

HD 75784 2-planet system; discovery of planet b (Giguere et al., 2015)⊳ discovery of planet c (Ment et al., 2018)⊳

HD 75898 discovery (Robinson et al., 2007)⊳ distinguishing true and alias periods using the Vuong test (Baluev, 2012)⊳

HD 76700 metal-enriched star; discovery (Tinney et al., 2003)⊳ measurement of ^{9}Be depletion (Delgado Mena et al., 2011)⊳

HD 76920 high eccentricity ($e = 0.86$) orbiting a giant star; discovery (Wittenmyer et al., 2017b)⊳

HD 77338 discovery (Jenkins et al., 2013a)⊳ stellar abundances (Kushniruk et al., 2014)⊳

HD 79498 discovery (Robertson et al., 2012a)⊳

HD 80606 see transiting systems

HD 81040 discovery (Sozzetti et al., 2006a)⊳

HD 81688 discovery (Sato et al., 2008a)⊳

HD 82886 discovery (Johnson et al., 2011a)⊳

HD 82943 2-planet system in 2:1 resonance; discovery of planets b and c announced in ESO press release (2001 April 4); stellar abundances (Santos et al., 2000a)⊳ dynamical stability (Goździewski & Maciejewski, 2001)⊳ stellar ^{6}Li as evidence for planet engulfment (Israelian et al., 2001)⊳ dynamical stability (Ji et al., 2002b)⊳ search for ^{6}Li (Reddy et al., 2002)⊳ dynamical stability (Hadjidemetriou & Psychoyos, 2003)⊳ measurements of ^{6}Li (Israelian et al., 2003)⊳ apsidal anti-alignment (Ji et al., 2003a)⊳ dynamical stability (Ji et al., 2003c)⊳ evolution of resonant systems (Kley et al., 2004)⊳ orbit solution formalising original discovery (Mayor et al., 2004)⊳ alternative orbit solutions avoiding dynamical catastrophe (Ferraz-Mello et al., 2005)⊳ dynamical analysis (Psychoyos & Hadjidemetriou, 2005)⊳ alternative fit to radial velocity data, based on 1:1 resonance pair (Goździewski & Konacki, 2006)⊳ dynamical analysis (Lee et al., 2006)⊳ dynamical analysis (Barnes & Greenberg, 2007)⊳ unreliability of orbit determination (Beaugé et al., 2008)⊳ ^{6}Li/^{7}Li ratio (Ghezzi et al., 2009)⊳ photometric phase variations of long-period eccentric planets (Kane & Gelino, 2010)⊳ constraints on location of dust-producing planetesimals (Moro-Martín et al., 2010a)⊳ alignment of planetary orbits and debris disk (Kennedy et al., 2013)⊳ 10-yr of Keck radial velocity data support 2:1 resonance (Tan et al., 2013)⊳ annual CORALIE error correction, and evidence for planet d in 1:2:5 resonance (Baluev & Beaugé, 2014)⊳ long-term stability (Antoniadou & Voyatzis, 2016)⊳ planetary migration as the origin of the 2:1 mean motion resonance (Ramos et al., 2017)⊳

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HD 83443 unpublished discovery of planets b and c (see Butler et al., 2002)▷ stellar abundances (Santos et al., 2000a)▷ confirmation of planet b but not planet c (Butler et al., 2002)▷ tidal evolution and constraints on Love number (Wu & Goldreich, 2002)▷ orbit solution formalising original discovery (Mayor et al., 2004)▷

HD 85390 discovery (Mordasini et al., 2011)▷ high eccentricity as artefact of unidentified multiple planets (Wittenmyer et al., 2013)▷

HD 85512 discovery (Pepe et al., 2011)▷ 3d climate modeling of close-in land planets (Leconte et al., 2013)▷

HD 86081 discovery (Johnson et al., 2006b)▷ stellar multiplicity (Ngo et al., 2017)▷

HD 86226 discovery (Arriagada et al., 2010)▷ possible radio detection with GMRT (Sirothia et al., 2014)▷

HD 86264 discovery (Fischer et al., 2009)▷

HD 86950 discovery (Wittenmyer et al., 2017c)▷

HD 87646 a giant planet (MARVELS–7 b) and a brown dwarf candidate (MARVELS–7 c) represent the first close binary with more than one substellar circumprimary companion; discovery with MARVELS (Ma et al., 2016)▷

HD 87883 discovery (Fischer et al., 2009)▷

HD 88133 discovery (Fischer et al., 2005)▷ cyclic transit probabilities for long-period eccentric orbits due to apsidal precession (Kane et al., 2012)▷ post-Newtonian effects (Li, 2012)▷ evidence for direct detection of the thermal spectrum of the non-transiting hot gas giant (Piskorz et al., 2016)▷

HD 89307 discovery (Fischer et al., 2009)▷ improved orbit (Boisse et al., 2012)▷

HD 89744 high eccentricity ($e = 0.7$); discovery (Korzennik et al., 2000)▷ imaging of co-moving stellar companion (Mugrauer et al., 2004a)▷ high eccentricity as artefact of unidentified multiple planets (Wittenmyer et al., 2013)▷ long-term stability (Antoniadou & Voyatzis, 2016)▷

HD 90156 discovery (Mordasini et al., 2011)▷

HD 92788 2-planet system; discovery (Fischer et al., 2001)▷ confirmation (Mayor et al., 2004)▷ high eccentricity as artefact of unidentified multiple planets (Wittenmyer et al., 2013)▷ confirmation of planet c (Rickman et al., 2019)▷

HD 92987 discovery (Rickman et al., 2019)▷

HD 93083 discovery (Lovis et al., 2005)▷

HD 94834 discovery (Luhn et al., 2019)▷

HD 95089 2-planet system; discovery of planet b (Johnson et al., 2010b)▷ discovery of planet c (Bryan et al., 2016b)▷

HD 95127 discovery (Niedzielski et al., 2015b)▷

HD 95872 discovery (Endl et al., 2016)▷

HD 96063 discovery (Johnson et al., 2011a)▷ 3d atmospheric circulation modeling (Medvedev et al., 2013)▷

HD 96127 discovery (Gettel et al., 2012b)▷

HD 96167 discovery (Peek et al., 2009)▷ high-contrast imaging search for substellar companions (Mugrauer & Ginski, 2015)▷

HD 97658 see transiting systems

HD 98219 discovery (Johnson et al., 2011a)▷

HD 98649 high eccentricity ($e = 0.85$); discovery, and uncertain origin of high eccentricity (Marmier et al., 2013)▷ updated orbit (Rickman et al., 2019)▷

HD 98736 discovery (Ment et al., 2018)▷

HD 99109 discovery (Butler et al., 2006b)▷

HD 99492 discovery of planet b (Marcy et al., 2005)▷ claimed discovery of outer planet c (Meschiari et al., 2011)▷ stellar activity as an explanation for claimed planet c (Kane et al., 2016a)▷ application of atmospheric retrieval model (Lupu et al., 2016)▷

HD 99706 2-planet system; discovery of planet b (Johnson et al., 2011a)▷ discovery of planet c (Bryan et al., 2016b)▷

HD 100655 discovery (Omiya et al., 2012)▷

HD 100777 discovery (Naef et al., 2007)▷

HD 101930 discovery (Lovis et al., 2005)▷

HD 102117 discovery (Lovis et al., 2005)▷ independent discovery (Tinney et al., 2005)▷

HD 102195 referred to by discoverers as ET–1 (Exoplanet Tracker); discovery and confirmation with KPNO 2.1-m and HET–HRS (Ge et al., 2006)▷ confirmation from HARPS (Melo et al., 2007)▷ stellar magnetic field topology (Fares et al., 2013)▷ stellar wind properties, magnetic fields, bow shocks and radio emission (Vidotto et al., 2015)▷ detection of molecular absorption (Guilluy et al., 2019)▷

HD 102272 1- or 2-planet system (1 in NASA); discovery of planets b and c (Niedzielski et al., 2009a)▷ long-term stability (Antoniadou & Voyatzis, 2016)▷

HD 102329 2-planet system; discovery of planet b (Johnson et al., 2011a)▷ discovery of planet c (Bryan et al., 2016b)▷

HD 102365 discovery (Tinney et al., 2011a)▷ limits on radio emission at 154 MHz from the Murchison Widefield Array (Murphy et al., 2015)▷

HD 102843 discovery (Feng et al., 2019b)▷

HD 102956 discovery (Johnson et al., 2010a)▷

HD 103197 discovery (Mordasini et al., 2011)▷

HD 103720 discovery (Moutou et al., 2015)▷

HD 103774 discovery (Lo Curto et al., 2013)▷

HD 103949 discovery (Feng et al., 2019b)▷

HD 104067 discovery, and significant magnetic cycles (Ségransan et al., 2011)▷

HD 104985 discovery (Sato et al., 2003)▷

HD 106252 discovery (Fischer et al., 2002a)▷ confirmation (Perrier et al., 2003)▷

HD 106270 discovery (Johnson et al., 2011a)▷

HD 106515A discovery (Desidera et al., 2012)▷ improved orbit (Marmier et al., 2013)▷ binary star dynamics (Rica et al., 2017)▷

HD 107148 discovery (Butler et al., 2006b)▷ wide white dwarf companion from imaging, HD 107148B (Mugrauer et al., 2014)▷ spectroscopy of HD 107148B (Mugrauer & Dinçel, 2016)▷

HD 108147 discovery (Pepe et al., 2002)▷ cyclic transit probabilities for long-period eccentric orbits due to apsidal precession (Kane et al., 2012)▷

HD 108341 high eccentricity ($e = 0.85$); discovery (Moutou et al., 2015)▷

HD 108863 discovery (Johnson et al., 2011a)▷

HD 108874 2-planet system; discovery of planet b (Butler et al., 2003)▷ discovery of planet c (Vogt et al., 2005)▷ dynamical stability and proximity to 4:1 resonance (Goździewski et al., 2006)▷ dynamical stability (Libert & Henrard, 2007)▷ stable orbits for Trojan terrestrial planets in habitable zone (Schwarz et al., 2007)▷ secular orbital dynamics (Veras & Ford, 2010)▷ secular evolution in second-order Hamiltonian expansion (Libert & Sansottera, 2013)▷ three year monitoring and improved orbits from HARPS–N (Benatti et al., 2017)▷

HD 109246 discovery (Boisse et al., 2010)▷

HD 109271 2-planet system; discovery of planets b and c (Lo Curto et al., 2013)▷

HD 109749 discovery (Fischer et al., 2006)▷

HD 110014 discovery (de Medeiros et al., 2009)▷

HD 111232 discovery (Mayor et al., 2004)▷ confirmation (Minniti et al., 2009)▷

HD 111591 long-period planet ($P = 1056$ d) orbiting a K giant; discovery (Jeong et al., 2018)▷

HD 111998 discovery (Borgniet et al., 2017)▷

HD 113337 discovery (Borgniet et al., 2014)▷

HD 113538 2-planet system; discovery of planets b and c (Moutou et al., 2011b)▷ orbit update (Moutou et al., 2015)▷

HD 113996 long-period planet ($P = 610$ d) orbiting a K giant; discovery (Jeong et al., 2018)▷

HD 114386 1- or 2-planet system (listed as 1-planet system in NASA) discovery of planet b and unconfirmed planet c (Udry et al., 2003b)▷ discovery from CORALIE (Mayor et al., 2004)▷ measurement of ^{9}Be depletion (Delgado Mena et al., 2011)▷

HD 114613 discovery (Wittenmyer et al., 2014a)▷

HD 114729 discovery (Butler et al., 2003)▷ imaging of co-moving stellar companion (Mugrauer et al., 2005b)▷ possible additional planets (Goździewski & Migaszewski, 2006)▷

HD 114762 discovery, probable brown dwarf (Latham et al., 1989)▷ non-detection of transits (Robinson et al., 1990)▷ confirmation of discovery orbit (Cochran et al., 1991)▷ radio emission (Bastian et al., 2000)▷ co-moving companion (Patience et al., 2002)▷ limits on radio emission (Farrell et al., 2004)▷ revised orbit and transit constraints (Kane et al., 2011c)▷ inclination effect on phase variations (Kane & Gelino, 2012a)▷

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HD 114783 2-planet system; discovery of planet b (Vogt et al., 2002)⊳ discovery of planet c (Bryan et al., 2016b)⊳

HD 116029 2-planet system; discovery of planet b (Johnson et al., 2011a)⊳ stellar multiplicity (Ngo et al., 2017)⊳ discovery of planet c (Bryan et al., 2016b)⊳

HD 117207 discovery (Marcy et al., 2005)⊳ detection of stellar magnetic field (Fossati et al., 2013b)⊳

HD 117618 discovery (Tinney et al., 2005)⊳ high eccentricity as an artefact of unidentified multiple planets (Wittenmyer et al., 2013)⊳

HD 118203 discovery (da Silva et al., 2006)⊳

HD 120084 discovery (Sato et al., 2013a)⊳

HD 121056 not in NASA archive; claimed 2-planet system from AAT observations (Wittenmyer et al., 2015)⊳

HD 121504 discovery (Mayor et al., 2004)⊳

HD 125390 discovery (Luhn et al., 2019)⊳

HD 125595 discovery (Ségransan et al., 2011)⊳

HD 125612 3-planet system; discovery of planet b (Fischer et al., 2007)⊳ imaging of co-moving companion (Mugrauer & Neuhäuser, 2009)⊳ discovery of planets c and d (Lo Curto et al., 2010)⊳ super-Earth architecture explained by outer giant planet scattering (Huang et al., 2017b)⊳

HD 126525 initial discovery (Mayor et al., 2011)⊳ confirmation (Barbato et al., 2018)⊳

HD 126614 discovery (Howard et al., 2010)⊳

HD 128311 2-planet system; discovery of planet b (Butler et al., 2003)⊳ discovery of planet c in possible 2:1 resonance (Vogt et al., 2005)⊳ alternative fit based on 1:1 resonance pair (Goździewski & Konacki, 2006)⊳ dynamical evolution and migration (Sándor & Kley, 2006)⊳ constraints on dust-producing planetesimals (Moro-Martín et al., 2010a)⊳ dynamical evolution (Zhang et al., 2010)⊳ analysis of radial velocity variations (Pál, 2010)⊳ measurement of ^{9}Be depletion (Delgado Mena et al., 2011)⊳ secular evolution in second-order Hamiltonian expansion (Libert & Sansottera, 2013)⊳ HST–FGS astrometry providing inclination, but not supporting resonance (McArthur et al., 2014)⊳ limits on radio emission at 154 MHz from the Murchison Widefield Array (Murphy et al., 2015)⊳ reanalysis of radial velocity data and stability analysis (Rein, 2015)⊳

HD 128356 discovery (Jenkins et al., 2017)⊳

HD 129445 discovery (Arriagada et al., 2010)⊳

HD 130322 discovery (Udry et al., 2000)⊳ stellar magnetic field topology (Fares et al., 2013)⊳ revised orbit new photometry and radial velocities, transit constraints, rotation from star spots (Hinkel et al., 2015a)⊳ stellar wind properties, magnetic fields, bow shocks and radio emission (Vidotto et al., 2015)⊳

HD 131496 discovery (Johnson et al., 2011a)⊳

HD 131664 brown dwarf of $18-23 M_J$; discovery (Moutou et al., 2009b)⊳ mass constrained by Hipparcos astrometry (Sozzetti & Desidera, 2010)⊳ habitable zone (Kane & Gelino, 2012b)⊳

HD 132406 discovery (da Silva et al., 2007)⊳

HD 132563B planet orbiting one component of hierarchical triple system; discovery (Desidera et al., 2011)⊳

HD 133131A and **HD 133131B** G2+G2 'twin' binary, 360 au separation, with 2 planets around A, and one around B; discovery (Teske et al., 2016b)⊳

HD 134060 2-planet system; discovery of planets b and c (Mayor et al., 2011)⊳ confirmation (Udry et al., 2019)⊳

HD 134987 2-planet system; discovery of planet b (Vogt et al., 2000)⊳ updated orbit (Butler et al., 2006b)⊳ discovery of planet c (Jones et al., 2010)⊳ secular evolution in second-order Hamiltonian expansion (Libert & Sansottera, 2013)⊳

HD 136352 3-planet system; discovery (Mayor et al., 2011)⊳ confirmation (Udry et al., 2019)⊳

HD 136418 discovery (Johnson et al., 2010b)⊳

HD 137388A discovery, and long-term stellar activity (Dumusque et al., 2011a)⊳

HD 139357 discovery (Döllinger et al., 2009a)⊳

HD 141399 4-planet system; discovery, one of the first with APF (Vogt et al., 2014)⊳ improved orbit constraints (Hébrard et al., 2016)⊳ system is hierarchically AMD-stable (Laskar & Petit, 2017)⊳ formation of habitable planets (Dvorak et al., 2019)⊳

HD 141937 discovery (Udry et al., 2002)⊳

HD 142022A high-eccentricity ($e = 0.53$) long-period ($P \sim 5$ yr) planet in wide binary; discovery (Eggenberger et al., 2006)⊳

HD 142245 discovery (Johnson et al., 2011a)⊳ high-contrast imaging search for substellar companions (Mugrauer & Ginski, 2015)⊳

HD 142415 discovery (Mayor et al., 2004)⊳

HD 143105 discovery (Hébrard et al., 2016)⊳

HD 143361 discovery (Minniti et al., 2009)⊳ additional observations (Jenkins et al., 2017)⊳

HD 145377 discovery (Moutou et al., 2009b)⊳

HD 145457 discovery (Sato et al., 2010)⊳

HD 145934 discovery (Feng et al., 2015)⊳

HD 147018 2-planet system; discovery of planets b and c (Ségransan et al., 2010)⊳ dynamical stability (Elser et al., 2013)⊳ limits on radio emission at 154 MHz from the Murchison Widefield Array (Murphy et al., 2015)⊳

HD 147379 discovery with CARMENES (Reiners et al., 2018)⊳ confirmation with SOPHIE (Hobson et al., 2018)⊳

HD 147513 discovery (Udry et al., 2003b)⊳ discovery (Mayor et al., 2004)⊳ possible additional planets (Goździewski & Migaszewski, 2006)⊳ ^{6}Li/^{7}Li ratio (Ghezzi et al., 2009)⊳ mass constraints from Hipparcos (Reffert & Quirrenbach, 2011)⊳ stability of possible Trojan planets in habitable zone (Funk et al., 2012)⊳ secular evolution in second-order Hamiltonian expansion (Libert & Sansottera, 2013)⊳ limits on radio emission at 154 MHz from the Murchison Widefield Array (Murphy et al., 2015)⊳ coronal structure (Alvarado-Gómez et al., 2016a)⊳ stellar wind and coronal heating (Alvarado-Gómez et al., 2016b)⊳ spectropolarimetric study of host star (Hussain et al., 2016)⊳

HD 147873 2-planet system; discovery (Jenkins et al., 2017)⊳

HD 148156 discovery (Naef et al., 2010)⊳

HD 148164 2-planet system; discovery (Ment et al., 2018)⊳

HD 148284 discovery (Ment et al., 2018)⊳

HD 148427 discovery (Fischer et al., 2009)⊳

HD 149026 see transiting systems

HD 149143 discovery (Fischer et al., 2006)⊳ confirmation (da Silva et al., 2006)⊳

HD 150706 discovery (Udry et al., 2003b)⊳ published orbit (Boisse et al., 2012)⊳

HD 152079 discovery (Arriagada et al., 2010)⊳ additional observations (Jenkins et al., 2017)⊳

HD 152581 discovery (Johnson et al., 2011a)⊳

HD 153950 discovery (Moutou et al., 2009b)⊳

HD 154345 discovery (Wright et al., 2007)⊳ Jupiter-like planet and 9-yr stellar activity cycle (Wright et al., 2008)⊳ improved orbit (Boisse et al., 2012)⊳

HD 154672 discovery (López-Morales et al., 2008)⊳ additional observations (Jenkins et al., 2017)⊳

HD 154857 2-planet system; discovery of planet b, and evidence for planet c (McCarthy et al., 2004)⊳ evidence for planet c (O'Toole et al., 2007)⊳ measurement of ^{9}Be depletion (Delgado Mena et al., 2011)⊳ confirmation of planet c (Wittenmyer et al., 2014a)⊳

HD 155233 discovery (Wittenmyer et al., 2016a)⊳

HD 155358 2-planet system around low-metallicity star ([Fe/H = –0.68]; discovery of planets b and c (Cochran et al., 2007)⊳ consistency with a stable Kozai-resonant state (Libert & Tsiganis, 2009)⊳ analysis of radial velocity variations (Pál, 2010)⊳ revised analysis using EXOFIT (Balan & Lahav, 2011)⊳ revised period for planet c, indicating 2:1 resonance (Robertson et al., 2012a)⊳ 3d atmospheric circulation modeling (Medvedev et al., 2013)⊳ orbital evolution of a pair of giant planets in mean motion resonance (André & Papaloizou, 2016)⊳ orbital configuration and conditions for mean motion resonance (Ma et al., 2017)⊳ resonance, formation, and stability (Silburt & Rein, 2017)⊳

HD 156279 2-planet system; discovery of planet b (Díaz et al., 2012)⊳ discovery of planet c (Bryan et al., 2016b)⊳

HD 156411 discovery (Naef et al., 2010)⊳ thermal detection of long-period eccentric planets during pericentre passage with Spitzer and JWST (Kane & Gelino, 2011)⊳

HD 156668 discovery (Howard et al., 2011a)⊳ distinguishing true and alias periods using the Vuong test (Baluev, 2012)⊳ no evidence of transits from Spitzer (Kammer et al., 2014)⊳

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HD 156846 high eccentricity ($e = 0.85$); discovery (Tamuz et al., 2008)⊳ orbit from photometry and Keck–HIRES monitoring (Kane et al., 2011d)⊳ thermal detection of long-period eccentric planets during pericentre passage with Spitzer and JWST (Kane & Gelino, 2011)⊳

HD 158038 discovery (Johnson et al., 2011a)⊳

HD 158996 discovery (Bang et al., 2018)⊳

HD 159243 2-planet system; discovery (Moutou et al., 2014b)⊳

HD 159868 2-planet system; discovery of planet b (O'Toole et al., 2007)⊳ discovery of planet c, and revised orbit for planet b (Wittenmyer et al., 2012b)⊳

HD 160691 see μ Ara

HD 162020 discovery (Udry et al., 2002)⊳ constraints on radio emission from GMRT (Winterhalter et al., 2005)⊳ inclination effect on phase variations (Kane & Gelino, 2012a)⊳ limits on radio emission at 154 MHz from the Murchison Widefield Array (Murphy et al., 2015)⊳

HD 163296 not in NASA archive; evidence for 2-planet system within the circumstellar disk from dynamical disk motion; time-variable self-shadowing of the disk in scattered light (Wisniewski et al., 2008)⊳ thermal disk structure from CO lines (Akiyama et al., 2011)⊳ detection of c-C_3H_2 with ALMA (Qi et al., 2013)⊳ mid-plane disk conditions from gas and dust modelling (Boneberg et al., 2016)⊳ increased H_2CO production in the outer disk (Carney et al., 2017)⊳ small-scale disk structure from ALMA (Isella et al., 2018)⊳ constraints on turbulence and embedded planet mass from planet–disk hydrodynamic simulations (Liu et al., 2018c)⊳ dust modeling of combined ALMA and VLT–SPHERE data (Muro-Arena et al., 2018)⊳ DCO^+ as a tracer of thermal inversion in the disk (Salinas et al., 2018)⊳ inner disk emission from VLTI and CHARA (Setterholm et al., 2018)⊳ kinematical detection of two embedded Jupiter-mass planets from gas rotation profile with ALMA (Teague et al., 2018)⊳

HD 163607 2-planet system, planet b of high eccentricity ($e = 0.7$); discovery of planets b and c (Giguere et al., 2012)⊳ dynamical stability (Elser et al., 2013)⊳ secular evolution in second-order Hamiltonian expansion (Libert & Sansottera, 2013)⊳ dynamics of eccentric systems (Kane & Raymond, 2014)⊳

HD 164509 discovery of planet b, and evidence for planet c (Giguere et al., 2012)⊳ possible radio detection with GMRT (Sirothia et al., 2014)⊳ new stellar companion from Gemini–DSSI (Wittrock et al., 2016) stellar multiplicity (Ngo et al., 2017)⊳

HD 164595 discovery (Courcol et al., 2015)⊳

HD 164604 discovery (Arriagada et al., 2010)⊳

HD 164922 2-planet system; discovery of planet b (Butler et al., 2006b)⊳ discovery of planet c (Fulton et al., 2016)⊳

HD 165155 discovery (Jenkins et al., 2017)⊳

HD 166724 single massive planet of high eccentricity ($e = 0.7$); discovery (Marmier et al., 2013)⊳

HD 167042 discovery (Johnson et al., 2008a)⊳ confirmation (Sato et al., 2008b)⊳

HD 168443 2-planet system; discovery of planet b (Marcy et al., 1999)⊳ discovery of planet c (Marcy et al., 2001b)⊳ confirmation (Udry et al., 2002)⊳ dynamical stability of habitable zone (Érdi et al., 2004)⊳ planet b mass ($34 M_J$) from Hipparcos astrometry (Reffert & Quirrenbach, 2006)⊳ proximity to resonance (Libert & Henrard, 2007)⊳ secular orbital dynamics (Veras & Ford, 2010)⊳ favourable for tests of solar spin–orbit coupling (Perryman & Schulze-Hartung, 2011)⊳ absence of non-grazing transit for planet b (Pilyavsky et al., 2011)⊳ dynamical stability (Elser et al., 2013)⊳ dynamics of eccentric systems (Kane & Raymond, 2014)⊳ limits on stellar companions to host stars with eccentric planets (Kane et al., 2014)⊳ limits on radio emission at 154 MHz from the Murchison Widefield Array (Murphy et al., 2015)⊳

HD 168746 discovery (Pepe et al., 2002)⊳ models of planet radius (Bodenheimer et al., 2003)⊳ post-Newtonian effects (Li, 2012)⊳ chromospheric activity (Kuznyetsova et al., 2014)⊳

HD 169830 2-planet system; stellar abundances (Santos et al., 2000a)⊳ discovery of planet b (Naef et al., 2001b)⊳ dynamical stability of habitable zone (Érdi et al., 2004)⊳ dynamical stability (Goździewski & Konacki, 2004)⊳ discovery of planet c (Mayor et al., 2004)⊳ proximity to resonance (Libert & Henrard, 2007)⊳ consistency with a stable Kozai-resonant state (Libert & Tsiganis, 2009)⊳ secular evolution in second-order Hamiltonian expansion (Libert & Sansottera, 2013)⊳

HD 170469 discovery (Fischer et al., 2007)⊳

HD 171028 discovery (Santos et al., 2007)⊳ further observations with HARPS (Santos et al., 2011)⊳

HD 171238 discovery (Ségransan et al., 2010)⊳

HD 173416 discovery (Liu et al., 2009)⊳

HD 175167 discovery (Arriagada et al., 2010)⊳

HIP 175370 unconfirmed (not in NASA archive); discovery (Hrudková et al., 2017)⊳

HD 175541 discovery (Johnson et al., 2007b)⊳

HD 175607 discovery (Mortier et al., 2016)⊳

HD 176986 2-planet system; discovery (Suárez Mascareño et al., 2018)⊳

HD 177565 discovery (Feng et al., 2017a)⊳

HD 177830 2-planet system; discovery of planet b (Vogt et al., 2000)⊳ measurement of ^{9}Be depletion (Delgado Mena et al., 2011)⊳ improved orbit, and planet c (Meschiari et al., 2011)⊳ secular evolution in second-order Hamiltonian expansion (Libert & Sansottera, 2013)⊳ distant stellar companion not affecting dynamical evolution (Roberts et al., 2015b)⊳

HD 178911B host star is distant component of hierarchical triple system; discovery (Zucker et al., 2002)⊳

HD 179079 discovery (Valenti et al., 2009)⊳

HD 179949 discovery (Tinney et al., 2001)⊳ planet-induced chromospheric activity (Shkolnik et al., 2003)⊳ orbit dependence of chromospheric activity and magnetic interaction (Shkolnik et al., 2005)⊳ constraints on radio emission from GMRT (Winterhalter et al., 2005)⊳ magnetic communication (Preusse et al., 2006)⊳ constraints on atmospheric TiO and VO from VLT–CRIRES (Barnes et al., 2008a)⊳ enhanced stellar magnetic activity due to close-in planet (Lanza, 2008)⊳ planet-induced stellar X-ray activity from Chandra–ACIS-S (Saar et al., 2008)⊳ magnetic interaction with host star (Kopp et al., 2011)⊳ stellar magnetic field, differential rotation and chromospheric activity (Fares et al., 2012)⊳ planet-induced emission due to star–planet interaction (Gurdemir et al., 2012)⊳ stellar magnetic field topology (Fares et al., 2013)⊳ simultaneous optical and X-ray spectroscopy disfavours star–planet interaction (Scandariato et al., 2013)⊳ magnetic energy fluxes in sub-Alfvén planet–star and moon–planet interactions (Saur et al., 2013)⊳ atmospheric CO and H_2O for non-transiting planet from VLT–CRIRES (Brogi et al., 2014)⊳ time scales of radio emission variability (See et al., 2015)⊳ stellar wind properties, magnetic fields, bow shocks and radio emission (Vidotto et al., 2015)⊳ 3d atmospheric modeling and light curve (Jiménez-Torres, 2016)⊳ stellar flares modeling due to star–planet magnetic field interaction (Lanza, 2018)⊳

HD 180053 discovery (Luhn et al., 2019)⊳

HD 180314 discovery (Sato et al., 2010)⊳

HD 180617 high proper motion binary system containing the low mass star vB 10; discovery (Kaminski et al., 2018)⊳

HD 180902 discovery (Johnson et al., 2010b)⊳

HD 181234 discovery (Rickman et al., 2019)⊳

HD 181342 discovery (Johnson et al., 2010b)⊳

HD 181433 3-planet system, all with high eccentricities; discovery of planets b, c, d (Bouchy et al., 2009)⊳ revised orbits based on dynamic stability, with planets c and d in 5:2 resonance (Campanella, 2011)⊳ eccentricities excited by ejection of additional giant planet (Campanella et al., 2013)⊳

HD 181720 discovery (Santos et al., 2010)⊳ further observations with HARPS (Santos et al., 2011)⊳

HD 183263 2-planet system; discovery of planet b (Marcy et al., 2005)⊳ discovery of planet c (Wright et al., 2009b)⊳ secular evolution in second-order Hamiltonian expansion (Libert & Sansottera, 2013)⊳ new radial velocities (Feng et al., 2015)⊳

HD 185269 high-eccentricity ($e = 0.3$) hot Jupiter; discovery (Johnson et al., 2006a)⊳ independent discovery (Moutou et al., 2006)⊳

HD 187085 high-eccentricity 1000-d orbit; discovery (Jones et al., 2006)⊳

HD 187123 2-planet system; discovery of planet b (Butler et al., 1998)⊳ stellar abundances (Gonzalez et al., 1999)⊳ tidal constraints on mass (Trilling, 2000)⊳ indication of planet c (Vogt et al., 2000)⊳ orbit confirmation (Naef et al., 2004)⊳ confirmation of planet c (Wright et al., 2007)⊳ dynamical stability (Elser et al., 2013)⊳ new radial velocities (Feng et al., 2015)⊳

HD 188015 discovery (Marcy et al., 2005)⊳ possible additional planets (Goździewski & Migaszewski, 2006)⊳ ejection of putative Earth-mass planets from habitable zone (Yeager et al., 2011)⊳

HD 189733 see transiting systems

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HD 190360 2-planet system; discovery of planet b (Naef et al., 2003)▷ discovery of planet b (Udry et al., 2003b)▷ discovery of planet c (Vogt et al., 2005)▷ possible additional planets (Goździewski & Migaszewski, 2006)▷ proximity to resonance (Libert & Henrard, 2007)▷ secular orbital dynamics (Veras & Ford, 2010)▷ measurement of ^{9}Be depletion (Delgado Mena et al., 2011)▷ cyclic transit probabilities for long-period eccentric orbits due to apsidal precession (Kane et al., 2012)▷ dynamical stability (Elser et al., 2013)▷

HD 190647 discovery (Naef et al., 2007)▷

HD 190984 discovery (Santos et al., 2010)▷ further observations with HARPS (Santos et al., 2011)▷

HD 191806 discovery (Díaz et al., 2016a)▷

HD 192263 discovery (Santos et al., 2000b)▷ independent discovery (Vogt et al., 2000)▷ planet falsely attributed to stellar variability (Henry et al., 2002)▷ planet confirmation (Santos et al., 2003)▷ confirmation, stellar rotation, spots, and transit constraints (Dragomir et al., 2012a)▷

HD 192310 ≡ GJ 785; 2-planet system; discovery of planet b (Howard et al., 2011b)▷ discovery of planet c (Pepe et al., 2011)▷ limits on radio emission at 154 MHz from the Murchison Widefield Array (Murphy et al., 2015)▷

HD 192699 discovery (Johnson et al., 2007b)▷

HD 195019 star is component of binary system; discovery (Fischer et al., 1999)▷ updated orbit (Vogt et al., 2000)▷ stability of orbits in binary systems (Musielak et al., 2005)▷

HD 196050 discovery (Jones et al., 2002a)▷ independent discovery (Udry et al., 2003b)▷ independent discovery (Mayor et al., 2004)▷ imaging of co-moving stellar companion (Mugrauer et al., 2005b)▷

HD 196067 discovery (Marmier et al., 2013)▷

HD 196885A discovery, and orbit constraints for HD 196885 B (Correia et al., 2008)▷ spectroscopy of HD 196885 B (Chauvin et al., 2007)▷ independent confirmation (Fischer et al., 2009)▷ co-moving nature and orbit curvature of HD 196885 B (Chauvin et al., 2011)▷ formation in accretion-hostile regions of binary systems (Thébault, 2011)▷ dynamical analysis (Giuppone et al., 2012)▷ planet formation in small separation binaries (Rafikov, 2013)▷ application of chaos indicators (Satyal et al., 2013)▷ chaotic and quasi-periodic phase space regions from MEGNO (Satyal et al., 2014)▷ habitable terrestrial planets in tight binary systems (Funk et al., 2015)▷ orbital dynamics and Lyapunov time (Melnikov, 2017)▷

HD 197037 discovery (Robertson et al., 2012a)▷ stellar companion from lucky imaging (Ginski et al., 2016) ▷

HD 200964 2-planet system; discovery of planets b and c, and proximity to a 4:3 resonance (Johnson et al., 2011b)▷ difficulty explaining 4:3 mean motion resonance (Rein et al., 2012)▷ stability and characterisation of 4:3 resonance (Wittenmyer et al., 2012a)▷ formation and evolution of 4:3 resonant system (Tadeu dos Santos et al., 2015)▷ orbital dynamics (Mia & Kushvah, 2016)▷

HD 202206 1- or 2-planet system orbiting a face-on G+M binary (1-planet system in NASA); inner is massive, outer less massive; stellar abundances (Santos et al., 2000a)▷ discovery of planet b, possible planet c, and possible formation scenarios (Udry et al., 2002)▷ discovery of planet c, in 5:1 resonance (Correia et al., 2005)▷ dynamical stability, and sensitivity to mutual inclinations (Goździewski et al., 2006)▷ dynamical stability (Libert & Henrard, 2007)▷ dynamical stability (Couetdic et al., 2010)▷ constraints on location of dust-producing planetesimals (Moro-Martín et al., 2010a)▷ astrometric modeling with HST–FGS (Benedict & Harrison, 2017)▷

HD 202696 2-Jovian planet system; discovery (Trifonov et al., 2019b)▷

HD 203473 discovery (Ment et al., 2018)▷

HD 204313 2- or 3-planet system (listed as 2-planet system in NASA); discovery of planet b (Ségransan et al., 2010)▷ discovery of planet c (Mayor et al., 2011)▷ proposed planet d, in 3:2 resonance with planet b (Robertson et al., 2012b)▷ confirmation and characterisation of planets b–c (Díaz et al., 2016b)▷

HD 204941 discovery, and stellar activity (Dumusque et al., 2011a)▷

HD 205739 discovery (López-Morales et al., 2008)▷

HD 206255 discovery (Feng et al., 2019b)▷

HD 206610 discovery (Johnson et al., 2010b)▷

HD 207832 2-planet system; discovery of planets b and c (Haghighipour et al., 2012)▷ stellar multiplicity (Ngo et al., 2017)▷

HD 208487 1- or 2-planet system (listed as 1-planet system in NASA); discovery of planet b (Tinney et al., 2005)▷ possible additional planets (Goździewski & Migaszewski, 2006)▷ proposed planet c (Gregory, 2007a)▷ measurement of ^{9}Be depletion (Delgado Mena et al., 2011)▷

HD 208527 planet orbiting M giant; discovery (Lee et al., 2013)▷

HD 208897 discovery (Yılmaz et al., 2017)▷

HD 209458 see transiting systems

HD 210193 discovery (Feng et al., 2019b)▷

HD 210277 discovery (Marcy et al., 1999)▷ stellar abundances (Gonzalez et al., 1999)▷ detection of debris disk with IRTF–CoCo (Trilling et al., 2000)▷ stability of possible Trojan planets in habitable zone (Funk et al., 2012)▷

HD 210702 discovery (Johnson et al., 2007b)▷ stellar diameter and temperature (von Braun et al., 2014)▷

HD 211810 discovery (Ment et al., 2018)▷

HD 211970 discovery (Feng et al., 2019b)▷

HD 212301 discovery (Lo Curto et al., 2006)▷ imaging of co-moving companion (Mugrauer & Neuhäuser, 2009)▷

HD 212771 discovery (Johnson et al., 2010b)▷ K2 asteroseismology and mass determination (Campante et al., 2017)▷ TESS asteroseismology (Campante et al., 2019)▷

HD 213240 discovery (Santos et al., 2001)▷ imaging of co-moving stellar companion (Mugrauer et al., 2005b)▷ compositional diversity due to giant planet migration (Carter-Bond et al., 2012)▷

HD 213885 discovery (Espinoza et al., 2019a)▷

HD 214823 discovery (Díaz et al., 2016a)▷

HD 215152 4-planet system; suggested discovery of planets b and c (Mayor et al., 2011) confirmation of planets b–e (Delisle et al., 2018)▷

HD 215497 2-planet system; discovery (Lo Curto et al., 2010)▷

HD 216435 ≡ τ^{1} Gru; discovery (Jones et al., 2003)▷

HD 216437 discovery (Jones et al., 2002a)▷ independent discovery (Udry et al., 2003b)▷ independent discovery (Mayor et al., 2004)▷

HD 216536 discovery (Niedzielski et al., 2015b)▷

HD 216770 discovery (Mayor et al., 2004)▷ measurement of ^{9}Be depletion (Delgado Mena et al., 2011)▷

HD 217107 2-planet system; discovery of planet b (Fischer et al., 1999)▷ tidal constraints on mass (Trilling, 2000)▷ updated orbit (Vogt et al., 2000)▷ models of planet radius (Bodenheimer et al., 2003)▷ discovery of planet c, and transit constraints (Vogt et al., 2005)▷ dynamical stability (Libert & Henrard, 2007)▷ ^{6}Li/^{7}Li ratio (Ghezzi et al., 2009)▷ search for infrared emission with Gemini–Phoenix (Cubillos et al., 2011)▷ Bayesian modeling (Tuomi et al., 2011)▷ post-Newtonian effects (Li, 2012)▷ stellar diameter (Boyajian et al., 2013)▷ dynamical stability (Elser et al., 2013)▷ new radial velocities (Feng et al., 2015)▷

HD 217786 discovery (Moutou et al., 2011b)▷ stellar companion from lucky imaging (Ginski et al., 2016) ▷

HD 217850 discovery (Ment et al., 2018)▷

HD 218566 discovery (Meschiari et al., 2011)▷

HD 219077 discovery, high eccentricity (0.77) (Marmier et al., 2013)▷

HD 219134 see transiting systems

HD 219415 discovery (Gettel et al., 2012a)▷

HD 219828 2-planet system; discovery of planet b, and evidence for planet c (Melo et al., 2007)▷ chromospheric activity (Kuznyetsova et al., 2014)▷ confirmation of planet c (Santos et al., 2016)▷

HD 220074 planet orbiting an M giant; discovery (Lee et al., 2013)▷

HD 220197 discovery (Barbato et al., 2019)▷

HD 220689 discovery (Marmier et al., 2013)▷

HD 220773 discovery (Robertson et al., 2012a)▷

HD 220842 discovery (Hébrard et al., 2016)▷

HD 221287 discovery (Naef et al., 2007)▷

HD 221420 discovery (Kane et al., 2019)▷

HD 221585 discovery (Díaz et al., 2016a)▷

HD 222076 discovery (Wittenmyer et al., 2017c)▷

HD 222155 discovery, suggestion of planet c (Boisse et al., 2012)▷

HD 222582 discovery (Vogt et al., 2000)▷

HD 224538 discovery (Jenkins et al., 2017)▷

HD 224693 discovery (Johnson et al., 2006b)▷

HD 231701 discovery (Fischer et al., 2007)▷

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HD 233604 planet orbiting at 0.75 au from K5 giant host, in engulfment zone; discovery (Nowak et al., 2013)▷

HD 233832 discovery (Barbato et al., 2019)▷

HD 238914 discovery (Adamów et al., 2018)▷

HD 240210 discovery of planet b, and evidence for others (Niedzielski et al., 2009b)▷

HD 240237 discovery (Gettel et al., 2012b)▷

HD 285507 first (eccentric) hot Jupiter in the Hyades open cluster; discovery (Quinn et al., 2014)▷

HD 285968 ≡ GJ 176; discovery (P = 10.2 d) (Endl et al., 2008)▷ P = 10.2 d confirmed (Butler et al., 2009)▷ alternative fit to P = 8.8 d (Forveille et al., 2009)▷ stellar diameter and temperature (von Braun et al., 2014)▷ effects of stellar activity on radial velocity signal for M dwarfs (Robertson et al., 2015a)▷ confirmation from CARMENES (Trifonov et al., 2018a)▷ host star age from kinematics and α-element enrichment (Veyette & Muirhead, 2018)▷

HD 290327 discovery (Naef et al., 2010)▷

HD 330075 discovery (Pepe et al., 2004)▷ measurement of ^{9}Be depletion (Delgado Mena et al., 2011)▷

HIP (Hipparcos)

HIP 5158 2-planet system; discovery of planets b and c (Lo Curto et al., 2010)▷ confirmation of planets b and c (Feroz et al., 2011a)▷

HIP 8541 discovery (Jones et al., 2016b)▷

HIP 11915 not in NASA archive; discovery (Bedell et al., 2015)▷

HIP 11952 not in NASA archive; retracted system around a metal-poor star; claimed discovery from FEROS (Setiawan et al., 2012)▷ unconfirmed by HARPS/HARPS–N (Desidera et al., 2013)▷ re-analysis of FEROS data invalidates original claim (Müller et al., 2013)▷

HIP 12961 discovery (Forveille et al., 2011b)▷

HIP 13044 not in NASA archive (existence questioned in 2014); planet orbiting a metal-poor red horizontal branch star; FEROS discovery (Setiawan et al., 2010)▷ radial velocity contribution from tides (Arras et al., 2012)▷ survival models (Passy et al., 2012)▷ origin of orbit (Bear et al., 2011)▷ origin of orbit (Tutukov & Fedorova, 2013)▷ data reanalysis does not confirm planet (Jones & Jenkins, 2014)▷

HIP 14810 3-planet system; discovery of planet b (Butler et al., 2006b)▷ independent discovery of planet b, and discovery of planet c (Wright et al., 2007)▷ discovery of planet d (Wright et al., 2009a)▷ dynamical stability (Elser et al., 2013)▷ hot Jupiter migration attributed to disk interactions (Wang et al., 2017a)▷

HIP 35173 discovery (Feng et al., 2019b)▷

HIP 54373 discovery (Feng et al., 2019b)▷

HIP 57274 3-planet system; discovery of planets b, c, d (Fischer et al., 2012)▷ dynamical stability (Elser et al., 2013)▷ no evidence of transits from Spitzer (Kammer et al., 2014)▷

HIP 63242 discovery (Jones et al., 2013)▷

HIP 65407 2-planet system; discovery (Hébrard et al., 2016)▷

HIP 65891 discovery (Jones et al., 2015b)▷

HIP 67537 high-eccentricity (e = 0.59, $M_{\rm p} \sin i$ = 11.1$M_{\rm J}$); discovery from CHIRON/FEROS (Jones et al., 2017)▷

HIP 67851 2-planet system; discovery (Jones et al., 2015a)▷ confirmation of planet c (Jones et al., 2015b)▷

HIP 70849 discovery (Ségransan et al., 2011)▷

HIP 71135 discovery (Feng et al., 2019b)▷

HIP 74890 discovery (Jones et al., 2016b)▷

HIP 75458 see ι Dra

HIP 79431 discovery (Apps et al., 2010)▷ limits on radio emission at 154 MHz from the Murchison Widefield Array (Murphy et al., 2015)▷

HIP 91258 discovery (Moutou et al., 2014b)▷

HIP 97233 discovery (Jones et al., 2015a)▷

HIP 105854 discovery (Jones et al., 2014)▷

HIP 107773 discovery (Jones et al., 2015b)▷

HIP 109384 discovery (Hébrard et al., 2016)▷

HIP 109600 discovery (Hébrard et al., 2016)▷

HR

HR 228 see HD 4732

HR 810 ≡ ι Hor ≡ HD 17051; discovery (Kürster et al., 2000)▷ asteroseismology and fundamental star parameters (Laymand & Vauclair, 2007)▷ an evaporated member of the primordial Hyades cluster (Vauclair et al., 2008)▷ 1.6 year stellar magnetic activity cycle (Metcalfe et al., 2010)▷ effects of stellar activity (Boisse et al., 2011)▷

HR 5183 discovery (Blunt et al., 2019)▷ orbital stability and habitability (Kane & Blunt, 2019)▷

KELT

KELT–6 c see transiting systems

Kepler/K2

Kepler–19 d see transiting systems
Kepler–20 g see transiting systems
Kepler–25 d see transiting systems
Kepler–48 e see transiting systems
Kepler–56 d see transiting systems
Kepler–65 e see transiting systems
Kepler–68 d see transiting systems
Kepler–93 c see transiting systems
Kepler–94 c see transiting systems
Kepler–97 c see transiting systems
Kepler–407 c see transiting systems
Kepler–424 c see transiting systems
Kepler–432 c see transiting systems
Kepler–454 c see transiting systems
K2–18 c see transiting systems
K2–96 d ≡ HD 3167; see transiting systems

LSPM

LSPM J2116+0234 discovery (Lalitha et al., 2019)▷

NGC/IC/Pr (Praesepe)

IC 4651 9122 member of open cluster IC 4651; discovery (Leão et al., 2018)▷ planetary signal complicated by stellar radial velocity modulations (Delgado Mena et al., 2018)▷

NGC 2682 Sand 364 member of open cluster NGC 2682 (M67); discovery (Brucalassi et al., 2014)▷

NGC 2682 Sand 978 member of open cluster NGC 2682 (M67); discovery (Brucalassi et al., 2017)▷

NGC 2682 YBP 401 member of open cluster NGC 2682 (M67); discovery (Brucalassi et al., 2016)▷

NGC 2682 YBP 1194 member of open cluster NGC 2682 (M67); discovery (Brucalassi et al., 2014)▷

NGC 2682 YBP 1514 member of open cluster NGC 2682 (M67); discovery (Brucalassi et al., 2014)▷

NGC 2423 3 not in NASA archive; member of open cluster NGC 2423; claimed discovery (Lovis & Mayor, 2007)▷ planetary signal complicated by stellar radial velocity modulations (Delgado Mena et al., 2018)▷

NGC 4349 127 not in NASA archive; member of open cluster NGC 4349; discovery (Lovis & Mayor, 2007)▷ planetary signal complicated by stellar radial velocity modulations (Delgado Mena et al., 2018)▷

Pr 201 ≡ BD+20 2184; member of open cluster Praesepe (M44); discovery (Quinn et al., 2012b)▷ stellar rotation (Kovács et al., 2014)▷

Pr 211 2-planet system with eccentric outer planet (e = 0.71); member of open cluster Praesepe (M44); discovery of planet b (Quinn et al., 2012b)▷ stellar rotation (Kovács et al., 2014)▷ discovery of planet c (Malavolta et al., 2016)▷ fly-by scenario can explain the eccentric outer planet (Pfalzner et al., 2018)▷

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TAP

TAP 26 discovery using Zeeman–Doppler imaging (Yu et al., 2017)▷

TYC (Hipparcos/Tycho)

TYC 1240–945–1 not in NASA archive; retracted system (MARVELS–1); originally reported as a $28 M_J$ companion in a $P = 5.9$ d, $e \sim 0$ orbit (Lee et al., 2011b)▷ subsequently reclassified as a face-on stellar binary in a 3–4 star system (Wright et al., 2013)▷

TYC 1422–614–1 2-planet system; discovery of planets b and c (Niedzielski et al., 2015a)▷

TYC 3318–01333–1 discovery (Adamów et al., 2018)▷

TYC 3667–1280–1 massive red giant ($M_\star = 1.9 M_\odot$) hosting a warm Jupiter ($a = 0.21$ au, $M_p \sin i = 5.4 M_J$); discovery from HET–HRS and HARPS–N (Niedzielski et al., 2016b)▷

TYC 4282–605–1 discovery (González-Álvarez et al., 2017)▷

WASP

WASP–8 c see transiting systems

WASP–41 c see transiting systems

WASP–47 c see transiting systems

WASP–53 c see transiting systems

WASP–94B c see transiting systems

XO

XO–2S b,c see transiting systems

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Appendix D. Transiting exoplanets

This (updated) appendix includes objects appearing in the online NASA Exoplanet Archive as of 31 December 2019, along with a small number of other candidates or retracted systems (the published Second Edition was complete to end 2017).

These notes list some key attributes of the system to underline its particular interest, give some indication of the attention the object has received (through the length of the bibliography), and provide a concise note on each paper to serve as a guide to the literature and a narrative of the progress in understanding the system. It makes no claim for completeness, and CDS–SIMBAD should be consulted for more details.

It includes only cross-identifications which are relevant in context, e.g., as used in the early discovery literature. CDS–SIMBAD or the NASA Exoplanet Archive should be consulted for other aliases. If a different alias was used in the NASA archive, this is explicitly noted.

Of the confirmed Kepler–NNN systems, the NASA Exoplanet Archive retains the KIC number, or the KOI number, as default identifier for a small number of systems. The listing here is according to the Kepler identifier.

The electronic version includes three classes of hyperlink: the object identifier (in bold) is linked to the host star page of the NASA Exoplanet Archive (it will be invalid if their syntax changes); each citation is linked to the bibliography; and the ▷ icon following the citation links to the relevant ADS page.

Independent discoveries: For independent discoveries, the first reported is considered the 'primary' identifier:

primary:		secondary:
HAT–P–7	≡	Kepler–2
HAT–P–11	≡	Kepler–3
HAT–P–14	≡	WASP–27
HAT–P–27	≡	WASP–40
HAT–P–30	≡	WASP–51
HAT–P–56	≡	K2–20
KELT–14	≡	WASP–122
KELT–20	≡	MASCARA–2
K2–29	≡	WASP–152
TRAPPIST–1	≡	K2–112
TrES–2	≡	Kepler–1
WASP–11	≡	HAT–P–10
WASP–28	≡	K2–1
WASP–47	≡	K2–23
WASP–75	≡	K2–40
WASP–85A	≡	K2–94
WASP–107	≡	K2–235
WASP–151	≡	K2–134
WASP–157	≡	K2–41
WASP–167	≡	KELT–13

Systems discovered by radial velocity, but with one planet (indicated) which also transits. All references to the system are included here:

30 Ari B	planet b
55 Cnc	planet e
GJ 436	planet b
GJ 3470	planet b
HD 17156	planet b
HD 39091	planet c
HD 80606	planet b
HD 97658	planet b
HD 149026	planet b
HD 189733	planet b
HD 209458	planet b
HD 219134	planets b and c

Systems discovered by transit photometry, with additional planet(s) discovered through radial velocity measures. All references to the system are included here:

CoRoT–7	planet c
HAT–P–11	planet c
HAT–P–13	planet c
HAT–P–17	planet c
HAT–P–44	planet c
KELT–6	planet c
Kepler–19	planet d
Kepler–20	planet g
Kepler–25	planet d
Kepler–48	planet e
Kepler–56	planet d
Kepler–65	planet e
Kepler–68	planet d
Kepler–93	planet c
Kepler–94	planet c
Kepler–97	planet c
Kepler–407	planet c
Kepler–424	planet c
Kepler–432	planet c
Kepler–454	planet c
K2–18	planet c
K2–96	planet d
WASP–8	planet c
WASP–41	planet c
WASP–47	planet c
WASP–53	planet c
WASP–94B	planet b
XO–2S	planets b and c

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Notes on individual systems

A. Radial velocity discoveries, subsequently found to transit

30 Ari B planet orbits one component of (2+2) quadruple stellar system; discovered by radial velocity (Guenther et al., 2009)⊳ transits identified *a posteriori* in Hipparcos photometry (Kane et al., 2015a)⊳ fourth stellar component (Roberts et al., 2015c)⊳ secular dynamics modeled with the `SecularMultiple` nested binary algorithm (Hamers & Portegies Zwart, 2016)⊳

55 Cnc ≡ HR 3522; 5-planet system, discovered by radial velocity, of which only planet e transits; discovery of planet b by radial velocity, evidence for planet c (Butler et al., 1997)⊳ stellar properties (Baliunas et al., 1997)⊳ circumstellar Vega-like disk from ISO (Dominik et al., 1998)⊳ stellar parameters (Fuhrmann et al., 1998)⊳ Be depletion in host star (Garcia Lopez & Perez de Taoro, 1998)⊳ stellar parameters, $T_{\rm eff}$, $\log g$, [Fe/H] (Gonzalez & Vanture, 1998)⊳ circumstellar Vega-like disk from infrared coronagraphy (Trilling & Brown, 1998)⊳ **2000:** limits on radio emission from VLA (Bastian et al., 2000)⊳ imaging of circumstellar disk (Trilling et al., 2000)⊳ disk not verified with HST–NICMOS coronagraphy (Schneider et al., 2001)⊳ disk not verified with JCMT–SCUBA (Jayawardhana et al., 2002)⊳ mass constraints from HST–FGS astrometry (McGrath et al., 2002)⊳ discovery of planets c and d (Marcy et al., 2002)⊳ planets b and c in 3:1 resonance (Ji et al., 2003b)⊳ habitability and orbit stability of Earth-type planets (von Bloh et al., 2003)⊳ resonant capture within protoplanetary disk (Kley et al., 2004)⊳ discovery of planet e (McArthur et al., 2004)⊳ radial velocity observations with ELODIE (Naef et al., 2004)⊳ **2005:** 3:1 resonance stability (Marzari et al., 2005)⊳ resonance migration (Beaugé et al., 2006)⊳ (a)symmetric 3:1 resonances (Voyatzis & Hadjidemetriou, 2006)⊳ 3:1 resonance stability (Barnes & Greenberg, 2007)⊳ evaporation of planet e, pre-discovery as transiting (Lecavelier des Etangs, 2007)⊳ stability of test particles (Rivera & Haghighipour, 2007)⊳ confirmation of planets c and d, and discovery of planet f (Fischer et al., 2008)⊳ chaotic stability (Gayon et al., 2008)⊳ Titius–Bode law and prediction of planet g (Poveda & Lara, 2008)⊳ system stability (Raymond et al., 2008)⊳ planets b and c not in resonance (Voyatzis, 2008)⊳ limits on polarised light (Lucas et al., 2009)⊳ **2010:** period ambiguity of planet d and revised period for planet e (Dawson & Fabrycky, 2010)⊳ drag-induced resonant capture in a multi-planet scenario (de la Fuente Marcos & de la Fuente Marcos, 2010)⊳ **2011:** magnetic drag and Ohmic dissipation (Castan & Menou, 2011)⊳ detection of planet e transits with Spitzer (Demory et al., 2011a)⊳ dynamical stability, coplanar orbits probably inclined to stellar equator (Kaib et al., 2011)⊳ atmospheric modeling of planet e from photometric phase curves (Kane et al., 2011b)⊳ stellar properties and improved radius for planet e from interferometry (von Braun et al., 2011b)⊳ detection of planet e transits with MOST (Winn et al., 2011c)⊳ **2012:** true and alias periods using the Vuong test (Baluev, 2012)⊳ elliptical instability of planet e due to tides, precession/nutation, and libration (Cebron et al., 2012)⊳ brightness temperature of planet e from stellar calibration (Crossfield, 2012)⊳ Titius–Bode law (Cuntz, 2012)⊳ wavelength-dependent astrometric motion (Coughlin & López-Morales, 2012)⊳ detection of planet e transits with Spitzer (Demory et al., 2012)⊳ extended atmosphere of planet e from HST–STIS and Chandra (Ehrenreich et al., 2012)⊳ mass of planet e from improved radial velocity (Endl et al., 2012)⊳ improved radius of planet e from Spitzer/MOST (Gillon et al., 2012a)⊳ atmospheric stability under tidal locking (Heng & Kopparla, 2012)⊳ C-rich interior of planet e from structure models (Madhusudhan et al., 2012)⊳ capture into spin–orbit resonance (Rodríguez et al., 2012)⊳ dynamical modeling (Van Laerhoven & Greenberg, 2012)⊳ **2013:** tidal dissipation and eccentricity pumping of planet e (Bolmont et al., 2013)⊳ chaotic rotation around synchronous state driven by tidal torque and asymmetric figure (Callegari & Rodríguez, 2013)⊳ hydrodynamic blow-off of atmospheric H (Lammer et al., 2013)⊳ simulated direct detection of reflected light of planet e via high-resolution spectroscopy (Martins et al., 2013)⊳ host star C/O abundance (Teske et al., 2013a)⊳ **2014:** Rossiter–McLaughlin effect of planet e from HARPS–N at 0.6 m s^{-1} indicates prograde polar orbit (Bourrier & Hébrard, 2014)⊳ ground-based transit detections of planet e with NOT–ALFOSC (de Mooij et al., 2014)⊳ MOST photometry (Dragomir et al., 2014)⊳ C_2H_2 at 1.0–1.5 and 9–14 μm as a diagnostic for hydrocarbon-rich atmospheres (Hu & Seager, 2014)⊳ no Rossiter–McLaughlin effect for planet e from HARPS–N at 0.35 m s^{-1} (López-Morales et al., 2014)⊳ N-body constraints and dynamical analysis (Nelson et al., 2014)⊳ **2015:** Doppler noise and 13-yr activity cycle (Baluev, 2015)⊳ tidal evolution and passage through secular resonances (Hansen & Zink, 2015)⊳ measures for characterising H_2O-rich super-Earths (Madhusudhan & Redfield, 2015)⊳ gyrochronology and isochrone ages (Maxted et al., 2015)⊳ **2016:** constraining the volatile fraction from transit observations (Alibert, 2016)⊳ map of the large day–night temperature gradient (Demory et al., 2016a)⊳ variability in dayside thermal emission (Demory et al., 2016a)⊳ favourable for lightning-discharge studies during transit (Hodosán et al., 2016a)⊳ exosphere transit models compared with solar data from SDO (Llama & Shkolnik, 2016)⊳ limits on Na and Ca from transmission spectrum with VLT–UVES, HARPS/HARPS–N (Ridden-Harper et al., 2016)⊳ possible HCN detection from HST–WFC3 (Tsiaras et al., 2016a)⊳ **2017:** Spitzer phase curve favours an atmosphere (Angelo & Hu, 2017)⊳ Bayesian analysis of interior structure using stellar abundance proxies (Dorn et al., 2017)⊳ limits on H_2O-vapour from Subaru–HDS and CFHT–ESPaDOnS (Esteves et al., 2017)⊳ climate and thermal phase curve (Hammond & Pierrehumbert, 2017)⊳ search utilising compressed sensing techniques (Hara et al., 2017)⊳ system is hierarchically AMD-stable (Laskar & Petit, 2017)⊳ probable formation of planet e from H_2O-poor material within the snow line (Lopez, 2017)⊳ cloud formation in metal-rich atmospheres (Mahapatra et al., 2017)⊳ transit photometry using beam-shaping diffusers (Stefansson et al., 2017)⊳ **2018:** prediction of 7 missing planets from Titius–Bode law (Aschwanden, 2018)⊳ far-UV chromospheric variability traces planet-induced coronal rain (Bourrier et al., 2018b)⊳ host star rotation over 20 yr, and revised system properties (Bourrier et al., 2018a)⊳ mass, radius, and composition of planet e from interferometry (Crida et al., 2018)⊳ confirmed variability in secondary eclipse depth of planet e from Spitzer (Tamburo et al., 2018)⊳ **2019:** formation of planet e from high-temperature condensates (Dorn et al., 2019)⊳ observability of molecular species in a N-dominated atmosphere for planet e (Miguel, 2019)⊳ existence of planets in the habitable zone (Satyal & Cuntz, 2019)⊳

GJ 436 M dwarf with one confirmed Neptune-mass planet (of high eccentricity) and two unconfirmed planets; radial velocity discovery with Keck–HIRES, and absence of photometric variability (Butler et al., 2004)⊳ secondary eclipse and orbit from Spitzer–IRAC, possible planet c (Deming et al., 2007a)⊳ characterisation with Spitzer and ground-based observations (Demory et al., 2007)⊳ optical transit detected at 0.6-m OFXB, and constraints on composition (H_2O-ice+H/He layer) (Gillon et al., 2007b)⊳ transit detection of planet b with Spitzer–IRAC (Gillon et al., 2007a)⊳ composition from evaporation status (Lecavelier des Etangs, 2007)⊳ parameters from stellar modeling (Maness et al., 2007)⊳ parameters from stellar modeling (Torres, 2007b)⊳ second planet unconfirmed by photometry (Alonso et al., 2008b)⊳ transit photometry with HST–FGS (Bean et al., 2008a)⊳ proposed orbit model for planet c considered implausible (Bean & Seifahrt, 2008)⊳ trend in transit parameters from ground photometry support planet c (Coughlin et al., 2008)⊳ planet c inferred from perturbed orbit of (near-grazing incidence) planet b, explaining large e (Ribas et al., 2008)⊳ homogeneous analysis and light curve properties (Southworth, 2008)⊳ second planet hypothesised to maintain eccentricity (Batygin et al., 2009)⊳ limits on transit time variations (Cáceres et al., 2009)⊳ composition modeling (Figueira et al., 2009)⊳ constraints on Trojan companions (Madhusudhan & Winn, 2009)⊳ improved transit photometry from HST–NICMOS and limits on transit time variations (Pont et al., 2009a)⊳ stellar proper motion and transit timing (Rafikov, 2009)⊳ homogeneous analysis: physical properties (Southworth, 2009)⊳ **2010:** search for planetary companions (Ballard et al., 2010a)⊳ EPOXI photometry transit limits of planet c, and star spots (Ballard et al., 2010b)⊳ atmospheric circulation models (Lewis et al., 2010)⊳ composition modeling (Nettelmann et al., 2010)⊳ interior composition (Rogers & Seager, 2010a)⊳ homogeneous analysis: additional planets and stellar models (Southworth, 2010)⊳ atmospheric modeling of $CO/CH_4/H_2O/CO_2$ from Spitzer secondary eclipse (Stevenson et al., 2010)⊳ **2011:** CH_4 inferred from multi-wavelength photometry (Beaulieu et al., 2011)⊳ heavy-element composition of disk-instability planets (Boley et al., 2011)⊳ atmospheric CH_4 (Beaulieu et al., 2011)⊳ models of thermal phase variations for eccentric orbits (Cowan & Agol, 2011a)⊳ outlier in heat redistribution attributed to eccentric orbit (Cowan & Agol, 2011b)⊳ exospheric Lyα absorption from HST–STIS (Ehrenreich et al., 2011)⊳ absence of molecular features from HST–NICMOS re-analysis (Gibson et al., 2011)⊳ modeling of tidal Love number (Kramm et al., 2011)⊳ stellar variability and dayside flux variations (Knutson et al., 2011)⊳ CH_4

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abundance under ultraviolet irradiation (Line et al., 2011)▷ atmospheric modeling from Spitzer: non-equilibrium chemistry (Madhusudhan & Seager, 2011)▷ secondary eclipse modeling with JWST predictions (Shabram et al., 2011)▷ **2012:** Rossiter–McLaughlin effect from Magellan, Keck, effect of star–planet tidal interactions on obliquities (Albrecht et al., 2012b)▷ Kozai resonance as an explanation for high eccentricity of planet b (Beust et al., 2012)▷ wavelength-dependent astrometric motion (Coughlin & López-Morales, 2012)▷ atmospheric stability under tidal locking (Heng & Kopparla, 2012)▷ post-Newtonian effects (Li, 2012)▷ two additional transiting planets (c and d) suggested from Spitzer (Stevenson et al., 2012b)▷ stellar diameter from CHARA (von Braun et al., 2012)▷ **2013:** ultraviolet radiation environment (France et al., 2013)▷ atmospheric disequilibrium diagnostics and C/O (Line & Yung, 2013)▷ atmospheric composition as a function of temperature, metallicity and C/O ratio (Moses et al., 2013a)▷ Doppler signatures of atmospheric circulation (Showman et al., 2013)▷ **2014:** models favour high metallicity, high CO/CH_4 ratio, and efficient tidal heating (Agúndez et al., 2014b)▷ extended Ly-α transit from HST–STIS suggests comet-like tail (Kulow et al., 2014)▷ featureless transmission spectrum ruling out cloud-free, H-dominated atmosphere (Knutson et al., 2014a)▷ systematic atmospheric retrieval analysis (Line et al., 2014)▷ metal-rich atmosphere depleted in CH_4 and enhanced in CO/CO_2 (Lanotte et al., 2014)▷ orbital dynamics and prediction of transit time variations for planet c (Maciejewski et al., 2014a)▷ no sub-Earth transiting companion from HST–WFC3 (Stevenson et al., 2014a)▷ location in Spitzer 3.6/4.5 μm colour–magnitude diagram (Triaud, 2014)▷ **2015:** compilation of light curves and transit timing (Baluev et al., 2015)▷ low CH_4/CO_2 ratio from carbonaceous refractory matter by impacting micrometeorites (Dangi et al., 2015)▷ giant comet-like cloud of escaping H (Ehrenreich et al., 2015)▷ He atmospheres (Hu et al., 2015b)▷ revisiting Spitzer transit observations (Morello et al., 2015)▷ effect of Ly-α radiation on mini-Neptune atmospheres around M stars (Miguel et al., 2015)▷ **2016:** stellar wind interactions from HST–STIS (Bourrier et al., 2016)▷ extreme ultraviolet flux and the escaping atmosphere (Guo & Ben-Jaffel, 2016)▷ exosphere transit models compared with solar data from SDO (Llama & Shkolnik, 2016)▷ atmospheric escape of hot gas coupling plasma, photoionisation and Ly-α (Salz et al., 2016)▷ no asymmetry in ground-based ultraviolet transits (Turner et al., 2016b)▷ **2017:** search for Hα absorption (Cauley et al., 2017b)▷ extended egress over 10–25 h in Ly-α from HST–STIS (Lavie et al., 2017a)▷ forward/inverse modeling of emission and transmission spectrum (Morley et al., 2017a)▷ ultraviolet C II and Si III transit spectroscopy with HST–COS (Parke Loyd et al., 2017)▷ probe of host star wind (Vidotto & Bourrier, 2017)▷ **2018:** HST–STIS 0.53–1.03 μm transit spectrum (Lothringer et al., 2018)▷ atmospheric properties from thermal model of Spitzer data (Adams & Laughlin, 2018)▷ high obliquity from photospheric spectral mapping during transit (Bourrier et al., 2018c)▷ HST–STIS optical transmission (Lothringer et al., 2018)▷ cloud-top heights constrained by microphysical model of mineral clouds (Ohno & Okuzumi, 2018)▷ maps, retrieved composition, and constraints predicted for JWST (Schlawin et al., 2018a)▷ visual-channel radial-velocities and orbit updates from CARMENES(Trifonov et al., 2018a)▷ chemo-kinematic ages of eccentric-planet-hosting M dwarfs (Veyette & Muirhead, 2018)▷ **2019:** interaction of the expanding atmosphere with the stellar wind (Berezutsky et al., 2019)▷ search for metallic ions (dos Santos et al., 2019b)▷ detectable molecular features with JWST (Kawashima et al., 2019)▷ modeling of in-transit Ly$alpha$ absorption (Khodachenko et al., 2019)▷ predicting the extreme ultraviolet radiation environment (Peacock et al., 2019a)▷

GJ 3470 discovered by radial velocity (ESO–HARPS), with transits from ESO–TRAPPIST (Bonfils et al., 2012)▷ flat atmospheric transmission spectrum from Keck–MOSFIRE (Crossfield et al., 2013)▷ transit photometry and secondary eclipse from Spitzer–IRAC (Demory et al., 2013b)▷ cloud-free atmosphere from optical to near-infrared transit with Okayama (Fukui et al., 2013)▷ atmospheric scattering from ultraviolet and near infrared transits with LBT (Nascimbeni et al., 2013b)▷ revised star and planet parameters from optical to near-infrared transits (Biddle et al., 2014)▷ flat transmission spectrum from 1–5 μm from HST–WFC3 (Ehrenreich et al., 2014)▷ metallicity and temperature effects on CH_4/CO (Venot et al., 2014)▷ atmospheric Rayleigh scattering (Dragomir et al., 2015)▷ transit timing variation and transmission spectroscopy (Awiphan et al., 2016)▷ atmospheric escape coupling plasma, photoionisation and Ly-α emission (Salz et al., 2016)▷ spectrally resolved Rayleigh scattering slope from GTC–OSIRIS (Chen et al., 2017a)▷ constraints on co-orbiting Trojans (Lillo-Box et al., 2018)▷ atmospheric characterisation (Kosiarek et al., 2019b)▷

HD 17156 long-period (21.2 d) and high eccentricity (e = 0.67); discovery from radial velocity with N2K–Subaru (Fischer et al., 2007)▷ transits detected (Barbieri et al., 2007)▷ Rossiter–McLaughlin effect (Cochran et al., 2008)▷ improved transit photometry (Gillon et al., 2008)▷ theoretical infrared light curves (Irwin et al., 2008)▷ Rossiter–McLaughlin effect from OAO–HIDES, later superseded (Narita et al., 2008)▷ transits and Rossiter–McLaughlin effect from TNG–SARG (Barbieri et al., 2009)▷ atmospheric modeling (Koskinen et al., 2009)▷ Rossiter–McLaughlin effect from Subaru–HDS (Narita et al., 2009a)▷ stellar proper motion and transit timing (Rafikov, 2009)▷ transit measurements and prediction of secondary eclipse (Winn et al., 2009b)▷ time-dependent atmospheric model for eccentric orbits (Iro & Deming, 2010)▷ models of thermal phase variations for eccentric orbits (Cowan & Agol, 2011a)▷ asteroseismology from HST–FGS (Gilliland et al., 2011)▷ transits from HST–FGS (Nutzman et al., 2011b)▷ photometry and new spectroscopy (Southworth, 2011)▷ eccentricity from photo-eccentric effect (Dawson & Johnson, 2012)▷ asteroseismology and age determination (Lebreton, 2012)▷ favourable for polarisation studies (Wiktorowicz & Laughlin, 2014)▷ optical and X-ray observations of star–planet interaction (Maggio et al., 2015)▷ stellar flares modeling due to star–planet magnetic field interaction (Lanza, 2018)▷

HD 39091 $\equiv \pi$ Men (V = 5.65 mag); 2-planet system, planet b from radial velocity, planet c (first TESS discovery) from transit photometry; discovery of planet b from AAT (Jones et al., 2002b)▷ discovery of planet c from TESS (Gandolfi et al., 2018)▷

HD 80606 planet orbits one component of wide (2000 au) binary (HD 80606/HD 80607), high eccentricity (e = 0.933), and transits host star over ~12 h; radial velocity discovery and high eccentricity (Naef et al., 2001a)▷ planet orbit may originate from Kozai resonance/migration (Wu & Murray, 2003)▷ detection by UCL observatory (Fossey et al., 2009)▷ detection by Esteve Duran observatory (Garcia-Melendo & McCullough, 2009)▷ detection of secondary eclipse from Spitzer and planet heating from pericentre photometry (Laughlin et al., 2009)▷ independent transit detection by three groups: OHP/SOPHIE (Moutou et al., 2009a)▷ Rossiter–McLaughlin effect (Pont et al., 2009b)▷ orbit constraints from transit ingress (Winn et al., 2009c)▷ transit observations with Spitzer and SOPHIE (Hébrard et al., 2010b)▷ multi-site transit coverage (Hidas et al., 2010)▷ full 12-hr transit observed by Spitzer and OHP–SOPHIE (Hébrard et al., 2010b)▷ time-dependent atmospheric model for eccentric orbits (Iro & Deming, 2010)▷ constraints on radio emission at pericentre from VLA (Lazio et al., 2010)▷ multi-site transit coverage (Shporer et al., 2010)▷ transit time variations in eccentric hierarchical triple systems, Kozai cycles and tidal friction (Borkovits et al., 2011)▷ tidal evolution (Correia et al., 2011)▷ models of thermal phase variations for eccentric orbits (Cowan & Agol, 2011a)▷ outlier in heat redistribution attributed to eccentric orbit (Cowan & Agol, 2011b)▷ photometry and new spectroscopy (Southworth, 2011)▷ limits on atmospheric K (Colón et al., 2012)▷ habitable zone for eccentric orbits (Kane & Gelino, 2012b)▷ 12-hr transit observed by MOST (Roberts et al., 2013)▷ superrotating atmosphere in cyclostrophic balance (Peralta et al., 2014)▷ polarisation with POLISH–2 (Wiktorowicz & Laughlin, 2014)▷ atmospheric radiative and dynamical time scales from periastron passage observations with Spitzer (de Wit et al., 2016a)▷ no evidence for star–planet interaction at pericentre passage (Figueira et al., 2016)▷ detailed chemical abundances from Keck–HIRES (Mack et al., 2016)▷ formation by stellar perturbations (Shara et al., 2016)▷ atmospheric properties from thermal model of Spitzer data (Adams & Laughlin, 2018)▷ chemical composition of the wide stellar binary and constraints on planet formation (Liu et al., 2018a)▷ planet radii in the presence of star spots from ingress and egress durations (Morris et al., 2018d)▷ detecting general relativistic orbital precession (Blanchet et al., 2019)▷

HD 97658 radial velocity discovery with Keck–HIRES (Howard et al., 2011b)▷ transit detection, unpublished (Henry et al., 2011)▷ transit not confirmed by MOST (Dragomir et al., 2012b)▷ transit detection by MOST (Dragomir et al., 2013)▷ C_2H_2 at 1.0–1.5 and 9–14 μm as diagnostic for hydrocarbon-rich atmospheres (Hu & Seager, 2014)▷ transmission spectrum from HST–WFC3 (Knutson et al., 2014b)▷ orbit parameters versus atmospheric species (Miguel & Kaltenegger, 2014)▷ transit confirmation from Spitzer (Van Grootel et al., 2014)▷

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limits on H-exosphere from HST–STIS, Chandra and XMM–Newton (Bourrier et al., 2017d)▷ Bayesian analysis of interior structure using stellar abundance proxies (Dorn et al., 2017)▷ detectable molecular features with JWST (Kawashima et al., 2019)▷

HD 149026 small hot Saturn-mass ($0.37 M_J$) planet; radial velocity discovery with N2K–Subaru, transit detection, heavy element core (Sato et al., 2005)▷ constraints on Li and K (Bozorgnia et al., 2006)▷ transits and heavy core (Charbonneau et al., 2006)▷ atmosphere and interior models (Fortney et al., 2006)▷ possible origin of the massive core (Ikoma et al., 2006)▷ possible origin of the massive core (Broeg & Wuchterl, 2007)▷ secondary eclipse and high brightness temperature (Harrington et al., 2007)▷ Rossiter–McLaughlin effect (Wolf et al., 2007)▷ homogeneous analysis and light curve properties (Southworth, 2008)▷ 5 transits from Fairborn (Winn et al., 2008a)▷ 4 near infrared transits from HST–NICMOS (Carter et al., 2009)▷ formation and migration (Dodson-Robinson & Bodenheimer, 2009)▷ secondary eclipse depth and infrared phase variations from Spitzer–IRAC (Knutson et al., 2009b)▷ radius from Spitzer transits (Nutzman et al., 2009)▷ stellar proper motion and transit timing (Rafikov, 2009)▷ homogeneous analysis: physical properties (Southworth, 2009)▷ homogeneous analysis and light curve properties (Southworth, 2010)▷ heavy-element composition of disk-instability planets (Boley et al., 2011)▷ alkali line absorption in Na I and K I (Jensen et al., 2011)▷ 3 transits and 11 secondary eclipses from Spitzer favour high CO and CO_2 (Stevenson et al., 2012a)▷ atmospheric disequilibrium diagnostics (Line & Yung, 2013)▷ atmospheric heat redistribution efficiency drops as stellar insolation rises (Perez-Becker & Showman, 2013)▷ systematic atmospheric retrieval analysis (Line et al., 2014)▷ constraints on Bond albedo and day–night heat transport from secondary eclipse depths (Schwartz & Cowan, 2015)▷ atmospheric properties from thermal model of Spitzer data (Adams & Laughlin, 2018)▷ correlation between phase curve offset and irradiation temperature (Zhang et al., 2018a)▷ signatures of obliquities in thermal phase curves (Adams et al., 2019)▷

HD 189733 $1.1 M_J$ planet orbiting nearby (19 pc) K0 star at $a = 0.03$ au, host star is primary of a binary system, secondary is an M dwarf at 216 au; radial velocity discovery with OHP–ELODIE, and transit discovery (Bouchy et al., 2005b)▷ **2006:** identification of secondary M dwarf at 216 au (Bakos et al., 2006b)▷ multicolour photometry, transit parameters (Bakos et al., 2006a)▷ prominent secondary eclipse from Spitzer (Deming et al., 2006)▷ *a posteriori* transit detection in Hipparcos photometry (Hébrard & Lecavelier des Etangs, 2006)▷ Rossiter–McLaughlin effect ($\lambda = -1.4°$) from Keck–HIRES (Winn et al., 2006)▷ **2007:** stellar angular diameter from CHARA ($R = 1.2 R_J$ and $\rho = 0.9\,\mathrm{Mg\,m^{-3}}$) (Baines et al., 2007)▷ limits on H_2O and CO absorption at 2.0–2.4 μm from Keck–NIRSPEC (Barnes et al., 2007a)▷ transit detection limits of $2 R_\oplus$ from 21 d of MOST (Croll et al., 2007b)▷ limits on atmospheric H_2O from Spitzer–IRAC (Ehrenreich et al., 2007)▷ flat atmospheric spectrum (7.5–14.7 μm) from Spitzer (Grillmair et al., 2007)▷ energy redistribution from irradiated day-side (Knutson et al., 2007a)▷ strong complex stellar magnetic field from Zeeman signature in CFHT–ESPaDOnS polarimetry (Moutou et al., 2007)▷ star spots, with no evidence for satellites or rings from HST–ACS (Pont et al., 2007a)▷ H_2O absorption (Tinetti et al., 2007)▷ quasi-periodic flux variations with 13.4 d period attributed to stellar rotation (Winn et al., 2007c)▷ **2008:** polarised scattered light of amplitude 2×10^{-4} (Berdyugina et al., 2008)▷ H_2O detection and circulation models from Spitzer (Barman, 2008)▷ transits at 3.6 and 5.8 μm with Spitzer–IRAC suggest sub-micron particle haze (Beaulieu et al., 2008)▷ two secondary eclipses from Spitzer show 4 μm opacity and no temperature inversion (Charbonneau et al., 2008)▷ strong H_2O absorption in day-side emission spectrum (Grillmair et al., 2008)▷ host star rotation period $P = 11.953 \pm 0.009$ d (Henry & Winn, 2008)▷ enhanced stellar magnetic activity due to close-in planet (Lanza, 2008)▷ Rayleigh scattering by $MgSiO_3$ (0.55–1.05 μm) gives $T_{\mathrm{atm}} = 1340$ K (Lecavelier des Etangs et al., 2008a)▷ 10 transits over 21 d by MOST and limits on transit time variations (Miller-Ricci et al., 2008a)▷ featureless transmission spectrum from HST–ACS (Pont et al., 2008a)▷ Na I doublet absorption with HET–HRS (Redfield et al., 2008)▷ H_2O and CH_4 absorption from secondary eclipse with HST–NICMOS (Swain et al., 2008b)▷ 3d simulations of atmospheric circulation (Showman et al., 2008)▷ linear polarisation attributed to thin cloud of sub-μm dust grains (Sengupta, 2008)▷ homogeneous analysis and light curve properties (Southworth, 2008)▷ **2009:** stellar activity and stellar rotation from OHP–SOPHIE (Boisse et al., 2009)▷ constraints on CO from Spitzer–IRAC (Désert et al., 2009)▷ constraints on day-night circulation from Spitzer–MIPS at 24 μm (Knutson et al., 2009c)▷ limits on radio emission at 244 and 614 MHz from GMRT (Lecavelier des Etangs et al., 2009)▷ abundances and minimum mass of heavy elements (Mousis et al., 2009)▷ stellar proper motion and transit timing (Rafikov, 2009)▷ homogeneous analysis: physical properties (Southworth, 2009)▷ Rayleigh scattering by sub-micron haze particles with no H_2O from HST–NICMOS (Sing et al., 2009)▷ H_2O, CO, CO_2 required to explain near-infrared day-side spectrum from HST–NICMOS (Swain et al., 2009b)▷ 3d simulations coupling atmospheric dynamics to cloud-free radiative transfer (Showman et al., 2009)▷ limits on 307–347 MHz radio emission during secondary eclipse from NRAO (Smith et al., 2009a)▷ Rossiter–McLaughlin effect from ESO–HARPS (Triaud et al., 2009)▷ non-detection of polarised scattered light from POLISH (Wiktorowicz, 2009)▷ **2010:** atmospheric modeling from six transits and six eclipses with Spitzer–IRAC (Agol et al., 2010)▷ constraints on H_2O and other molecules from Keck–NIRSPEC (Barnes et al., 2010)▷ inflation through Ohmic dissipation (Batygin & Stevenson, 2010)▷ line profile tomography probing star and planet rotations and orbit (Collier Cameron et al., 2010a)▷ atmospheric models and the effects of TiO, VO, CO, CH_4 (Fortney et al., 2010)▷ no evidence of star–planet magnetospheric interactions from CFHT polarimetry (Fares et al., 2010)▷ constraints on companions from transit time variations with NOT/WHT (Hrudková et al., 2010)▷ effect of night-side pollution on transit depth (Kipping & Tinetti, 2010)▷ high-temperature photochemistry and CH_4, CO_2, CO, and H_2O abundances (Line et al., 2010)▷ evaporation rates (Lecavelier des Etangs, 2010)▷ observation with digital SLR cameras (Littlefield, 2010)▷ Ohmic dissipation (Perna et al., 2010b)▷ X-ray detection during transits probing coronal–magnetospheric structure from XMM–Newton (Pillitteri et al., 2010)▷ ground-based near-infrared emission spectrum from IRTF–SpeX (Swain et al., 2010)▷ homogeneous analysis and light curve properties (Southworth, 2010)▷ **2011:** stellar limb darkening from multicolour light curves (Abubekerov et al., 2011)▷ disentangling planetary signals from stellar activity (Boisse et al., 2011)▷ re-confirmation of polarised reflected light from multicolour observations (Berdyugina et al., 2011)▷ reflection effect (Budaj, 2011)▷ time-dependent magnetohydrodynamic simulation of interplanetary environment (Cohen et al., 2011)▷ models of thermal phase variations for eccentric orbits (Cowan & Agol, 2011a)▷ directed follow-up approach for transit detection using low-cadence surveys (Dzigan & Zucker, 2011)▷ transit parameters at 3.6 μm from Spitzer–IRAC (Désert et al., 2011d)▷ mass loss from extreme ultraviolet and X-ray radiation (Ehrenreich & Désert, 2011)▷ limits on molecular features from archival HST–NICMOS transmission spectroscopy (Gibson et al., 2011)▷ mass-loss rates consistent with an atomic hydrogen/proton mixture (Guo, 2011)▷ alkali line absorption in Na I and K I (Jensen et al., 2011)▷ polarisation studies (Kostogryz et al., 2011)▷ radial velocity variations due to stellar activity from MOST/SOPHIE photometry (Lanza et al., 2011a)▷ limits on 150 MHz radio emission from GMRT (Lecavelier des Etangs et al., 2011)▷ determination of planet albedo from Subaru (Langford et al., 2011)▷ volatile enrichment and heavy elements (Mousis et al., 2011)▷ limits on 3.25 μm line emission from Keck–NIRSPEC (Mandell et al., 2011)▷ disequilibrium C, O, and N chemistry, and enhanced abundances of CH_4, NH_3, and HCN (Moses et al., 2011)▷ X-ray activity when planet close to active stellar regions from XMM–Newton (Pillitteri et al., 2011)▷ equatorial superrotation (Showman & Polvani, 2011)▷ high-altitude haze from optical/near-ultraviolet transmission spectroscopy with HST–STIS (Sing et al., 2011b)▷ effects of CH_4 quenching (Visscher & Moses, 2011)▷ **2012:** effects of stellar activity (Aigrain et al., 2012)▷ wavelength-dependent astrometric motion (Coughlin & López-Morales, 2012)▷ secondary eclipse scanning from archival Spitzer–IRAC (de Wit et al., 2012)▷ modeling of archival HST–NICMOS transmission spectroscopy (Gibson et al., 2012b)▷ effect of tidal locking on magnetospheric and atmospheric evolution (Gibson et al., 2012a)▷ effect of clouds and hazes (Heng et al., 2012)▷ tidal effects and spin–orbit alignment from orbit eccentricity (Husnoo et al., 2012)▷ temperature-pressure profile and upper atmospheric heating from HST–STIS Na I doublet (Huitson et al., 2012)▷ limb darkening coefficients from 3d stellar atmosphere fits to HST data (Hayek et al., 2012)▷ Hα in the transmission spectrum (Jensen et al., 2012)▷ non-equilibrium chemistry from 3.6 and 4.5 μm Spitzer phase curves (Knutson et al., 2012)▷ variation in evaporation from Ly-α transmission spectroscopy with HST–STIS (Lecavelier des Etangs et al., 2012)▷ atmospheric structure and composi-

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tion from secondary eclipse spectroscopy (Lee et al., 2012c)▷ secondary eclipse map and location of day-side hot spot from Spitzer–IRAC (Majeau et al., 2012)▷ ground-based near-infrared emission spectrum from IRTF–SpeX (Waldmann et al., 2012)▷ atmospheric chemistry (Venot et al., 2012)▷ **2013:** atmospheric escape in Ly-α from HST–STIS (Bourrier et al., 2013)▷ neutral oxygen at 130 nm with HST–COS (Ben-Jaffel & Ballester, 2013)▷ 3d model of H escape (Bourrier & Lecavelier des Etangs, 2013)▷ H_2O absorption in day-side atmosphere at 3.2 μm from VLT–CRIRES (Birkby et al., 2013)▷ planet mass determination from atmospheric scale height (de Wit & Seager, 2013)▷ CO in day-side atmosphere at 2–2.3 μm with VLT–CRIRES (de Kok et al., 2013)▷ 3d radiative-hydrodynamical simulations (Dobbs-Dixon & Agol, 2013)▷ albedo from HST–STIS at 290–570 nm imply deep blue planet colour (Evans et al., 2013)▷ host star spin-up by angular momentum transfer from planet (Guinan, 2013)▷ computation of albedo in terms of cloud properties (Heng & Demory, 2013)▷ variable transit curves predicted in ultraviolet due to stellar wind bow shocks (Llama et al., 2013)▷ atmospheric disequilibrium diagnostics (Line & Yung, 2013)▷ C/O modeling and confirmation of C-rich atmosphere (Moses et al., 2013b)▷ atmospheric heat redistribution efficiency drops as stellar insolation rises (Perez-Becker & Showman, 2013)▷ soft X-ray transit detection with Chandra–ACIS (Poppenhaeger et al., 2013)▷ effects of dust-dominated atmosphere on emission spectrum and phase curves (Pont et al., 2013)▷ 3d atmospheric circulation with magnetic drag and Ohmic dissipation (Rauscher & Menou, 2013)▷ atmospheric CO absorption from Keck–NIRSPEC (Rodler et al., 2013a)▷ Doppler signatures of atmospheric circulation (Showman et al., 2013)▷ transmission spectrum from HST–NICMOS from blind-source separation (Waldmann et al., 2013)▷ **2014:** chemical model (Agúndez et al., 2014a)▷ atmospheric clouds, and degeneracy between cloud properties and Na abundance (Barstow et al., 2014)▷ detecting exomoons via transiting plasma torus (Ben-Jaffel & Ballester, 2014)▷ evidence for H_2O at 1.15 and 1.4 μm from HST–WFC3 eclipses (Crouzet et al., 2014)▷ ground-based near-infrared transmission spectrum from IRTF–SpeX (Danielski et al., 2014)▷ analysis of rotating star spots using SOAP–2 (Dumusque et al., 2014a)▷ systematic atmospheric retrieval analysis (Line et al., 2014)▷ atmospheric composition of day–night terminators (Lee et al., 2014c)▷ orbit parameters versus atmospheric species (Miguel & Kaltenegger, 2014)▷ re-evaluation of Spitzer–IRAC primary transit observations (Morello et al., 2014)▷ H_2O at 1.15 and 1.4 μm from HST–WFC3 transits (McCullough et al., 2014)▷ H_2O abundance from HST–WFC3 transmission spectra (Madhusudhan et al., 2014)▷ X-ray variability and high stellar activity due to angular momentum transfer from planet to star (Pillitteri et al., 2014a)▷ atmospheric circulation (Rauscher & Kempton, 2014)▷ assessment of CH_4 detection (Swain et al., 2014)▷ variability of spectral lines during transit (Shliakhetska et al., 2014)▷ re-analysis of secondary eclipse time series spectroscopy from Spitzer–IRS (Todorov et al., 2014)▷ magnetohydrodynamic simulations of upper atmosphere (Trammell et al., 2014)▷ location in Spitzer 3.6/4.5 μm colour–magnitude diagram (Triaud, 2014)▷ equatorial waves and superrotation (Tsai et al., 2014)▷ atmospheric clouds, and relation between pressure, abundance, and particle size (Vahidinia et al., 2014)▷ favourable for polarisation studies (Wiktorowicz & Laughlin, 2014)▷ hot CH_4 using a comprehensive computed line list from ExoMol (Yurchenko et al., 2014)▷ **2015:** first exoplanet transit observed with SOFIA (Angerhausen et al., 2015b)▷ compilation of light curves and transit timing (Baluev et al., 2015)▷ stellar diameter from CHARA (Boyajian et al., 2015)▷ analytical model of the Rossiter–McLaughlin effect (Baluev & Shaidulin, 2015)▷ centre-to-limb variations across the stellar Fraunhofer lines from transits (Czesla et al., 2015)▷ optical hydrogen absorption consistent with a thin bow shock leading the planet (Cauley et al., 2015)▷ chromatic Rossiter–McLaughlin effect (Di Gloria et al., 2015)▷ non-isothermal theory for interpreting Na lines in transmission spectra (Heng et al., 2015)▷ models of local and global cloud formation (Lee et al., 2015b)▷ spatially resolved eastward winds and planet rotation (Louden & Wheatley, 2015)▷ impact of stellar activity on X-ray and ultraviolet transits (Llama & Shkolnik, 2015)▷ gyrochronology and isochrone ages (Maxted et al., 2015)▷ far ultraviolet variability of the host star and possible mass accretion from the planet (Pillitteri et al., 2015)▷ constraints on Bond albedo and day–night heat transport from secondary eclipse depths (Schwartz & Cowan, 2015)▷ time scales of radio emission variability (See et al., 2015)▷ search for reflected light (Valyavin et al., 2015a)▷ spectrally resolved detection of Na with HARPS (Wyttenbach et al., 2015)▷ **2016:** excess absorption in the emission cores of Ca II, H-α, and Na I D during transits (Barnes et al., 2016)▷ chromatic line-profile tomography (Borsa et al., 2016)▷ absence of polarisation from AAT–HIPPI (Bott et al., 2016)▷ rotation and winds from CO and H_2O absorption from VLT–CRIRES (Brogi et al., 2016)▷ variation in the pre-transit Balmer line signal (Cauley et al., 2016)▷ Rossiter–McLaughlin effect 'reloaded' (Cegla et al., 2016)▷ extreme ultraviolet flux and the escaping atmosphere (Guo & Ben-Jaffel, 2016)▷ non-equilibrium cloud formation (Helling et al., 2016)▷ `StarSim` stellar activity modelling of the photometric and radial velocity curves (Herrero et al., 2016)▷ favourable for lightning-discharge studies during transit (Hodosán et al., 2016a)▷ atmospheric circulation (Kataria et al., 2016)▷ ultraviolet light curves attributed to outgassing from Trojan satellites on tadpole orbits (Kislyakova et al., 2016)▷ multiple-scattering polarised radiative transfer (Kopparla et al., 2016)▷ 3d radiative-hydrodynamic cloud modeling (Lee et al., 2016)▷ exosphere transit models compared with solar data from SDO (Llama & Shkolnik, 2016)▷ HST–WFC3 transmission spectra explained by solar composition atmospheres with patchy clouds (Line & Parmentier, 2016)▷ atmospheric escape of hot gas coupling plasma, photoionisation and Ly-α emission (Salz et al., 2016)▷ H_2O in clear/cloudy atmospheres from infrared transit spectroscopy (Sing et al., 2016)▷ near ultraviolet transit depth attributed to planet atmosphere (Turner et al., 2016a)▷ envelope enrichment and predicted H_2O abundance (Venturini et al., 2016)▷ **2017:** spectral analysis based on temporal multifractality (Agarwal et al., 2017)▷ limits on H_2O-vapour at 650 nm from HARPS (Allart et al., 2017)▷ atmospheric retrieval analysis with NEMESIS (Barstow et al., 2017)▷ effects of 3d thermal structure on 1d atmospheric retrieval (Blecic et al., 2017)▷ atmospheric Na from HARPS–N (Casasayas-Barris et al., 2017)▷ abnormal Hα variability during near-transit observations (Cauley et al., 2017c)▷ seven Hα transits using ESO–HARPS and Keck–HIRES from 2006–2015 (Cauley et al., 2017a)▷ unfeasability of chromatic line-profile tomography (Cegla et al., 2017)▷ effect of stellar flares on upper atmosphere (Chadney et al., 2017)▷ theoretical phase curve assuming thermochemical equilibrium (Dobbs-Dixon & Cowan, 2017)▷ evolving magnetic field from Zeeman–Doppler imaging 2013–15 (Fares et al., 2017)▷ mode of the Hα and Na transmission spectrum (Huang et al., 2017a)▷ atmospheric Na revealed by planet's orbital motion with VLT–UVES (Khalafinejad et al., 2017)▷ time-resolved VLT–UVES observations of a stellar flare during primary transit (Klocová et al., 2017)▷ atmospheric aerosols (Lavvas & Koskinen, 2017)▷ dynamical mineral clouds from atmospheric modeling (Lee et al., 2017)▷ atmospheric modeling with HELIOS (Malik et al., 2017)▷ models of transmitted and polarised scattered X-ray flux (Marin & Grosso, 2017)▷ Rossiter–McLaughlin effect determined from differential least-squares deconvolution (Strachan & Anglada-Escudé, 2017)▷ atmospheric modeling with reduced C-H-O chemical network, VULCAN (Tsai et al., 2017)▷ magnetospheric conditions and radio emission (Weber et al., 2017)▷ stellar absorption line centre-to-limb variations (Yan et al., 2017)▷ atmospheric structure and dynamics from Doppler-shifted emission spectra (Zhang et al., 2017)▷ **2018:** atmospheric properties from thermal model of Spitzer data (Adams & Laughlin, 2018)▷ H_2O in the transmission spectrum from GIANO (Brogi et al., 2018)▷ magnetic star–planet interactions from orbitally phased Ca II K variations (Cauley et al., 2018)▷ atmospheric simulations including chemical advection (Drummond et al., 2018b)▷ variability of Hα and Ca emission (Kohl et al., 2018)▷ stellar flare modeling due to star–planet magnetic field interaction (Lanza, 2018)▷ atmospheric models with the UK 3D Met Office Unified Model (Lines et al., 2018b)▷ tropospheric and thermospheric coupling (Pino et al., 2018)▷ He I 1083 nm absorption from CARMENES (Salz et al., 2018)▷ maps, retrieved composition, and constraints predicted for JWST (Schlawin et al., 2018a)▷ **2019:** multiple H_2O-band detections from CARMENES (Alonso-Floriano et al., 2019a)▷ high-resolution transmission spectrum and atmospheric Doppler shifts from 3D GCMs (Flowers et al., 2019)▷ transmission spectrum from broad-band filters (Kasper et al., 2019)▷ K-absorption (Keles et al., 2019)▷ star does not accrete significant material from the planet (Route & Looney, 2019)▷ effects of disequilibrium C-chemistry (Steinrueck et al., 2019)▷

HD 209458 planet with $P = 3.52$ d, $M_p \sin i = 0.62 M_J$, $R_p = 1.32 R_J$, $a = 0.046$ au, transiting a $1.1 M_\odot$ G0 dwarf at 47 pc, with $\Delta F = 0.017$ mag; radial velocity discovery with Keck–HIRES (Henry et al., 2000)▷ transit detection (Henry et al., 1999)▷ (Henry et al., 2000)▷ (Charbonneau et al., 2000)▷ *a posteriori* detection in Hipparcos photometry: (Söderhjelm et al., 1999)▷ (Robichon & Arenou, 2000)▷ (Castel-

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lano et al., 2000)▷ limits on emission/absorption lines during transit (Bundy & Marcy, 2000)▷ multicolour transits (Jha et al., 2000)▷ spectroscopic orbit from Keck–HIRES (Mazeh et al., 2000)▷ first detection of Rossiter–McLaughlin effect with OHP–ELODIE (Queloz et al., 2000a)▷ **2001:** transit photometry from HST–STIS (Brown et al., 2001)▷ prediction of molecular signatures during secondary eclipse (Brown, 2001)▷ limb darkening (Deeg et al., 2001)▷ limits on emission/absorption lines during transit with VLT–UVES (Moutou et al., 2001)▷ **2002:** Na concentration affected by non-LTE (Barman et al., 2002)▷ limits on CO at 2.3 μm with Keck–NIRSPEC (Brown et al., 2002)▷ atmospheric Na at 589.3 nm with HST (Charbonneau et al., 2002)▷ star/planet parameters and stellar age of 5.2 Gyr (Cody & Sasselov, 2002)▷ transits with 0.25-m telescope (Hudgins & Filipović, 2002)▷ **2003:** evolutionary models do not explain large planet radius by irradiation alone (Baraffe et al., 2003)▷ planet rotation from oblateness in transit photometry (Barnes & Fortney, 2003)▷ tidal and kinetic heating effects on planet radii (Bodenheimer et al., 2003)▷ age and irradiation may explain radius (Burrows et al., 2003)▷ global circulation characterised by polar vortices and broad zonal jets (Cho et al., 2003)▷ atmospheric models of Na absorption (Fortney et al., 2003)▷ atmospheric H driven by H_2O photolysis and reaction of OH with H_2 (Liang et al., 2003)▷ limits on He I at 1083 nm from VLT–ISAAC (Moutou et al., 2003)▷ limits on CH_4 from transmission spectroscopy at 3.6 μm with VLT–ISAAC (Richardson et al., 2003b)▷ limits on CO and H_2O absorption at 2.2 μm from IRTF–SpeX (Richardson et al., 2003a)▷ extended/escaping upper atmosphere in Ly-α (Vidal-Madjar et al., 2003)▷ **2004:** evaporation rate and lifetime versus planet mass (Baraffe et al., 2004)▷ effect of tidal locking on magnetospheric and atmospheric evolution (Grießmeier et al., 2004)▷ review (Ksanfomality, 2004)▷ atmospheric escape and atmospheric lifetime (Lecavelier des Etangs et al., 2004)▷ limits on Na absorption from comets with HET–HRS (Mendelowitz et al., 2004)▷ detection of O/C from HST–STIS (Vidal-Madjar et al., 2004)▷ limits on exospheric Hα absorption from Subaru–HRS (Winn et al., 2004)▷ **2005:** atmospheric composition and global circulation at 0.5–25 μm from Spitzer–IRAC–MIPS (Burrows et al., 2005)▷ 3d atmospheric circulation models and predicted wind speeds (Cooper & Showman, 2005)▷ limits on CO at 2 μm from Keck–NIRSPEC (Deming et al., 2005)▷ atmospheric models of 24 μm Spitzer data suggest re-radiation of stellar flux over entire planet (Fortney et al., 2005)▷ time-dependent radiative model and dependence of Na on orbit phase (Iro et al., 2005)▷ eccentricity from 85 radial velocity measurements 1999–2005 from Keck/Lick (Laughlin et al., 2005b)▷ limits on atomic species from Subaru–HDS (Narita et al., 2005)▷ limits on secondary eclipse from K-band photometry with UKIRT (Snellen, 2005)▷ hydrodynamic escape of neutral gas (Tian et al., 2005)▷ obliquity tides as a heat source for close-in orbits (Winn & Holman, 2005)▷ period accuracy 0.016 s from revised photometry/radial velocity (Wittenmyer et al., 2005)▷ limits on 150 MHz radio emission from GMRT (Winterhalter et al., 2005)▷ **2006:** integral field spectroscopy for Na I detection with WHT–INTEGRAL (Arribas et al., 2006)▷ disequilibrium abundances for CO and CH_4 (Cooper & Showman, 2006)▷ tests of general relativistic gravitoelectric correction require transit accuracies to 0.1 s (Iorio, 2006a)▷ dynamical constraints on quadrupole mass moment (Iorio, 2006b)▷ albedo limit of 0.25 from MOST photometry (Rowe et al., 2006)▷ infrared radius from Spitzer–MIPS (Richardson et al., 2006)▷ discrepancy in transit colour (Tingley et al., 2006)▷ **2007:** hot H absorption (Ballester et al., 2007)▷ H_2O absorption (Barman, 2007)▷ theoretical spectral models with a thermal inversion and H_2O emission (Burrows et al., 2007)▷ absorption by atomic H with no indication of evaporation (Ben-Jaffel, 2007)▷ transit limits on companions from MOST (Croll et al., 2007a)▷ mid-infrared phase variations (Cowan et al., 2007)▷ ground-based limits on secondary eclipse with IRTF (Deming et al., 2007b)▷ enhanced mass loss through hydrodynamic escape by stellar tidal forces (Erkaev et al., 2007)▷ modeling escape and composition of the irradiated atmosphere (García Muñoz, 2007)▷ limb darkening from HST–STIS (Knutson et al., 2007c)▷ dependence of evaporation rate on potential energy (Lecavelier des Etangs, 2007)▷ 3d hydrodynamical models and mass-loss rate (Schneiter et al., 2007)▷ **2008:** diagnostic potential of albedo measurements (Burrows et al., 2008)▷ spectral, spatial, and temporal properties of H exosphere (Ben-Jaffel, 2008)▷ TiO and VO optical absorption from HST–STIS (Désert et al., 2008)▷ extended exosphere and hydrogen loss from HST–ACS (Ehrenreich et al., 2008)▷ energetic neutral atoms explains high-velocity hydrogen (Holmström et al., 2008)▷ lower albedos predicted by radiation transfer models (Hood et al., 2008)▷ atmospheric temperature inversion from 3.6–8.0 μm emission spectrum with Spitzer–IRAC (Knutson et al., 2008)▷ Rayleigh scattering by H_2 and pressure–altitude relation (Lecavelier des Etangs et al., 2008c)▷ radiation pressure can account for high-velocity H atoms (Lecavelier des Etangs et al., 2008b)▷ limits on companion planets from transit time variations with MOST (Miller-Ricci et al., 2008b)▷ albedo limit of 0.04 from MOST (Rowe et al., 2008)▷ featureless emission spectrum over 7.4–15.2 μm with Spitzer–IRS (Swain et al., 2008a)▷ atmospheric circulation with simplified forcing (Showman et al., 2008)▷ ground-based detection of Na from Subaru–HDS (Snellen et al., 2008)▷ limb darkening from HST–STIS (Sing et al., 2008a)▷ temperature-pressure profile at terminator from Na absorption and Rayleigh scattering (Sing et al., 2008b)▷ homogeneous analysis and light curve properties: (Southworth, 2008)▷ reconfirmation of evaporation (Vidal-Madjar et al., 2008)▷ **2009:** limb darkening mismatch with atmosphere models (Claret, 2009)▷ homogeneous analysis and light curve properties: (Southworth, 2009)▷ coupled radiative-dynamical atmospheric circulation (Showman et al., 2009)▷ H_2O, CH_4, and CO_2 at 1.5–2.5 μm from HST–NICMOS (Swain et al., 2009a)▷ **2010:** light curve analysis (Abubekerov et al., 2010)▷ inflation through Ohmic dissipation (Batygin & Stevenson, 2010)▷ atmospheric H_2O at 3.6–8.0 μm with Spitzer–IRAC (Beaulieu et al., 2010)▷ energetic atoms in upper atmosphere (Ben-Jaffel & Sona Hosseini, 2010)▷ photometric and spectral signatures of 3d models (Burrows et al., 2010)▷ radiative hydrodynamic simulations and temporal variability (Dobbs-Dixon et al., 2010)▷ magnetospheric properties from energetic neutral atoms (Ekenbäck et al., 2010)▷ atmospheric models and the effects of TiO, VO, CO, CH_4 (Fortney et al., 2010)▷ limits on far-ultraviolet auroral/dayglow emission from HST–COS (France et al., 2010)▷ mass loss and tidal evolution (Guo, 2010)▷ relevance to testing (general relativistic like) Horava–Lifshitz gravity (Iorio & Ruggiero, 2010)▷ characterising the thermosphere with ultraviolet transit observations (Koskinen et al., 2010)▷ evaporation rates (Lecavelier des Etangs, 2010)▷ tidal heating (Leconte et al., 2010)▷ mass-loss from HST–COS consistent with models that include metals in outflowing gas (Linsky et al., 2010)▷ thermal inversion and molecular abundances (Madhusudhan & Seager, 2010)▷ limits on Trojan asteroids from MOST (Moldovan et al., 2010)▷ thermal inversion and molecular abundances (Madhusudhan & Seager, 2010)▷ effects of magnetic drag on atmospheric winds (Perna et al., 2010a)▷ Ohmic dissipation (Perna et al., 2010b)▷ suprathermal H produced by dissociation of molecular H_2 (Shematovich, 2010)▷ shifts in CO lines due to planet's orbital velocity (Snellen et al., 2010a)▷ transits of limb-brightened lines and tentative Si IV absorption (Schlawin et al., 2010)▷ homogeneous analysis and light curve properties (Southworth, 2010)▷ **2011:** directed follow-up approach for transit detection using low-cadence surveys (Dzigan & Zucker, 2011)▷ mass loss rate from extreme ultraviolet and X-ray radiation (Ehrenreich & Désert, 2011)▷ constraints from HST–COS (France et al., 2011)▷ mass-loss rates consistent with an atomic hydrogen/proton mixture (Guo, 2011)▷ coupled radius–orbit evolutionary models (Ibgui et al., 2011)▷ alkali line absorption in Na I and K I (Jensen et al., 2011)▷ spectroscopic methods for detecting scattered starlight (Langford et al., 2011)▷ limits on radio emission at 150 MHz from GMRT (Lecavelier des Etangs et al., 2011)▷ transmission spectroscopy accounting for eccentricity and longitude of pericentre (Montalto et al., 2011)▷ disequilibrium C, O, and N chemistry, and enhanced CH_4, NH_3, and HCN (Moses et al., 2011)▷ temperature–pressure profile, ionisation layer, and thermosphere from Na D lines (Vidal-Madjar et al., 2011)▷ **2012:** effects of atmospheric circulation (Agúndez et al., 2012)▷ wavelength-dependent astrometric motion (Coughlin & López-Morales, 2012)▷ transit and eclipse parameters from Spitzer–MIPS 24 μm observations (Crossfield et al., 2012c)▷ impact of circumplanetary jets on transit spectra and timing offsets (Dobbs-Dixon et al., 2012)▷ limb darkening coefficients from 3d stellar atmosphere fits to HST data (Hayek et al., 2012)▷ Hα in the transmission spectrum (Jensen et al., 2012)▷ constraints on eccentricity from tidal dissipation (Laskar et al., 2012)▷ high-speed winds with atmospheric drag from anomalous Doppler shifts during transit (Miller-Ricci Kempton & Rauscher, 2012)▷ atmospheric chemistry (Venot et al., 2012)▷ **2013:** ground-based detection of Ca, and possibly Sc and H (Astudillo-Defru & Rojo, 2013)▷ 3d model of H escape with radiative blow-out and stellar wind interactions (Bourrier & Lecavelier des Etangs, 2013)▷ near-infrared transmission spectroscopy with HST–NICMOS (Deming et al., 2013)▷ photochemical-dynamical model for escaping heavy atoms (Kosk-

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inen et al., 2013a)▷ photochemical-dynamical model for escaping heavy atoms (Koskinen et al., 2013b)▷ 3d mixing and application to day–night cold trap (Parmentier et al., 2013)▷ atmospheric heat redistribution versus stellar insolation (Perez-Becker & Showman, 2013)▷ 3d atmospheric circulation with magnetic drag and Ohmic dissipation (Rauscher & Menou, 2013)▷ Doppler signatures of atmospheric circulation (Showman et al., 2013)▷ atomic Mg from HST–STIS, and confirmation of hydrodynamic escape (Vidal-Madjar et al., 2013)▷ **2014:** chemical model (Agúndez et al., 2014a)▷ modeling Mg escape (Bourrier et al., 2014)▷ mass-loss rates (Cherenkov et al., 2014)▷ no evidence for atmospheric thermal inversion (Diamond-Lowe et al., 2014)▷ ionisation in thermosphere (Ionov et al., 2014)▷ thermal escape and mass-loss (Koskinen et al., 2014)▷ effects of photoionisation on transit depth in K (Lavvas et al., 2014)▷ H_2O abundance from HST–WFC3 transmission spectra (Madhusudhan et al., 2014)▷ atmospheric circulation (Rauscher & Kempton, 2014)▷ magnetohydrodynamic atmosphere simulations (Rogers & Showman, 2014)▷ location in Spitzer 3.6/4.5 μm colour–magnitude diagram (Triaud, 2014)▷ mass loss rates and stellar wind (Villarreal D'Angelo et al., 2014)▷ favourable for polarisation studies (Wiktorowicz & Laughlin, 2014)▷ phase curve at 4.5 μm from Spitzer–IRAC (Zellem et al., 2014b)▷ ground-based infrared emission spectra from IRTF–SpeX and Hale–TripleSpec (Zellem et al., 2014a)▷ **2015:** no Si III from HST data in far ultraviolet (Ballester & Ben-Jaffel, 2015)▷ modeling Mg escape (Bourrier et al., 2015b)▷ stellar diameter from CHARA (Boyajian et al., 2015)▷ atmospheric heating by stellar radiation from soft X-rays to extreme ultraviolet (Ionov & Shematovich, 2015)▷ atmospheric mass loss including extreme ultraviolet irradiation and planetary magnetic dipole (Khodachenko et al., 2015)▷ gyrochronology and isochrone ages (Maxted et al., 2015)▷ transmission spectroscopy using VLT–KMOS (Parviainen et al., 2015)▷ high-energy irradiation and mass-loss rates (Salz et al., 2015)▷ constraints on Bond albedo and day–night heat transport from secondary eclipse depths (Schwartz & Cowan, 2015)▷ evidence against strong thermal inversion from high-dispersion spectroscopy (Schwarz et al., 2015)▷ **2016:** magnetospheric models, bow shocks, and near-ultraviolet absorption (Alexander et al., 2016)▷ UK Met Office global circulation model (Amundsen et al., 2016)▷ atmospheric parameters from HST spectrophotometry (del Burgo & Allende Prieto, 2016)▷ extreme ultraviolet flux and the escaping atmosphere (Guo & Ben-Jaffel, 2016)▷ non-equilibrium cloud formation (Helling et al., 2016)▷ atmospheric circulation (Kataria et al., 2016)▷ limits on H_3^+ from VLT–CRIRES (Lenz et al., 2016)▷ no thermal inversion and solar H_2O abundance from HST–WFC3 (Line et al., 2016)▷ molecular formation throughout the region of atmospheric mass loss (Pinotti & Boechat-Roberty, 2016)▷ photoionisation of planetary winds (Schneiter et al., 2016)▷ atmospheric escape of hot gas coupling plasma, photoionisation and Ly-α emission (Salz et al., 2016)▷ H_2O in clear/cloudy atmospheres from infrared transit spectroscopy (Sing et al., 2016)▷ confirmation of H_2O from HST–WFC3 with Bayesian spectral retrieval (Tsiaras et al., 2016b)▷ envelope enrichment and H_2O abundance (Venturini et al., 2016)▷ inhomogeneous clouds from asymmetric transits (von Paris et al., 2016a)▷ **2017:** atmospheric retrieval with NEMESIS (Barstow et al., 2017)▷ C/O and O/H ratios suggest origin beyond the snow line (Brewer et al., 2017)▷ combining low- and high-resolution spectroscopy (Brogi et al., 2017)▷ effect of stellar flares on upper atmosphere (Chadney et al., 2017)▷ coronal mass ejections and atmospheric mass-loss (Cherenkov et al., 2017)▷ Chandra–HRC confirms X-ray emission, and derived mass-loss rates (Czesla et al., 2017)▷ spectral line profiles retrieved across the stellar disk (Dravins et al., 2017)▷ atmospheric model accounting for stellar wind and planet's magnetic moment (Erkaev et al., 2017)▷ models of Lyα absorption (Khodachenko et al., 2017)▷ inflated radius attributed to internal heating at 10^7 Pa (Komacek & Youdin, 2017)▷ atmospheric aerosols (Lavvas & Koskinen, 2017)▷ modeling the high-energy irradiation from HST–COS (ultraviolet) and XMM–Newton (Louden et al., 2017a)▷ evidence of N chemistry (NH_3) from HST–WFC3 (MacDonald & Madhusudhan, 2017b)▷ evidence of N chemistry (NH_3 and/or HCN), patchy clouds, and H_2O (MacDonald & Madhusudhan, 2017a)▷ 3d atmospheric models of the deep atmosphere and zonal jets (Mayne et al., 2017)▷ inflated radius attributed to advection of potential temperature (Tremblin et al., 2017)▷ atmospheric modeling with reduced C-H-O chemical network, VULCAN (Tsai et al., 2017)▷ magnetospheric conditions and radio emission (Weber et al., 2017)▷ stellar absorption line centre-to-limb variations (Yan et al., 2017)▷ atmospheric structure and dynamics from Doppler-shifted emission spectra (Zhang et al., 2017)▷ **2018:** atmospheric properties from thermal model of Spitzer data (Adams & Laughlin, 2018)▷ influence of stellar flares on atmospheric dynamics (Bisikalo et al., 2018)▷ influence of stellar radiation pressure on planet envelope flow structure (Cherenkov et al., 2018)▷ observable signatures of wind-driven chemistry (Drummond et al., 2018a)▷ evidence for HCN, CO, and H_2O from VLT–CRIRES (Hawker et al., 2018)▷ atmospheric models with the UK 3D Met Office Unified Model (Lines et al., 2018b)▷ transmission spectra from a 3D simulated cloudy atmosphere (Lines et al., 2018a)▷ Bayesian atmospheric analysis (Morello, 2018)▷ modeling of absorption by heavy minor species (Shaikhislamov et al., 2018)▷ influence of magnetised winds on the escaping upper atmosphere (Villarreal D'Angelo et al., 2018)▷ **2019:** He I in the transmission spectrum (Alonso-Floriano et al., 2019b)▷ K-absorption (Keles et al., 2019)▷ H_2O-vapour detection in the transmission spectrum with CARMENES (Sánchez-López et al., 2019)▷

HD 219134 6-planet low-mass system around bright (V = 5.5) nearby (d = 6.5 pc) star, all discovered from radial velocity measures (planets b and c also transit), with periods 3.1, 6.8, 22.8, 46.7, 94.2 and 2247 d; discovery of a 4-planet system from HARPS–N on La Palma–TNG (first of the HARPS–N Rocky Planet Search programme) with planet b transits discovered from Spitzer (Motalebi et al., 2015)▷ 2 additional planets, f and g, from Keck–HIRES and Lick–Levy (Vogt et al., 2015)▷ 12-yr stellar activity cycle from 27 yr of radial velocities (Johnson et al., 2016a)▷ planet c transits discovered from Spitzer (Gillon et al., 2017a)▷ Bayesian analysis of interior structure using stellar abundance proxies (Dorn et al., 2017)▷ spatially-resolved spectroscopy across the stellar surface (Dravins et al., 2017)▷ quantified degeneracy of interior parameters of planets b and c (Dorn & Heng, 2018)▷ observations of stellar magnetism, wind, and high-energy flux (Folsom et al., 2018)▷ grid of upper atmosphere models (Kubyshkina et al., 2018)▷ stellar-wind sputtered exospheres of the rocky planets b and c (Vidotto et al., 2018)▷ formation from high-temperature condensates (Dorn et al., 2019)▷ internal composition inferred from stellar properties (Ligi et al., 2019)▷

B. Discovered from transit photometry, ordered by identifier

Star names/constellations (ordered by constellation)

V1298 Tau 4-planet system from K2 photometry; warm Jupiter-sized planet transiting a young solar analogue (David et al., 2019a)▷ 3 further planets from the K2 data (David et al., 2019b)▷

DS Tuc A discovery (Benatti et al., 2019)▷

Wolf 503 discovery (Peterson et al., 2018)▷

BD

BD+20 594 see K2–56 (BD+20 594 is default identifier in NASA)

CoRoT

CoRoT–1 discovery (Barge et al., 2008)▷ secondary eclipse in CoRoT data (Alonso et al., 2009a)▷ transit time analysis (Bean, 2009)▷ VLT transit and occultation photometry (Gillon et al., 2009b)▷ secondary eclipse from ARC (Rogers et al., 2009)▷ apsidal precession due to planetary tidal bulge (Ragozzine & Wolf, 2009)▷ low albedo (Snellen et al., 2009a)▷ transit time analysis (Csizmadia et al., 2010)▷ Rossiter–McLaughlin effect from Keck–HIRES and VLT–FORS (Pont et al., 2010)▷ pre-discovery transits from BEST (Rauer et al., 2010)▷ predicted transit duration variations due to apsidal and nodal precession (Damiani & Lanza, 2011)▷ secondary eclipse from Spitzer (Deming et al., 2011a)▷ photometry and new spectroscopy (Southworth, 2011)▷ prospects for detecting bow shocks (Vidotto et al., 2011)▷ tidal effects on radial velocity (Arras et al., 2012)▷ tidal effects and spin–orbit alignment from orbit eccentricity (Husnoo et al., 2012)▷ false-positive analysis (Nefs et al., 2012)▷ secondary eclipse from Palomar–WIRC (Zhao et al., 2012b)▷ confirmation of secondary eclipse (Parviainen et al., 2013)▷ atmospheric characterisation with HST–WFC3 (Ranjan et al., 2014)▷ constraints on TiO/VO from transmission spectrum with IRTF (Schlawin et al., 2014)▷ primary/secondary transit detections (Gibson, 2015)▷ no asymmetry in ground-based ultraviolet transits (Turner et al., 2016b)▷ heat recirculation and albedo from comparison of optical phase curve and secondary eclipse (von Paris et al., 2016b)▷ improved orbit and increased inflation from HARPS–N (Bonomo et al., 2017a)▷

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CoRoT–2 highly active host star with optical variability caused by magnetic activity, highly inflated planet radius, and gravitationally bound stellar companion candidate, 2MASS J19270636+0122577; discovery (Alonso et al., 2008a)▷ Rossiter–McLaughlin effect (Bouchy et al., 2008)▷ secondary eclipse in CoRoT data (Alonso et al., 2009b)▷ star spot modeling and differential rotation (Fröhlich et al., 2009)▷ localisation of stellar activity (Huber et al., 2009)▷ star spot modeling and star–planet magnetic interaction (Lanza et al., 2009b)▷ star spot modeling and star–planet magnetic interaction (Pagano et al., 2009)▷ star spot eclipse mapping (Wolter et al., 2009)▷ **2010:** secondary eclipse from WHT–LIRIS (Alonso et al., 2010)▷ host star chemistry (Chavero et al., 2010)▷ thermal emission and tidal heating from Spitzer (Gillon et al., 2010c)▷ pre-discovery transits from BEST (Rauer et al., 2010)▷ star spot modeling (Silva-Valio et al., 2010)▷ atmospheric modeling from secondary eclipse (Snellen et al., 2010b)▷ secondary eclipse from Spitzer (Deming et al., 2011a)▷ predicted transit duration variations due to apsidal and nodal precession (Damiani & Lanza, 2011)▷ star spot and activity modeling (Guillot & Havel, 2011)▷ star–planet magnetic interactions (Lanza, 2011)▷ spot modeling and Rossiter–McLaughlin effect (Nutzman et al., 2011a)▷ spot modeling from 77 transits (Silva-Valio & Lanza, 2011)▷ stellar activity from VLT–UVES and Chandra (Schröter et al., 2011)▷ photometry and new spectroscopy (Southworth, 2011)▷ chromospheric Rossiter–McLaughlin effect (Czesla et al., 2012)▷ tidal effects and spin–orbit alignment from orbit eccentricity (Husnoo et al., 2012)▷ C/O ratio as a characterisation of atmospheres (Madhusudhan, 2012)▷ physical properties (Southworth, 2012)▷ confirmed stellar companion from lucky imaging (Faedi et al., 2013b)▷ C/O modeling and confirmation of C-rich atmosphere (Moses et al., 2013b)▷ confirmation of secondary eclipse (Parviainen et al., 2013)▷ orbit parameters versus atmospheric species (Miguel & Kaltenegger, 2014)▷ black body spectrum from HST–WFC3 (Wilkins et al., 2014)▷ **2015:** compilation of light curves and transit timing (Baluev et al., 2015)▷ gyrochronology and isochrone ages (Maxted et al., 2015)▷ nearby star from lucky imaging (Wöllert et al., 2015)▷ disentangling planetary and stellar activity (Bruno et al., 2016)▷ orbital decay due to non-linear tidal dissipation (Essick & Weinberg, 2016)▷ improved orbit from HARPS–N (Bonomo et al., 2017a)▷ Spitzer photometry shows westward hotspot offset of 23° (Dang et al., 2018)▷ signatures of obliquities in thermal phase curves (Adams et al., 2019)▷ new photometric analysis (Öztürk & Erdem, 2019)▷

CoRoT–3 planet/brown dwarf ($21 M_J$); discovery (Deleuil et al., 2008)▷ Rossiter–McLaughlin effect (Triaud et al., 2009)▷ host star chemistry (Chavero et al., 2010)▷ ellipsoidal modulation and relativistic beaming (Mazeh & Faigler, 2010)▷ limits on orbits and masses of moons (Weidner & Horne, 2010)▷ photometry and new spectroscopy (Southworth, 2011)▷ tidal effects and spin–orbit alignment from orbit eccentricity (Husnoo et al., 2012)▷ stellar companion from lucky imaging (Faedi et al., 2013b)▷ secondary eclipse (Parviainen et al., 2013)▷ nearby star from lucky imaging (Wöllert et al., 2015)▷

CoRoT–4 discovery (Aigrain et al., 2008)▷ confirmation from radial velocity, and star and planet parameters (Moutou et al., 2008)▷ stellar rotation, differential rotation, and star–planet magnetic interaction (Lanza et al., 2009a)▷ host star (Chavero et al., 2010)▷ star–planet magnetic interactions (Lanza, 2011)▷ photometry and new spectroscopy (Southworth, 2011)▷ false-positive analysis (Nefs et al., 2012)▷ gyrochronology and isochrone ages (Maxted et al., 2015)▷

CoRoT–5 discovery (Rauer et al., 2009)▷ host star (Chavero et al., 2010)▷ photometry and spectroscopy (Southworth, 2011)▷ tidal effects and spin–orbit alignment (Husnoo et al., 2012)▷ transit analysis from ground and space photometry (Raetz et al., 2019a)▷

CoRoT–6 discovery (Fridlund et al., 2010)▷ photospheric activity, rotation, and star–planet magnetic interaction (Lanza et al., 2011b)▷ star–planet magnetic interactions (Lanza, 2011)▷ photometry and new spectroscopy (Southworth, 2011)▷ significant secondary eclipse (Parviainen et al., 2013)▷ gyrochronology and isochrone ages (Maxted et al., 2015)▷

CoRoT–7 2-planet system of which only planet b transits (planet c discovered by radial velocity); high stellar activity; discovery (Léger et al., 2009)▷ discovery of planet c from radial velocity (Queloz et al., 2009)▷ **2010:** improved stellar parameters (Bruntt et al., 2010)▷ possible planet d (Hatzes et al., 2010)▷ tidal evolution and atmospheric evaporation (Jackson et al., 2010)▷ photospheric activity and stellar rotation (Lanza et al., 2010)▷ evaporation rates (Lecavelier des Etangs, 2010)▷ interior composition (Rogers & Seager, 2010a)▷ composition and atmospheric evaporation (Valencia et al., 2010)▷ disentangling planetary signals from stellar activity (Boisse et al., 2011)▷ effects of magnetic drag and Ohmic dissipation (Castan & Menou, 2011)▷ mass determination (Ferraz-Mello et al., 2011)▷ tidal evolution (Greenberg & Van Laerhoven, 2011)▷ constraints on exosphere (Guenther et al., 2011)▷ mass determination (Hatzes et al., 2011)▷ atmospheric constraints, proposed lava ocean (Léger et al., 2011)▷ thermal mass loss, and possible remnant of gas/ice giant (Leitzinger et al., 2011)▷ effects of stellar wind on exosphere and magnetosphere (Mura et al., 2011)▷ reassessment of radial velocity measurements (Pont et al., 2011)▷ tidal decay and orbit circularisation (Rodríguez et al., 2011)▷ photometry and new spectroscopy (Southworth, 2011)▷ prospects for detecting bow shocks (Vidotto et al., 2011)▷ elliptical instability (Cebron et al., 2012)▷ tidal evolution (Dong & Ji, 2012)▷ Spitzer observations and improved ephemeris (Fressin et al., 2012a)▷ composition modeling (Gong & Zhou, 2012)▷ atmospheric stability under tidal locking (Heng & Kopparla, 2012)▷ irradiation-driven mass-loss (Poppenhaeger et al., 2012a)▷ composition modeling and Fe-enrichment (Wagner et al., 2012)▷ stellar magnetic field topology (Fares et al., 2013)▷ mass loss by extreme ultraviolet and X-ray radiation (Kurokawa & Kaltenegger, 2013)▷ photophoretic separation of metals and silicates as an explanation for high density (Wurm et al., 2013)▷ new CoRoT transits and HARPS radial velocities (Barros et al., 2014a)▷ tidal evolution (Dong, 2014)▷ star spot modeling using CoRoT and HARPS data (Haywood et al., 2014b)▷ effects of stellar activity (Haywood et al., 2014a)▷ expected constraints on very hot super-Earths from JWST–NIRSPEC (Samuel et al., 2014)▷ **2015:** gyrochronology and isochrone ages (Maxted et al., 2015)▷ constraining planet structure from stellar chemistry (Santos et al., 2015a)▷ number of planetary signals present in radial velocity datasets (Faria et al., 2016)▷ coupled orbital and spin evolution using a Maxwell viscoelastic rheology (Rodríguez et al., 2016)▷ constraint on super-Earth interiors from stellar abundances (Brugger et al., 2017)▷ Bayesian analysis of interior structure using stellar abundance proxies (Dorn et al., 2017)▷ confirmation through 'Agatha' periodogram analysis (Feng et al., 2017a)▷ undetected giant planet predicted from formation model (Hoffmann et al., 2017)▷ cloud formation in metal-rich atmospheres (Mahapatra et al., 2017)▷ grid of upper atmosphere models (Kubyshkina et al., 2018)▷

CoRoT–8 discovery (Bordé et al., 2010)▷ debris disks (Krivov et al., 2011)▷ photometry and new spectroscopy (Southworth, 2011)▷ transit analysis from ground and space photometry (Raetz et al., 2019a)▷

CoRoT–9 longest period CoRoT planet ($P = 95$ d); discovery (Deeg et al., 2010)▷ limits on orbits and masses of moons (Weidner & Horne, 2010)▷ transit time variations (Borkovits et al., 2011)▷ photometry and new spectroscopy (Southworth, 2011)▷ superrotating atmosphere in cyclostrophic balance (Peralta et al., 2014)▷ 5 yr radial velocity suggest non-zero eccentricity (Bonomo et al., 2017b)▷ Spitzer constraints on rings and satellites (Lecavelier des Etangs et al., 2017)▷

CoRoT–10 discovery (Bonomo et al., 2010)▷ photometry and new spectroscopy (Southworth, 2011)▷

CoRoT–11 discovery and Rossiter–McLaughlin effect (Gandolfi et al., 2010)▷ predicted transit duration variations due to apsidal and nodal precession (Damiani & Lanza, 2011)▷ tidal analysis, candidate for orbit precession measurement (Lanza et al., 2011c)▷ photometry and new spectroscopy (Southworth, 2011)▷ line-profile tomography, Rossiter–McLaughlin effect (Gandolfi et al., 2012)▷ $CO \rightleftarrows CH_4$ time scales for orbital and vertical quenching for eccentric orbits (Visscher, 2012)▷ significant secondary eclipse (Parviainen et al., 2013)▷ nearby star from lucky imaging (Wöllert et al., 2015)▷

CoRoT–12 discovery (Gillon et al., 2010b)▷ photometry and new spectroscopy (Southworth, 2011)▷ new photometry and atmospheric models (Turner et al., 2017)▷ transit analysis from ground and space photometry (Raetz et al., 2019a)▷

CoRoT–13 discovery (Cabrera et al., 2010)▷ photometry and new spectroscopy (Southworth, 2011)▷ marginally significant secondary eclipse (Parviainen et al., 2013)▷ gyrochronology and isochrone ages (Maxted et al., 2015)▷

CoRoT–14 discovery (Tingley et al., 2011)▷ photometry/spectroscopy (Southworth, 2011)▷ tidal effects on radial velocity (Arras et al., 2012)▷

CoRoT–15 not in NASA; brown dwarf ($63 M_J$); discovery (Bouchy et al., 2011b)▷ photometry and new spectroscopy (Southworth, 2011)▷ significant secondary eclipse (Parviainen et al., 2013)▷

CoRoT–16 discovery (Ollivier et al., 2012)▷

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CoRoT–17 discovery (Csizmadia et al., 2011)▷ photometry and new spectroscopy (Southworth, 2012)▷

CoRoT–18 discovery and Rossiter–McLaughlin effect (Hébrard et al., 2011b)▷ photometry and new spectroscopy (Southworth, 2012)▷ tidal effects and spin–orbit alignment from orbit eccentricity (Husnoo et al., 2012)▷ marginally significant secondary eclipse (Parviainen et al., 2013)▷ gyrochronology and isochrone ages (Maxted et al., 2015)▷ transit analysis from ground and space photometry (Raetz et al., 2019a)▷ analysis of transit light curves with star spots (Raetz et al., 2019b)▷

CoRoT–19 discovery and Rossiter–McLaughlin effect (Guenther et al., 2012)▷ photometry and new spectroscopy (Southworth, 2012)▷

CoRoT–20 2-planet system; planet b is a high density ($8.9\,\mathrm{Mg\,m^{-3}}$), high eccentricity hot Jupiter ($e = 0.56$); discovery and tidal analysis for planet b (Deleuil et al., 2012)▷ photometry and new spectroscopy (Southworth, 2012)▷ discovery of (massive, eccentric, outer) planet c from 6 yr of HARPS/SOPHIE follow-up (Rey et al., 2018)▷ brown dwarf companion with $P = 4.6$ yr interacting with planet b (Rey et al., 2018)▷ transit analysis from ground and space photometry (Raetz et al., 2019a)▷

CoRoT–21 not in NASA; extreme tidal forces leading to orbit decay and stellar spin-up in 800 Myr; discovery and tidal analysis, $M_\mathrm{p} = 2.3 M_\mathrm{J}$ (Pätzold et al., 2012)▷ secondary eclipse (Parviainen et al., 2013)▷

CoRoT–22 discovery (Moutou et al., 2014a)▷

CoRoT–23 discovery and tidal analysis (Rouan et al., 2012)▷ photometry and new spectroscopy (Southworth, 2012)▷ improved orbit from HARPS–N (Bonomo et al., 2017a)▷

CoRoT–24 2-planet system, both transiting (first for CoRoT) with periods 5.1 d and 11.8 d; discovery (Alonso et al., 2014)▷ hydrodynamic escape rates and planetary radius (Lammer et al., 2016)▷ Roche lobe overflow model and mass-loss for short-period gaseous planets (Jackson et al., 2017)▷

CoRoT–25 discovery (Almenara et al., 2013)▷

CoRoT–26 discovery (Almenara et al., 2013)▷

CoRoT–27 dense ($12.6\,\mathrm{Mg\,m^{-3}}$) $10 M_\mathrm{J}$ planet in a 3.6-d orbit; discovery (Parviainen et al., 2014)▷ transit analysis from ground and space photometry (Raetz et al., 2019a)▷

CoRoT–28 slightly evolved star, G8/9 IV discovery and asymmetric transit (Cabrera et al., 2015)▷

CoRoT–29 possibly asymmetric transits, attributed to oblate star or spots; discovery (Cabrera et al., 2015)▷ chromatic light curves from GTC–OSIRIS do not confirm asymmetry (Pallé et al., 2016)▷ transit profile and artificial megastructures (Wright et al., 2016b)▷

CoRoT–30…CoRoT–32 not in NASA

CoRoT–33 not in NASA; brown dwarf ($59 M_\mathrm{J}$) in the brown dwarf desert; discovery, 3:2 resonance with star rotation (Csizmadia et al., 2015)▷

CoRoT–ID 223977153 discovery (Boufleur et al., 2018)▷

EPIC

(default name in the NASA Archive, detailed here under the Kepler–id)

EPIC–201238110 see K2–296

EPIC–201497682 see K2–297

EPIC–201841433 see K2–298

EPIC–205718330 not in NASA archive; possible star-grazing comets (Ansdell et al., 2019)▷

EPIC–206024342 see K2–299

EPIC–206032309 see K2–300

EPIC–206042996 see K2–301

EPIC–206215704 see K2–302

EPIC–206317286 see K2–303

EPIC–211822797 see K2–103

EPIC–211945201 see K2–236

EPIC–212297394 see K2–304

EPIC–212424622 see K2–305

EPIC–212499991 see K2–306

EPIC–212587672 see K2–307

EPIC–212737443 see K2–310

EPIC–220674823 see K2–106

EPIC–235240266 not in NASA archive; possible star-grazing comets (Ansdell et al., 2019)▷

EPIC–246851721 see K2–267

EPIC–248847494 see K2–311

GJ

GJ 143 ≡ HD 21749 (TOI–186); 2-planet system; TESS candidate validated with HARPS (Trifonov et al., 2019a)▷ confirmation and discovery of planet c with TESS (Dragomir et al., 2019)▷

GJ 357 3-planet system; planet b discovered from transits, planets c and d from radial velocity (Luque et al., 2019b)▷ precision radial velocities and dynamical simulations (Jenkins et al., 2019b)▷

GJ 1132 2-plant system; discovery of planet b by MEarth–South, and radial velocity by ESO–HARPS (Berta-Thompson et al., 2015)▷ atmospheric composition (Schaefer et al., 2016)▷ radial velocity requirements to detect other planets (Cloutier et al., 2017b)▷ constraints on other bodies from transits with MEarth–S and Spitzer (Dittmann et al., 2017a)▷ possible detection of H_2O and/or CH_4 (Southworth et al., 2017)▷ suitability for JWST (Morley et al., 2017b)▷ scaling relations for rocky planet interiors (Zeng & Jacobsen, 2017)▷ discovery of planet c (Bonfils et al., 2018a)▷ optical transmission spectroscopy with Magellan (Diamond-Lowe et al., 2018)▷ line-by-line GCM (Ding & Wordsworth, 2019)▷ analysis of atmospheric temperature profiles (Malik et al., 2019)▷ Lyα stellar emission and atmospheric evolution (Waalkes et al., 2019)▷

GJ 1214 super-Earth at 15 pc, favourable for transmission spectroscopy; studies aim to establish whether the atmosphere is dominated by relatively heavy molecules such as H_2O, or high-altitude clouds obscuring its lower layers; discovery by MEarth (Charbonneau et al., 2009)▷ **2010:** atmospheric constraints on composition (Bean et al., 2010)▷ observable consequences of H-rich atmosphere (Miller-Ricci & Fortney, 2010)▷ composition modeling (Rogers & Seager, 2010b)▷ transit ephemeris (Sada et al., 2010)▷ **2011:** atmospheric constraints from VLT/Magellan (Bean et al., 2011)▷ detectability of CO_2 with HST (Belu et al., 2011)▷ stellar rotation (Berta et al., 2011)▷ atmospheric constraints from CFHT–WIRCam (Croll et al., 2011a)▷ atmospheric constraints from Keck–NIRSPEC (Crossfield et al., 2011)▷ transit times from Magellan (Carter et al., 2011)▷ atmospheric constraints from Spitzer (Désert et al., 2011a)▷ transit search targeting known transiting systems (Gillon et al., 2011a)▷ transit times from APO (Kundurthy et al., 2011)▷ atmospheric constraints from Spitzer (Nettelmann et al., 2011)▷ **2012:** atmospheric constraints from HST–WFC3 (Berta et al., 2012)▷ atmospheric models (Benneke & Seager, 2012)▷ elliptical instability (Cebron et al., 2012)▷ wavelength-dependent astrometric motion (Coughlin & López-Morales, 2012)▷ atmospheric constraints from INT/NOT/WHT (de Mooij et al., 2012)▷ tidal evolution (Dong & Ji, 2012)▷ atmospheric models (Howe & Burrows, 2012)▷ atmospheric stability under tidal locking (Heng & Kopparla, 2012)▷ atmospheric constraints from GTC–OSIRIS (Murgas et al., 2012)▷ atmospheric models (Menou, 2012)▷ atmospheric models (Miller-Ricci Kempton et al., 2012)▷ **2013:** star and planet properties (Anglada-Escudé et al., 2013a)▷ astrometric distance from CAPS, and infrared spectroscopy (Anglada-Escudé et al., 2013a)▷ extended cloudy H_2/He atmosphere (Barstow et al., 2013)▷ seven transits with UKIRT–WFC confirming featureless atmosphere (Colón & Gaidos, 2013)▷ transit depths in blue light, confirming limited atmosphere or small scale height dominated by H_2O (de Mooij et al., 2013a)▷ ultraviolet radiation environment (France et al., 2013)▷ Spitzer observations over 20 d, with atmospheric constraints from Rayleigh scattering (Fraine et al., 2013)▷ population synthesis models of atmospheric composition (Fortney et al., 2013)▷ limits on transit time variations (Harpsøe et al., 2013)▷ 11 defocused transits, and limits on transit time variations (Harpsøe et al., 2013)▷ hydrodynamic blow-off of atmospheric H (Lammer et al., 2013)▷ atmospheric models favour high clouds and hydrocarbon haze (Morley et al., 2013)▷ atmospheric constraints from IRSF–SIRIUS (Narita et al., 2013b)▷ Subaru photometry over 32 nights suggesting 1% H_2O/99% N_2 atmosphere (Narita et al., 2013a)▷ atmospheric constraints from infrared transit photometry with ISF–SIRIUS (Narita et al., 2013b)▷ nine transits with Kuiper and STELLA–I (Teske et al., 2013c)▷ atmospheric models suggesting H/He<7% by mass (Valencia et al., 2013)▷ simulations using the MIT general circulation model (Zalucha et al., 2013)▷ **2014:** transit/eclipse from SOAR (Cáceres et al., 2014)▷ tidal evolution (Dong, 2014)▷ limits on additional planet transits from Spitzer (Gillon et al., 2014b)▷ C_2H_2 at 1.0–1.5 and 9–14 μm as a diagnostic for hydrocarbon-rich atmospheres (Hu & Seager, 2014)▷ atmospheric circulation (Kataria et al., 2014)▷ limits on cloud-free models dominated by H_2O, CH_4, CO, NO, or CO_2 from HST (Kreidberg et al., 2014b)▷ astrometry from CTIO–SMARTS (RECONS) and brown

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dwarf limits (Lurie et al., 2014)⊳ X-ray coronal emission and evaporation rate from XMM–Newton (Lalitha et al., 2014)⊳ atmospheric constraints from five GTC narrow-band transits (Wilson et al., 2014)⊳ **2015:** atmospheric vertical mixing driven by anti-Hadley circulation (Charnay et al., 2015a)⊳ formation of high inhomogeneous atmospheric clouds (Charnay et al., 2015b)⊳ measures for characterising H_2O-rich super-Earths (Madhusudhan & Redfield, 2015)⊳ transmission spectroscopy using VLT–KMOS (Parviainen et al., 2015)⊳ **2016:** condensate clouds (KCl/ZnS, K2SO4/ZnO, graphite, etc) as functions of H/O and C/O (Mbarek & Kempton, 2016)⊳ **2017:** simultaneous optical and near-infrared photometry with SOFIA (Angerhausen et al., 2017)⊳ unsupervised correlated noise removal for transit light curve fitting (Dehghan Firoozabadi et al., 2017)⊳ optical transmission spectrum revealing heterogeneous stellar photosphere (Rackham et al., 2017)⊳ **2018:** transit light curves with simultaneous fit to stellar specific intensity and planetary radius (Aronson & Piskunov, 2018)⊳ microphysics of KCl and ZnS clouds (Gao & Benneke, 2018)⊳ cloud-top heights constrained by microphysical modeling of mineral clouds (Ohno & Okuzumi, 2018)⊳ **2019:** molecular features detectable with JWST (Kawashima et al., 2019)⊳ photochemical hazes (Lavvas et al., 2019)⊳

GJ 9827 see K2–135

HAT

HAT–P–1 discovery, and orbit around one component of a stellar binary (Bakos et al., 2007b)⊳ 6 transits from ground photometry (Winn et al., 2007a)⊳ Rossiter–McLaughlin effect (Johnson et al., 2008b)⊳ radius (Liu et al., 2008a)⊳ homogeneous analysis and light curve properties (Southworth, 2008)⊳ six transits and refined parameters (Winn et al., 2008b)⊳ stellar proper motion and transit timing (Rafikov, 2009)⊳ light curve properties (Southworth, 2009)⊳ light curve properties (Southworth, 2010)⊳ secondary eclipse from Spitzer–IRAC (Todorov et al., 2010a)⊳ secondary eclipse from WHT–LIRIS (de Mooij et al., 2011)⊳ secondary eclipses from HST–STIS (Béky et al., 2013)⊳ near infrared transmission spectroscopy and 1.4 μm H_2O band from HST–WFC3 (Wakeford et al., 2013)⊳ stellar binary abundances (Liu et al., 2014a)⊳ Na/optical absorption from HST–STIS/WFC3 near infrared transmission spectra (Nikolov et al., 2014)⊳ favourable for polarisation studies (Wiktorowicz & Laughlin, 2014)⊳ constraints on optical transmission spectrum (Montalto et al., 2015)⊳ detection of K from GTC–OSIRIS (Wilson et al., 2015)⊳ cloudiness index from transit radii associated with Na/K lines (Heng, 2016)⊳ atmospheric circulation (Kataria et al., 2016)⊳ H_2O in clear/cloudy atmospheres from infrared transit spectroscopy (Sing et al., 2016)⊳ no asymmetry in ground-based ultraviolet transits (Turner et al., 2016b)⊳ atmospheric retrieval with NEMESIS (Barstow et al., 2017)⊳ ground-based optical transmission spectrum (Todorov et al., 2019)⊳

HAT–P–2 ≡ HD 147506; high eccentricity (e = 0.2) hot Jupiter; discovery (Bakos et al., 2007a)⊳ Rossiter–McLaughlin effect (Winn et al., 2007e)⊳ Rossiter–McLaughlin effect (Loeillet et al., 2008)⊳ revised parameters from photometry and radial velocity (Pál et al., 2010)⊳ homogeneous analysis and light curve properties (Southworth, 2010)⊳ models of thermal phase variations for eccentric orbits (Cowan & Agol, 2011a)⊳ predicted transit duration variations due to apsidal and nodal precession (Damiani & Lanza, 2011)⊳ alkali line absorption in Na I and K I (Jensen et al., 2011)⊳ Rossiter–McLaughlin effect (Albrecht et al., 2012b)⊳ tidal effects on radial velocity (Arras et al., 2012)⊳ $CO \rightleftarrows CH_4$ time scales for orbital and vertical quenching for eccentric orbits (Visscher, 2012)⊳ stellar magnetic field topology (Fares et al., 2013)⊳ orbit and secondary eclipse, day-side inversion, and trend in radial velocity from Spitzer (Lewis et al., 2013)⊳ atmospheric circulation (Lewis et al., 2014)⊳ atmospheric escape of hot gas coupling plasma, photoionisation and Ly-α emission (Salz et al., 2016)⊳ formation by stellar perturbations (Shara et al., 2016)⊳ improved orbit from HARPS–N (Bonomo et al., 2017a)⊳ planet-induced stellar pulsations from 350 h of Spitzer 4.5 μm photometry (de Wit et al., 2017)⊳ low-cost échelle spectroscopy (Garai et al., 2017)⊳ atmospheric properties from thermal model of Spitzer data (Adams & Laughlin, 2018)⊳ marginally significant pre-discovery transits from Hipparcos (McDonald & Kerins, 2018)⊳

HAT–P–3 discovery (Torres et al., 2007)⊳ transit time analysis (Gibson et al., 2010b)⊳ metal content from density (Chan et al., 2011)⊳ transits from Asiago–TASTE (Nascimbeni et al., 2011a)⊳ Rossiter–McLaughlin effect from Magellan, Keck (Albrecht et al., 2012b)⊳ transit photometry, size suggesting high metallicity (Chan et al., 2012)⊳ photometry and new spectroscopy (Southworth, 2012)⊳ transit and radial velocity fitting with EXOFAST (Eastman et al., 2013)⊳ Spitzer–IRAC secondary eclipse photometry (Todorov et al., 2013)⊳ new transit photometry (Ricci et al., 2017a)⊳ new transit timing observations (Maciejewski et al., 2018b)⊳ Rossiter–McLaughlin effect from HARPS–N (Mancini et al., 2018)⊳

HAT–P–4 discovery (Kovács et al., 2007)⊳ search for additional planets from EPOXI (Ballard et al., 2011a)⊳ 10 transits from EPOXI (Christiansen et al., 2011)⊳ photometry and new spectroscopy (Southworth, 2011)⊳ Rossiter–McLaughlin effect (Winn et al., 2011b)⊳ tidal effects and spin–orbit alignment from orbit eccentricity (Husnoo et al., 2012)⊳ Spitzer–IRAC secondary eclipse photometry (Todorov et al., 2013)⊳ signatures of rocky planet engulfment from metal enrichment and Li depletion (Saffe et al., 2017)⊳

HAT–P–5 discovery (Bakos et al., 2007c)⊳ debris disk (Krivov et al., 2011)⊳ four-colour photometry (Southworth et al., 2012c)⊳ new photometry and atmospheric models (Turner et al., 2017)⊳

HAT–P–6 discovery (Noyes et al., 2008)⊳ predicted transit duration variations due to apsidal and nodal precession (Damiani & Lanza, 2011)⊳ Rossiter–McLaughlin effect and retrograde orbit (Hébrard et al., 2011a)⊳ Rossiter–McLaughlin effect from Magellan, Keck (Albrecht et al., 2012b)⊳ internal gravity waves as explanation for apparent spin–orbit misalignment (Rogers et al., 2012)⊳ photometry and new spectroscopy (Southworth, 2012)⊳ atmospheric constraints from secondary eclipse with Spitzer–IRAC (Todorov et al., 2012)⊳

HAT–P–7 ≡ Kepler–2; hot Jupiter in highly inclined (83°) orbit; discovery in pre-operational Kepler field (Pál et al., 2008)⊳ **2009:** 10-d photometry from Kepler commissioning (Borucki et al., 2009)⊳ Rossiter–McLaughlin effect and retrograde orbit: Subaru–HDS (Narita et al., 2009b)⊳ Rossiter–McLaughlin effect and retrograde orbit: Keck–HIRES (Winn et al., 2009d)⊳ **2010:** secondary eclipse from EPOXI, Spitzer, Kepler (Christiansen et al., 2010)⊳ asteroseismology (Christensen-Dalsgaard et al., 2010)⊳ thermal inversion and molecular abundances (Madhusudhan & Seager, 2010)⊳ planetary structure in a tidally-relaxed inclined system (Mardling, 2010)⊳ possible faint stellar companions (Narita et al., 2010b)⊳ atmosphere and spectral models (Spiegel & Burrows, 2010)⊳ ellipsoidal variations (Welsh et al., 2010)⊳ **2011:** search for additional planets from EPOXI (Ballard et al., 2011a)⊳ photometry and spectroscopy (Southworth, 2011)⊳ detection of bow shocks (Vidotto et al., 2011)⊳ transits with Shandong/Weihai 1-m (Zhang et al., 2011)⊳ **2012:** Rossiter–McLaughlin effect from Magellan, Keck (Albrecht et al., 2012b)⊳ tidal effects on radial velocity (Arras et al., 2012)⊳ tidal effects and spin–orbit alignment from orbit eccentricity (Husnoo et al., 2012)⊳ ellipsoidal variations (Jackson et al., 2012)⊳ reflected light from Kepler, mass from ellipsoidal variations (Mislis et al., 2012)⊳ common proper motion companion and Kozai migration (Narita et al., 2012)⊳ asteroseismology and revised planet parameters (Van Eylen et al., 2012)⊳ internal gravity waves to explain apparent spin–orbit misalignment (Rogers et al., 2012)⊳ **2013:** light curve from 15 quarters of Kepler (Esteves et al., 2013)⊳ confirmed stellar companion from lucky imaging (Faedi et al., 2013b)⊳ 355 orbits from Kepler, cool spot due to planet-induced (stellar tidal) gravity darkening (Morris et al., 2013)⊳ asteroseismology and revised planet parameters (Oshagh et al., 2013b)⊳ atmospheric heat redistribution efficiency drops as stellar insolation rises (Perez-Becker & Showman, 2013)⊳ 500 transits from Kepler, transit depth variations attributed to Kepler systematics (Van Eylen et al., 2013)⊳ **2014:** orbit polar rather than retrograde (Benomar et al., 2014)⊳ stellar obliquity and seismology from Kepler (Lund et al., 2014)⊳ constraints on oblateness (Zhu et al., 2014)⊳ **2015:** Kepler secondary eclipse and phase curves (Angerhausen et al., 2015a)⊳ origin of high-order harmonics in Kepler light curves (Armstrong & Rein, 2015)⊳ Kepler phase curve with beaming and ellipsoidal variations (Esteves et al., 2015)⊳ Kepler phase curves with beaming, ellipsoidal, and reflection phase modulation (Faigler & Mazeh, 2015)⊳ spin–orbit angles from gravity darkening (Masuda, 2015)⊳ nearby star from lucky imaging (Wöllert et al., 2015)⊳ **2016:** variation in phase curve peak offset attributed to variation in atmospheric wind speed (Armstrong et al., 2016a)⊳ spin–orbit (retrograde) alignment from asteroseismology (Campante et al., 2016)⊳ use as a precision clock to constrain time variation of the gravitational constant (Masuda & Suto, 2016)⊳ inferring inhomogeneous cloud cover from asymmetric transits (von Paris et al., 2016a)⊳ heat recirculation and albedo from optical phase curve and secondary eclipse (von Paris et al., 2016b)⊳ 3.6 and 4.5 μm Spitzer phase curves (Wong et al.,

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2016)▷ **2017:** simple transit model (Ji et al., 2017)▷ constraints on magnetic field strength (Rogers, 2017)▷ **2018:** atmospheric properties from thermal model of Spitzer data (Adams & Laughlin, 2018)▷ HST–WFC3 thermal emission spectrum (Mansfield et al., 2018a)▷ **2019:** cloud and chemistry mapping (Helling et al., 2019b)▷

HAT–P–8 planet orbits primary of hierarchical triple system; discovery (Latham et al., 2009)▷ Rossiter–McLaughlin effect (Moutou et al., 2011a)▷ Rossiter–McLaughlin effect from OHP–SOPHIE (Simpson et al., 2011c)▷ atmospheric constraints from secondary eclipse with Spitzer (Todorov et al., 2012)▷ stellar companion from lucky imaging (Bergfors et al., 2013)▷ lucky imaging of host star (Faedi et al., 2013b)▷ low-mass binary companion from VLT–NACO (Ginski et al., 2013)▷ photometry with revised radius and mass (Mancini et al., 2013c)▷ Keck imaging indicates planet orbits primary of hierarchical triple system (Bechter et al., 2014)▷ three transits observed with Yunnan and Lijiang (Tan et al., 2014)▷ nearby star from lucky imaging (Wöllert et al., 2015)▷ simple transit model (Ji et al., 2017)▷

HAT–P–9 discovery (Shporer et al., 2009)▷ predicted transit duration variations due to apsidal and nodal precession (Damiani & Lanza, 2011)▷ Rossiter–McLaughlin effect (Moutou et al., 2011a)▷ revised ephemeris (Dittmann et al., 2012)▷ photometry and new spectroscopy (Southworth, 2012)▷ transit monitoring (Wang et al., 2019c)▷

HAT–P–10 see WASP–11

HAT–P–11 ≡ Kepler–3; 2-planet system, with significant obliquity of planet b and eccentric planet c; discovery of planet b in pre-operational Kepler field (Bakos et al., 2010)▷ confirmation and revised ephemeris (Dittmann et al., 2009a)▷ interior composition (Rogers & Seager, 2010a)▷ Rossiter–McLaughlin effect and high-inclination orbit (Winn et al., 2010b)▷ models of thermal phase variations for eccentric orbits (Cowan & Agol, 2011a)▷ star spots over 26 Kepler transits (Deming et al., 2011b)▷ Rossiter–McLaughlin effect (Hirano et al., 2011b)▷ star spot analysis (Sanchis-Ojeda & Winn, 2011)▷ photometry and new spectroscopy (Southworth, 2011)▷ infrared transits and star spots (Sada et al., 2012)▷ possible GMRT 150 MHz radio emission (Lecavelier des Etangs et al., 2013)▷ analysis of rotating star spots using SOAP–T (Oshagh et al., 2013a)▷ spin–period ratio of 6:1 from Kepler star spots (Béky et al., 2014a)▷ semi-analytical model for spotted star transits, SPOTROD (Béky et al., 2014b)▷ detection of H_2O in the transmission spectrum at 1.4 μm (Fraine et al., 2014)▷ Kepler secondary eclipse and phase curves (Angerhausen et al., 2015a)▷ prograde versus retrograde motion from star spot transit timing (Holczer et al., 2015)▷ gyrochronology and isochrone ages (Maxted et al., 2015)▷ lightning as a possible source of planetary radio emission (Hodosán et al., 2016b)▷ HST–WFC3 transmission spectra explained by solar composition atmosphere with patchy clouds (Line & Parmentier, 2016)▷ use as a precision clock to constrain time variation of the gravitational constant (Masuda & Suto, 2016)▷ discovery of secondary eclipse from all short-cadence Kepler data (Huber et al., 2017)▷ star spot distribution suggests solar-like dynamo (Morris et al., 2017b)▷ chromospheric activity consistent with ≳ 10-yr activity cycle (Morris et al., 2017a)▷ detection of He 1083.3 nm with HST–WFC3 (Mansfield et al., 2018b)▷ large star spot groups in its second observed magnetic activity cycle from holographic diffuser photometry (Morris et al., 2018e)▷ discovery of planet c from 10-yr of Keck–HIRES radial velocity data (Yee et al., 2018)▷ absorption features at 0.35–0.5/micron from HST (Chachan et al., 2019)▷ stellar spots versus Rayleigh scattering (Murgas et al., 2019)▷

HAT–P–12 discovery (Hartman et al., 2009)▷ ephemeris from 18 transits over 4.2 yr (Lee et al., 2012d)▷ possible transit duration variations from Pulkovo (Sokov et al., 2012)▷ transmission spectrum lacking H_2O from HTS–WFC3 (Line et al., 2013)▷ Spitzer–IRAC limits on secondary eclipse (Todorov et al., 2013)▷ broadband spectrophotometry from near ultraviolet to near infrared (Mallonn et al., 2015a)▷ atmospheric circulation (Kataria et al., 2016)▷ transits from Monterrey observatory (Sada & Ramón-Fox, 2016)▷ H_2O in clear/cloudy atmospheres from infrared transit spectroscopy (Sing et al., 2016)▷ atmospheric retrieval analysis with NEMESIS (Barstow et al., 2017)▷ new photometry and atmospheric models (Turner et al., 2017)▷ resolving the (cloudy) flat featureless spectrum from ground, and the (hazy) Rayleigh scattering from HST (Alexoudi et al., 2018)▷ constraints on co-orbiting Trojans (Lillo-Box et al., 2018)▷ Rossiter–McLaughlin effect from HARPS–N (Mancini et al., 2018)▷ new photometric analysis (Öztürk & Erdem, 2019)▷

HAT–P–13 2-planet system; inner transiting $e = 0.01$ hot Jupiter (planet b), and $15M_J$ $e = 0.67$ outer (non-transiting) planet c discovered from radial velocity; discovery (Bakos et al., 2009a)▷ predicted optical phase variations (Kane & Gelino, 2010)▷ planetary structure in a tidally-relaxed inclined system (Mardling, 2010)▷ absence of planet c transits (Szabó et al., 2010)▷ Rossiter–McLaughlin effect, possible planet d (Winn et al., 2010a)▷ 22 transits over 2.8 yr with one anomalous timing (Fulton et al., 2011)▷ transit times from Asiago–TASTE (Nascimbeni et al., 2011b)▷ variations in transit times (Pál et al., 2011)▷ transit time jitter (Payne & Ford, 2011)▷ constraints on metallicity and Love number (Kramm et al., 2012)▷ physical properties (Southworth et al., 2012a)▷ dynamical measures of internal structure from perturbations from a distant companion (Becker & Batygin, 2013)▷ secular orbit evolution and apsidal locking (Zhang et al., 2013)▷ favourable for polarisation studies (Wiktorowicz & Laughlin, 2014)▷ dynamical constraints on core mass from eccentricity derived from Spitzer–IRAC transits (Buhler et al., 2016)▷ transits from Monterrey observatory (Sada & Ramón-Fox, 2016)▷ no asymmetry in ground-based ultraviolet transits (Turner et al., 2016b)▷ secondary eclipses and evidence for low core mass (Hardy et al., 2017)▷

HAT–P–14 ≡ WASP–27; near-grazing transit; discovery (Torres et al., 2010)▷ predicted transit duration variations due to apsidal and nodal precession (Damiani & Lanza, 2011)▷ ephemeris (Nascimbeni et al., 2011a)▷ independent discovery as WASP–27 (Simpson et al., 2011a)▷ Rossiter–McLaughlin effect and retrograde orbit (Winn et al., 2011b)▷ photometry and new spectroscopy (Southworth, 2012)▷ simulated multi-colour photometry with MuSCAT (Fukui et al., 2016b)▷

HAT–P–15 discovery and composition (Kovács et al., 2010)▷ secondary eclipses at 0.35–0.5 μm (Wallack et al., 2019)▷

HAT–P–16 discovery (Buchhave et al., 2010)▷ Rossiter–McLaughlin effect from OHP–SOPHIE (Moutou et al., 2011a)▷ Rossiter–McLaughlin effect from Magellan/Keck (Albrecht et al., 2012b)▷ tidal effects and spin–orbit alignment from orbit eccentricity (Husnoo et al., 2012)▷ simultaneous transit observations with two telescopes (Ciceri et al., 2013)▷ magnetic field constraints from near ultraviolet observations at Steward–Kuiper (Pearson et al., 2014)▷ transits from Monterrey observatory (Sada & Ramón-Fox, 2016)▷

HAT–P–17 2-planet system; inner transiting planet in short-period (10 d) eccentric ($e = 0.34$) orbit, and outer (6000 d) non-transiting planet from radial velocity; discovery (Howard et al., 2012)▷ Rossiter–McLaughlin effect from Keck–HIRES (Fulton et al., 2013)▷ favourable for polarisation studies (Wiktorowicz & Laughlin, 2014)▷ Kepler phase curves and secondary eclipses (Angerhausen et al., 2015a)▷ improved orbits from HARPS–N (Bonomo et al., 2017a)▷ secondary eclipses at 0.35–0.5 μm (Wallack et al., 2019)▷

HAT–P–18 discovery (Hartman et al., 2011b)▷ Rossiter–McLaughlin effect from HARPS–N (Esposito et al., 2014)▷ ground-based transits (Seeliger et al., 2015)▷ Rayleigh scattering from WHT–ACAM transmission spectrum (Kirk et al., 2017)▷ photometric observations and transit solutions (Kjurkchieva et al., 2017)▷ secondary eclipses at 0.35–0.5 μm (Wallack et al., 2019)▷

HAT–P–19 discovery and possible second planet (Hartman et al., 2011b)▷ Spitzer secondary eclipse observations at 3.6 and 4.5 μm (Kammer et al., 2015)▷ transmission spectroscopy (Mallonn et al., 2015b)▷ ground-based transits (Seeliger et al., 2015)▷ new transit timing observations (Maciejewski et al., 2018b)▷ maps, retrieved composition, and constraints predicted for JWST (Schlawin et al., 2018a)▷

HAT–P–20 discovery (Bakos et al., 2011)▷ heavy-element composition of disk-instability planets (Boley et al., 2011)▷ tidal effects and spin–orbit alignment from orbit eccentricity (Husnoo et al., 2012)▷ light curves, possible transit time variations (Granata et al., 2014)▷ favourable for polarisation studies (Wiktorowicz & Laughlin, 2014)▷ secondary eclipses from Spitzer (Deming et al., 2015)▷ Rossiter–McLaughlin effect from HARPS–N (Esposito et al., 2017)▷ system parameters and transit timings (Sun et al., 2017a)▷ constraints on co-orbiting Trojans (Lillo-Box et al., 2018)▷

HAT–P–21 short-period eccentric orbit with transits near apocentre; discovery (Bakos et al., 2011)▷ predicted transit duration variations due to apsidal and nodal precession (Damiani & Lanza, 2011)▷ gyrochronology and isochrone ages (Maxted et al., 2015)▷

HAT–P–22 discovery (Bakos et al., 2011)▷ radial velocity search for massive long-period companion (Knutson et al., 2014c)▷ no asymmetry in ground-based ultraviolet transits (Turner et al., 2016b)▷ improved orbit from HARPS–N (Bonomo et al., 2017a)▷ 4.5 μm sec-

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ondary eclipse depths with Spitzer–IRAC (Kilpatrick et al., 2017)▷ Rossiter–McLaughlin effect from HARPS–N (Mancini et al., 2018)▷

HAT–P–23 discovery and short infall time (Bakos et al., 2011)▷ predicted transit duration variations due to apsidal and nodal precession (Damiani & Lanza, 2011)▷ Rossiter–McLaughlin effect (Moutou et al., 2011a)▷ tidal effects on radial velocity (Arras et al., 2012)▷ four transits from UMO (Ramón-Fox & Sada, 2013)▷ near-infrared secondary eclipse from Spitzer/Palomar (O'Rourke et al., 2014)▷ physical properties from multicolour photometry (Ciceri et al., 2015b)▷ transits from Monterrey observatory (Sada & Ramón-Fox, 2016)▷ improved orbit from HARPS–N (Bonomo et al., 2017a)▷ constraints on co-orbiting Trojans (Lillo-Box et al., 2018)▷ constraints on orbital decay from transit timing (Maciejewski et al., 2018a)▷

HAT–P–24 discovery, prediction of large Rossiter–McLaughlin effect (Kipping et al., 2010)▷ predicted transit duration variations due to apsidal and nodal precession (Damiani & Lanza, 2011)▷ Rossiter–McLaughlin effect from Magellan, Keck (Albrecht et al., 2012b)▷ parameters from Yunnan and Hokoon (Wang et al., 2013c)▷ observations with Rozhen 2-m telescope show no evidence for transit time or transit duration variations (Kjurkchieva et al., 2016)▷

HAT–P–25 discovery (Quinn et al., 2012a)▷

HAT–P–26 discovery (Hartman et al., 2011a)▷ limits on H_2O from Magellan–LDSS–3C (Stevenson et al., 2016a)▷ prominent H_2O-absorption from HST and Spitzer (Wakeford et al., 2017a)▷ preferred formation pathway through pebble accretion rather than planetesimal accretion (Ali-Dib & Lakhlani, 2018)▷ maps, retrieved composition, and constraints predicted for JWST (Schlawin et al., 2018a)▷ metal-rich atmosphere (MacDonald & Madhusudhan, 2019)▷ transit timing variations (von Essen et al., 2019c)▷ secondary eclipses at 0.35–0.5 μm (Wallack et al., 2019)▷

HAT–P–27 ≡ WASP–40; near-grazing transit; discovery (Béky et al., 2011)▷ independent discovery as WASP–40 (Anderson et al., 2011a)▷ Rossiter–McLaughlin effect (Brown et al., 2012b)▷ infrared transits (Sada et al., 2012)▷ ground-based transits (Seeliger et al., 2015)▷ nearby star from lucky imaging (Wöllert & Brandner, 2015)▷

HAT–P–28 discovery (Buchhave et al., 2011a)▷ nearby star from lucky imaging (Wöllert & Brandner, 2015)▷

HAT–P–29 discovery (Buchhave et al., 2011a)▷ radial velocity search for massive long-period companion (Knutson et al., 2014c)▷ nearby star from lucky imaging (Wöllert & Brandner, 2015)▷ improved orbit from HARPS–N (Bonomo et al., 2017a)▷ refined system parameters and transit timing variations (Wang et al., 2018d)▷ ephemeris refinement (Mallonn et al., 2019)▷

HAT–P–30 ≡ WASP–51; discovery and Rossiter–McLaughlin effect (Johnson et al., 2011c)▷ independent discovery as WASP–51 (Enoch et al., 2011a)▷ background stellar companions (Ginski et al., 2013)▷ transit observations (Maciejewski et al., 2016b)▷ favourable for polarisation studies (Wiktorowicz & Laughlin, 2014)▷ chromospheric activity, mass loss, and star–planet interaction (Staab et al., 2017)▷

HAT–P–31 discovery and possible second planet (Kipping et al., 2011)▷ ephemeris refinement (Mallonn et al., 2019)▷

HAT–P–32 discovery (Hartman et al., 2011c)▷ Rossiter–McLaughlin effect from Magellan, Keck (Albrecht et al., 2012b)▷ primary transits and transmission spectra from Gemini–North MOS indicate clouds (Gibson et al., 2013b)▷ radial velocity search for long-period companion (Knutson et al., 2014c)▷ 45 transits from YETI and limits on TTVs (Seeliger et al., 2014)▷ secondary eclipse photometry from Hale–WIRC/Spitzer–IRAC and stellar companion HAT–P–32B (Zhao et al., 2014)▷ transmission spectroscopy with LBT (Mallonn & Strassmeier, 2016)▷ transmission spectroscopy with GTC–OSIRIS (Nortmann et al., 2016)▷ broad band spectrophotometry (Mallonn et al., 2016)▷ stellar perturbations (Shara et al., 2016)▷ near-infrared transmission spectrum from HST–WFC3 (Damiano et al., 2017)▷ near ultraviolet transit photometry with LBT implies silicate aerosols (Mallonn & Wakeford, 2017)▷ thermal emission spectrum from HST–WFC3 (Nikolov et al., 2018b)▷ bimodal cloud distribution from high-precision (defocused) photometry of 8 transits with CAHA–BUSCA (Tregloan-Reed et al., 2018)▷ transit monitoring (Wang et al., 2019c)▷

HAT–P–33 discovery (Hartman et al., 2011c)▷ new photometry and atmospheric models (Turner et al., 2017)▷ transit timing analysis from 8 transits with NAOC–Xinglong (Wang et al., 2017b)▷ secondary eclipse from CFHT–WIRCam (Martioli et al., 2018)▷

HAT–P–34 high eccentricity and possible second planet; discovery (Bakos et al., 2012)▷ Rossiter–McLaughlin effect from Magellan, Keck (Albrecht et al., 2012b)▷

HAT–P–35 discovery (Bakos et al., 2012)▷ nearby star from lucky imaging (Wöllert & Brandner, 2015)▷

HAT–P–36 discovery (Bakos et al., 2012)▷ limits on transit time variations from 2009–2013 (Maciejewski et al., 2013c)▷ Rossiter–McLaughlin effect from HARPS–N (Mancini et al., 2015a)▷ orbital decay due to non-linear tidal dissipation (Essick & Weinberg, 2016)▷ constraints on co-orbiting Trojans (Lillo-Box et al., 2018)▷ photometric transit follow-up (Chakrabarty & Sengupta, 2019)▷ transit monitoring (Wang et al., 2019c)▷

HAT–P–37 discovery (Bakos et al., 2012)▷ additional transit observations (Maciejewski et al., 2016b)▷ new photometry and atmospheric models (Turner et al., 2017)▷

HAT–P–38 Saturn-like mass and radius; discovery (Sato et al., 2012a)▷ cloud modeling from HST–WFC3 (Bruno et al., 2018a)▷

HAT–P–39 discovery (Hartman et al., 2012)▷

HAT–P–40 discovery (Hartman et al., 2012)▷

HAT–P–41 discovery (Hartman et al., 2012)▷ nearby star from lucky imaging (Wöllert et al., 2015)▷ Rossiter–McLaughlin effect (Johnson et al., 2017)▷

HAT–P–42 discovery (Boisse et al., 2013)▷

HAT–P–43 discovery (Boisse et al., 2013)▷

HAT–P–44 2-planet system, inner (planet b) transiting, outer non-transiting discovered from radial velocity (Hartman et al., 2014)▷

HAT–P–45 discovery (Hartman et al., 2014)▷

HAT–P–46 discovery (Hartman et al., 2014)▷

HAT–P–47 not in NASA; discovery (Bakos et al., 2016)

HAT–P–48 not in NASA; discovery (Bakos et al., 2016)

HAT–P–49 discovery and fast stellar rotation (Bieryla et al., 2014)▷

HAT–P–50 discovery (Hartman et al., 2015c)▷

HAT–P–51 discovery (Hartman et al., 2015c)▷

HAT–P–52 discovery (Hartman et al., 2015c)▷

HAT–P–53 discovery (Hartman et al., 2015c)▷ new observations and transit solutions (Kjurkchieva et al., 2018)▷

HAT–P–54 hot Jupiter in field 0 of K2 (Bakos et al., 2015a)▷ new observations and transit solutions (Kjurkchieva et al., 2019)▷

HAT–P–55 discovery (Juncher et al., 2015)▷

HAT–P–56 ≡ K2–20; inflated massive hot Jupiter followed up with K2 Campaign 0 (Huang et al., 2015)▷ Rossiter–McLaughlin effect and super-synchronous spin–orbit alignment from Doppler tomography with TRES (Zhou et al., 2016a)▷ marginally significant pre-discovery transits from Hipparcos (McDonald & Kerins, 2018)▷

HAT–P–57 discovery and confirmation by Doppler tomography (Hartman et al., 2015a)▷

HAT–P–58 . . . HAT–P–64 in preparation

HAT–P–65 discovery (Hartman et al., 2016)▷

HAT–P–66 discovery (Hartman et al., 2016)▷

HAT–P–67 confirmation by Doppler tomography (Zhou et al., 2017)▷

HAT–P–68 in preparation

HAT–P–69 discovery from HATNet and confirmed by TESS (Zhou et al., 2019b)▷

HAT–P–70 discovery from HATNet and confirmed by TESS (Zhou et al., 2019b)▷

HATSouth

HATS–1 discovery (Penev et al., 2013)▷

HATS–2 discovery, star spots, and Rossiter–McLaughlin effect (Mohler-Fischer et al., 2013)▷ gyrochronology and isochrone ages (Maxted et al., 2015)▷

HATS–3 discovery (Bayliss et al., 2013)▷ Rossiter–McLaughlin effect from AAT–UCLES (Addison et al., 2014)▷

HATS–4 discovery (Jordán et al., 2014)▷

HATS–5 discovery (Zhou et al., 2014a)▷

HATS–6 discovery (Hartman et al., 2015b)▷

HATS–7 not in NASA; discovery (Bakos et al., 2015b)▷

HATS–8 discovery (Bayliss et al., 2015)▷

HATS–9 in field 7 of K2; discovery (Brahm et al., 2015)▷ refined properties from K2 (Bayliss et al., 2018b)▷

HATS–10 in field 7 of K2; discovery (Brahm et al., 2015)▷

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HATS–11 discovery (Rabus et al., 2016)▷ refined properties from K2 (Bayliss et al., 2018b)▷

HATS–12 discovery (Rabus et al., 2016)▷ refined properties from K2 (Bayliss et al., 2018b)▷

HATS–13 discovery (Mancini et al., 2015b)▷

HATS–14 discovery (Mancini et al., 2015b)▷ Rossiter–McLaughlin effect from Keck–HIRES (Zhou et al., 2015a)▷

HATS–15 discovery (Ciceri et al., 2016a)▷

HATS–16 discovery (Ciceri et al., 2016a)▷

HATS–17 discovery (Brahm et al., 2016b)▷

HATS–18 $2M_J$ planet in 0.8 d orbit; discovery (Penev et al., 2016)▷ stellar tidal dissipation from tidal spin-up (Penev et al., 2018)▷ photometric transit follow-up (Chakrabarty & Sengupta, 2019)▷

HATS–19 . . . HATS–21 not in NASA; discovery (Bhatti et al., 2017)

HATS–22 discovery (Bento et al., 2017)▷

HATS–23 discovery (Bento et al., 2017)▷

HATS–24 discovery (Bento et al., 2017)▷

HATS–25 discovery (Espinoza et al., 2016a)▷

HATS–26 discovery (Espinoza et al., 2016a)▷

HATS–27 discovery (Espinoza et al., 2016a)▷

HATS–28 discovery (Espinoza et al., 2016a)▷

HATS–29 discovery (Espinoza et al., 2016a)▷

HATS–30 discovery (Espinoza et al., 2016a)▷

HATS–31 discovery (de Val-Borro et al., 2016)▷

HATS–32 discovery (de Val-Borro et al., 2016)▷

HATS–33 discovery (de Val-Borro et al., 2016)▷

HATS–34 discovery (de Val-Borro et al., 2016)▷

HATS–35 discovery (de Val-Borro et al., 2016)▷

HATS–36 discovery (Bayliss et al., 2018b)

HATS–37 . . . HATS–38 in preparation

HATS–39 discovery (Bento et al., 2018)▷

HATS–40 discovery (Bento et al., 2018)▷

HATS–41 high-mass planet ($9.7M_J$) orbiting highest metallicity transit host star ([Fe/H] = 0.47); discovery (Bento et al., 2018)▷

HATS–42 discovery (Bento et al., 2018)▷

HATS–43 . . . HATS–46 discovery (Brahm et al., 2018b)▷

HATS–47 . . . HATS–49 in preparation

HATS–50 . . . HATS–53 discovery (Henning et al., 2018)▷

HATS–54 . . . HATS–58 discovery (Espinoza et al., 2019b)▷

HATS–59 2-planet system comprising transiting hot Jupiter with a massive outer companion; discovery (Sarkis et al., 2018a)▷

HATS–60 . . . HATS–69 discovery (Hartman et al., 2019)▷

HATS–70 discovery (Zhou et al., 2019a)▷

HD

(identifiers used as default alias in NASA Exoplanet Archive)

HD 2685 discovery with TESS (Jones et al., 2019)▷

HD 3167 see K2–96

HD 15337 2-planet system; discovery with TESS (Gandolfi et al., 2019)▷

HD 23472 2-planet system; HARPS validation (Trifonov et al., 2019a)▷

HD 39091 see listing in Section A (radial velocity discoveries)

HD 89345 see K2–234

HD 106315 see K2–109

HD 119130 see K2–292

HD 202772A discovery with TESS (Wang et al., 2019a)▷

HD 213885 discovery with TESS (Espinoza et al., 2019a)▷

HD 221416 discovery with TESS (Huber et al., 2019)▷

HIP

(identifiers used as default alias in NASA Exoplanet Archive)

HIP 41378 see K2–93

HIP 116454 see K2–2

HR

HR 858 3-planet system; discovery with TESS (Vanderburg et al., 2019)

KELT

KELT–1 brown dwarf ($27M_J$) orbiting V = 10.7 F star; discovery and Rossiter–McLaughlin effect (Siverd et al., 2012)▷ secondary eclipse from Spitzer (Beatty et al., 2014)▷ compilation of light curves and transit timing (Baluev et al., 2015)▷ secondary eclipse with CFHT–WIRCam and limits on ground-based systematics (Croll et al., 2015a)▷ H-band emission spectrum at R = 50 at 135 ppm from LBT–LUCI1 (Beatty et al., 2017a)▷ constraints on orbital decay from transit timing (Maciejewski et al., 2018a)▷ Spitzer phase curves and nightside clouds (Beatty et al., 2019)▷

KELT–2A hot Jupiter transiting primary of HD 42176 binary; discovery, Kozai hypothesis and predicted Rossiter–McLaughlin effect (Beatty et al., 2012)▷ secondary eclipse from CFHT–WIRCam (Martioli et al., 2018)▷ Keck–NIRSPEC and Spitzer–IRAC detection of the thermal emission spectrum (Piskorz et al., 2018)▷

KELT–3 discovery (Pepper et al., 2013)▷ search for Hα absorption (Cauley et al., 2017b)▷

KELT–4A hot Jupiter orbiting brightest component of hierarchical triple system (projected separation KELT–4A/4BC = 328 au, projected separation KELT–4B/4C = 10.30 au); discovery (Eastman et al., 2016)▷ secondary eclipse from CFHT–WIRCam (Martioli et al., 2018)▷

KELT–5 in preparation (Pepper, priv. comm.)

KELT–6 2-planet system, outer non-transiting; detection, confirmation from radial velocity, and possibility of outer non-transiting planet (Collins et al., 2014)▷ Rossiter–McLaughlin effect for planet b and confirmation of planet c from HARPS–N (Damasso et al., 2015b)▷

KELT–7 bright, rapidly rotating star; large Rossiter–McLaughlin effect (Bieryla et al., 2015)▷ super-synchronous spin–orbit alignment from Doppler tomography with TRES (Zhou et al., 2016a)▷

KELT–8 low density inflated planet with large atmospheric scale height; discovery (Fulton et al., 2015a)▷

KELT–9 hot planet (T_{eq} ~ 4600 K) in1.5-d orbit around an A/B star; discovery and Rossiter–McLaughlin effect (Gaudi et al., 2017)▷ Fe and Ti from HARPS–N spectroscopy (Hoeijmakers et al., 2018a)▷ ground-based near-ultraviolet secondary eclipse observed with INT–WFC (Hooton et al., 2018)▷ atmospheric chemistry (Kitzmann et al., 2018)▷ extended H envelope from CARMENES spectroscopy (Yan & Henning, 2018)▷ Rossiter–McLaughlin effect (Borsa et al., 2019)▷ variable transits and atmospheric dynamics (Cauley et al., 2019)▷ metals in the transmission spectrum (Hoeijmakers et al., 2019)▷ atmospheric ionised calcium (Yan et al., 2019)▷

KELT–10 first KELT–South exoplanet; discovery (Kuhn et al., 2016)▷

KELT–11 bright host star, highly inflated planet; discovery (Pepper et al., 2017b)▷ empirical stellar masses and radii from transits and (predicted) Gaia parallaxes (Beatty et al., 2017c)▷ high-resolution transmission spectroscopy (Žák et al., 2019)▷

KELT–12 discovery (Stevens et al., 2017)▷

KELT–13 see WASP–167

KELT–14 ≡ WASP–122; discovery (Rodriguez et al., 2016)▷ independent discovery as WASP–122 (Turner et al., 2016c)▷

KELT–15 discovery (Rodriguez et al., 2016)▷

KELT–16 planet near tidal disruption; discovery (Oberst et al., 2017)▷ constraints on orbital decay from transit timing (Maciejewski et al., 2018a)▷

KELT–17 hot Jupiter in misaligned orbit; discovery and Rossiter–McLaughlin effect (Zhou et al., 2016b)▷

KELT–18 discovery (McLeod et al., 2017)▷

KELT–19A hot Jupiter transiting Am star with distant stellar companion; discovery and Rossiter–McLaughlin effect (Siverd et al., 2018)▷

KELT–20 ≡ MASCARA–2; hot Jupiter orbiting a V = 7.6 mag A star; discovery (by KELT) and Rossiter–McLaughlin effect (Lund et al., 2017)▷ independent discovery (by MASCARA) and Rossiter–McLaughlin effect (Talens et al., 2018)▷ Na I and Hα absorption features (Casasayas-Barris et al., 2018)▷ detection of Ca II, Fe II, Na I, and Balmer-H with high-dispersion transit spectroscopy (Casasayas-Barris et al., 2019)▷

KELT–21 discovery (Johnson et al., 2018b)▷

KELT–22 not in NASA; discovery (Labadie-Bartz et al., 2019)▷

KELT–23A discovery (Johns et al., 2019)▷

KELT–24 discovery (Rodriguez et al., 2019a)▷

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Kepler

Kepler–1 see TrES–2 (in pre-operational Kepler field)

Kepler–2 see HAT–P–7 (in pre-operational Kepler field)

Kepler–3 see HAT–P–11 (in pre-operational Kepler field)

Kepler–4 discovery (Borucki et al., 2010)⊳ independent analysis, possible eccentric orbit, constraints on moons and Trojans (Kipping & Bakos, 2011a)⊳ photometry and new spectroscopy (Southworth, 2011)⊳ host star properties from Kepler asteroseismology (Huber et al., 2013b)⊳ Kepler secondary eclipse and phase curves (Angerhausen et al., 2015a)⊳ secondary eclipse measurement of 7 ppm at phase 0.7 implying an eccentric orbit (Sheets & Deming, 2017)⊳

Kepler–5 discovery (Koch et al., 2010)⊳ independent analysis, possible secondary eclipse, constraints on moons and Trojans (Kipping & Bakos, 2011a)⊳ secondary eclipse from Spitzer (Désert et al., 2011c)⊳ light curve modeling (Gostev, 2011)⊳ photometry and new spectroscopy (Southworth, 2011)⊳ secondary eclipses and phase variations (Esteves et al., 2013)⊳ Kepler secondary eclipse and phase curves (Angerhausen et al., 2015a)⊳ Kepler phase curve with beaming and ellipsoidal variations (Esteves et al., 2015)⊳ precision clock to constrain variation of the gravitational constant (Masuda & Suto, 2016)⊳ secondary eclipse from CFHT–WIRCam (Martioli et al., 2018)⊳ transit modeling (Huang et al., 2019)⊳

Kepler–6 discovery (Dunham et al., 2010)⊳ independent analysis, possible stellar rotation, constraints on moons and Trojans (Kipping & Bakos, 2011a)⊳ secondary eclipse from Spitzer (Désert et al., 2011c)⊳ light curve modeling (Gostev, 2011)⊳ photometry and new spectroscopy (Southworth, 2011)⊳ secondary eclipses and phase variations (Esteves et al., 2013)⊳ Kepler secondary eclipse and phase curves (Angerhausen et al., 2015a)⊳ Kepler phase curve with beaming and ellipsoidal variations (Esteves et al., 2015)⊳ precision clock to constrain variation of the gravitational constant (Masuda & Suto, 2016)⊳

Kepler–7 discovery (Latham et al., 2010)⊳ secondary eclipse, high albedo, and atmospheric modeling (Demory et al., 2011b)⊳ light curve modeling (Gostev, 2011)⊳ secondary eclipse, constraints on moons and Trojans (Kipping & Bakos, 2011a)⊳ photometry and new spectroscopy (Southworth, 2011)⊳ physical properties (Southworth, 2012)⊳ atmospheric modeling (Demory et al., 2013a)⊳ Kepler secondary eclipse and phase curves (Angerhausen et al., 2015a)⊳ Kepler phase curve with beaming and ellipsoidal variations (Esteves et al., 2015)⊳ model of visible-wavelength phase curves (Hu et al., 2015a)⊳ clouds maps derived from phase curve (Garcia Munoz & Isaak, 2015)⊳ atmospheric modeling, with westward phase shift of brightest region explained by clouds (Shporer & Hu, 2015)⊳ use as a precision clock to constrain time variation of the gravitational constant (Masuda & Suto, 2016)⊳ interpretation of phase curves using scattering within the FMS general circulation model (Oreshenko et al., 2016)⊳ inferring inhomogeneous cloud cover from asymmetric transits (von Paris et al., 2016a)⊳ inhomogeneous aerosols and atmospheric circulation (Roman & Rauscher, 2017)⊳

Kepler–8 discovery and Rossiter–McLaughlin effect (Jenkins et al., 2010)⊳ predicted transit duration variations due to apsidal and nodal precession (Damiani & Lanza, 2011)⊳ constraints on moons and Trojans (Kipping & Bakos, 2011a)⊳ photometry and new spectroscopy (Southworth, 2011)⊳ Rossiter–McLaughlin effect from Magellan, Keck (Albrecht et al., 2012b)⊳ secondary eclipses and phase variations (Esteves et al., 2013)⊳ Kepler secondary eclipse and phase curves (Angerhausen et al., 2015a)⊳ Kepler phase curve with beaming and ellipsoidal variations (Esteves et al., 2015)⊳ transit modeling (Huang et al., 2019)⊳

Kepler–9 3-planet system, outer two close to 2:1 commensurability; discovery by transit time variations (Holman et al., 2010)⊳ composition modeling and Fe-enrichment (Havel et al., 2011)⊳ light curve modeling and confirmation of planet d (Torres et al., 2011)⊳ composition (Gong & Zhou, 2012)⊳ orbit from transit times and radial velocities from TRADES (Borsato et al., 2014)⊳ photodynamical modelling over 8 yr of transit observations (Freudenthal et al., 2018)⊳ Rossiter–McLaughlin effect for the multi-planet system is consistent with spin–orbit alignment (Wang et al., 2018c)⊳ ground-based photometry, dynamical modeling, and recovery of transit ephemeris (Wang et al., 2018e)⊳ low densities from HARPS–N (Borsato et al., 2019)⊳

Kepler–10 2-planet system including first (small) Kepler rocky planet; discovery and asteroseismology (Batalha et al., 2011)⊳ effects of magnetic drag and Ohmic dissipation (Castan & Menou, 2011)⊳ confirmation of planet c (Fressin et al., 2011)⊳ mass loss constrains origin of rocky nature (Leitzinger et al., 2011)⊳ lava ocean and prediction of secondary eclipse (Rouan et al., 2011)⊳ additional planets predicted from packed planetary systems hypothesis (Fang & Margot, 2012)⊳ composition and Fe-enrichment (Gong & Zhou, 2012)⊳ capture into spin–orbit resonance (Rodríguez et al., 2012)⊳ composition and Fe-enrichment (Wagner et al., 2012)⊳ tidal evolution (Dong & Ji, 2013)⊳ atmospheric mass loss (Kurokawa & Kaltenegger, 2013)⊳ photophoretic separation of metals and silicates as an explanation for high density (Wurm et al., 2013)⊳ mass determination from HARPS–N (Dumusque et al., 2014b)⊳ tidal evolution (Dong, 2014)⊳ stellar parameters from asteroseismology (Fogtmann-Schulz et al., 2014)⊳ synchronisation and circularisation through tidal heating (Makarov & Efroimsky, 2014)⊳ secondary eclipse (Sheets & Deming, 2014)⊳ N-body constraints on collision and merger history (Terquem, 2014)⊳ Kepler phase curve with beaming and ellipsoidal variations (Esteves et al., 2015)⊳ model of visible-wavelength phase curves (Hu et al., 2015a)⊳ planet structure and Fe content (Santos et al., 2015a)⊳ low eccentricity from transit duration (Van Eylen & Albrecht, 2015)⊳ stellar chemical composition compared with 14 stellar twins (Liu et al., 2016)⊳ planet masses and densities (Weiss et al., 2016)⊳ constraint on super-Earth interiors from stellar abundances (Brugger et al., 2017)⊳ interior structure from stellar abundance proxies (Dorn et al., 2017)⊳ resolution of (HARPS–N and Keck–HIRES) mass discrepancy and improved mass for planet c (Rajpaul et al., 2017)⊳

Kepler–11 6-planet system, five tightly packed; discovery, coplanarity and stability (Lissauer et al., 2011)⊳ *in situ* accretion versus atmospheric erosion (Ikoma & Hori, 2012)⊳ mass loss and system evolution (Lopez et al., 2012)⊳ N-body modeling and stability (Migaszewski et al., 2012)⊳ low densities for all six planets from mass-radius combinations (Lissauer et al., 2013)⊳ hydrodynamic blow-off of atmospheric H (Lammer et al., 2013)⊳ H coronae around a CO_2-dominated planetary atmosphere (Bernard et al., 2014)⊳ accretion and evolution models (Bodenheimer & Lissauer, 2014)⊳ orbit from transit times and radial velocities from TRADES (Borsato et al., 2014)⊳ phase modulation of collective planetary system (Gelino & Kane, 2014)⊳ formation of tightly packed systems (Hands et al., 2014)⊳ stellar wind interaction and thermal escape (Kislyakova et al., 2014)⊳ system stability, and close proximity to disruptive two-body mean-motion resonances (Mahajan & Wu, 2014)⊳ superrotating atmosphere in cyclostrophic balance (Peralta et al., 2014)⊳ formation beyond the snow line, followed by inward migration, circularisation, and mass loss (Howe & Burrows, 2015)⊳ *in situ* and *ex situ* formation models (D'Angelo & Bodenheimer, 2016)⊳ extreme ultraviolet flux and the escaping atmosphere (Guo & Ben-Jaffel, 2016)⊳ orbital dynamics and mean motion resonances (Mia & Kushvah, 2016)⊳ young main sequence solar twin (Bedell et al., 2017)⊳ dynamical studies focusing on grazing collisions, scatterings and mergers (Hwang et al., 2017)⊳ constraints on outer planet architecture from co-planarity (Jontof-Hutter et al., 2017)⊳ dynamics of tightly-packed planetary systems in the presence of an outer planet (Granados Contreras & Boley, 2018)⊳ evolution of stellar high-energy emission and initial planetary atmospheric mass fractions (Kubyshkina et al., 2019b)⊳

Kepler–12 low-density highly-inflated planet; discovery and atmospheric characterisation (Fortney et al., 2011)⊳ photometry and new spectroscopy (Southworth, 2012)⊳ Kepler secondary eclipse and phase curves (Angerhausen et al., 2015a)⊳ Kepler phase curve with beaming and ellipsoidal variations (Esteves et al., 2015)⊳ atmospheric modeling, with westward phase shift of brightest region and substellar point explained by clouds (Shporer & Hu, 2015)⊳ use as a precision clock to constrain time variation of the gravitational constant (Masuda & Suto, 2016)⊳ transit modeling (Huang et al., 2019)⊳

Kepler–13 KOI–13 in NASA (Kepler–13A); short-period (1.7-d) planet orbiting brighter component of hierarchical triple stellar system; out-of-eclipse light curve has comparable contributions from planet and ellipsoidal variations induced in the star; candidate identification (Borucki et al., 2011)⊳ spin–orbit alignment from gravity-darkened host star rotation (Barnes et al., 2011a)⊳ speckle imaging (Howell et al., 2011)⊳ confirmation from orbit modeling of variability and tidal distortions (Shporer et al., 2011)⊳ orbit modeling (Szabó et al., 2011)⊳ orbit modeling (Mazeh et al., 2012)⊳ orbit modeling (Mislis & Hodgkin, 2012)⊳ spin–orbit resonance, transit duration variations, and precession of orbit plane (Szabó et al., 2012)⊳ third stellar component (Santerne et al., 2012)⊳ secondary eclipses and phase variations, including third harmonic (Esteves et al., 2013)⊳ misaligned prograde orbit from Rossiter–McLaughlin effect/Doppler

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tomography with HET (Johnson et al., 2014)⊳ reflection, beaming, and ellipsoidal variations from EXONEST (Placek et al., 2014)⊳ atmospheric characterisation and day-side temperature (Shporer et al., 2014)⊳ transit duration, peak depth and asymmetry changes due to rapid orbit precession (Szabó et al., 2014)⊳ **2015:** Kepler secondary eclipse and phase curves (Angerhausen et al., 2015a)⊳ origin of high-order harmonics in Kepler light curves (Armstrong & Rein, 2015)⊳ Kepler phase curve with beaming and ellipsoidal variations (Esteves et al., 2015)⊳ Kepler phase curves with beaming, ellipsoidal, and reflection phase modulation (Faigler & Mazeh, 2015)⊳ spin–orbit angles from gravity darkening (Masuda, 2015)⊳ as a precision clock to constrain time variation of the gravitational constant (Masuda & Suto, 2016)⊳ atmospheric cold-traps in the non-inverted emission spectrum from HST–WFC3 (Beatty et al., 2017b)⊳ spin–orbit angles from gravity darkening (Howarth & Morello, 2017)⊳ stellar and planet parameters from Hawaii parallax programme (Mann et al., 2017a)⊳ Rossiter–McLaughlin effect (Herman et al., 2018)⊳ application of close binary system analysis program WinFitter (Budding et al., 2018)⊳ Bayesian model testing of stellar ellipsoidal variations (Gai & Knuth, 2018)⊳ spin–orbit misalignment and precession from gravity darkening (Herman et al., 2018)⊳ high-resolution imaging transit photometry (Howell et al., 2019)⊳

Kepler–14 planet orbiting one component of binary system; discovery (Buchhave et al., 2011b)⊳ photometry and new spectroscopy (Southworth, 2012)⊳ host star properties from Kepler asteroseismology (Huber et al., 2013b)⊳ Kepler secondary eclipse and phase curves (Angerhausen et al., 2015a)⊳

Kepler–15 discovery and composition modeling (Endl et al., 2011)⊳ photometry and new spectroscopy (Southworth, 2012)⊳ Kepler secondary eclipse and phase curves (Angerhausen et al., 2015a)⊳

Kepler–16(AB) circumbinary planet, comprising Saturn-mass giant in coplanar circular orbit ($P = 229$ d) around eccentric binary ($P = 41$ d); the planet will cease transiting the secondary in 2014, and the primary in 2018, thereafter non-transiting until 2042; discovery (Doyle et al., 2011)⊳ Rossiter–McLaughlin effect indicating co-alignment of stellar orbit, planet orbit, and primary rotation (Winn et al., 2011a)⊳ dynamical mass ratio of stellar components (Bender et al., 2012)⊳ regions of dynamical stability for disks and planets (Jaime et al., 2012)⊳ N-body planetesimal accretion (Meschiari, 2012)⊳ N-body planetesimal accretion (Marzari et al., 2012)⊳ difficulties with *in situ* formation (Paardekooper et al., 2012)⊳ habitable zone (Quarles et al., 2012b)⊳ formation via gravitational instability (Zhu et al., 2012)⊳ analytic method for predicting eclipse timing variations (Armstrong et al., 2013)⊳ eccentricity damped by circumbinary disk (Dunhill & Alexander, 2013)⊳ determination of habitable zone (Kane & Hinkel, 2013)⊳ determination of habitable zone (Liu et al., 2013)⊳ analytic theory for binary orbits (Leung & Lee, 2013)⊳ influence of circumbinary disk gravity on planetesimal accumulation (Marzari et al., 2013)⊳ rotational synchronisation and the habitable zone (Mason et al., 2013)⊳ migration and gas accretion (Pierens & Nelson, 2013)⊳ dynamical stability of 11:2 resonance bounded by unstable 5:1 and 6:1 resonances (Popova & Shevchenko, 2013)⊳ climate modeling of habitable zone (Forgan, 2014)⊳ multi-orbital 'tight transits' (Liu et al., 2014b)⊳ circumbinary planet formation in debris belt (Meschiari, 2014)⊳ dynamical stability (Chavez et al., 2015)⊳ surface flux illumination and photosynthesis in circumbinary systems (Forgan et al., 2015)⊳ analytic orbit propagation for circumbinary planets (Georgakarakos & Eggl, 2015)⊳ circumbinary modeling in protoplanetary disks (Lines et al., 2015)⊳ habitability zones versus radiation and plasma environment (Zuluaga et al., 2016)⊳ role of disk self-gravity in orbital evolution (Mutter et al., 2017)⊳ simulations of the debris disk dynamics (Demidova & Shevchenko, 2018)⊳ discovery retrospective (Doyle, 2019)⊳ habitable zone dependency on binarity and climate models (Moorman et al., 2019)⊳

Kepler–17 discovery, obliquity from star spots, secondary eclipse, and atmospheric characterisation (Désert et al., 2011b)⊳ evidence for companion planets from transit timing variations (Steffen et al., 2010)⊳ independent confirmation from radial velocity (Bonomo et al., 2012)⊳ star spots and stellar rotation (Bonomo & Lanza, 2012)⊳ photometry and new spectroscopy (Southworth, 2012)⊳ differential stellar rotation (Reinhold et al., 2013)⊳ spin–orbit ratio not exactly 8:1 (Béky et al., 2014a)⊳ Kepler secondary eclipse and phase curves (Angerhausen et al., 2015a)⊳ prograde versus retrograde motion from star spot transit timing (Holczer et al., 2015)⊳ gyrochronology and isochrone ages (Maxted et al., 2015)⊳ stellar magnetic cycles (Estrela & Valio, 2016)⊳ use as a precision clock to constrain time variation of the gravitational constant (Masuda & Suto, 2016)⊳ stellar activity and rotation (Valio et al., 2017)⊳ planet radii in the presence of star spots from ingress and egress durations (Morris et al., 2018d)⊳ stellar activity and rotation (Lanza et al., 2019)⊳

Kepler–18 3-planet system, outer two (c and d) near 2:1 mean motion resonance; discovery through transit time variations, radial velocity variations, and Spitzer observations (Cochran et al., 2011)⊳ masses from correlated transit time variations near mean motion resonance (Montet & Johnson, 2013)⊳

Kepler–19 3-planet system; planet d (non-transiting) from radial velocity; discovery of planet b, prediction of (non-transiting) planet c from transit time variations (Ballard et al., 2011b)⊳ small planets have low eccentricities (Van Eylen & Albrecht, 2015)⊳ confirmation of planet c and discovery of planet d (non-transiting) from radial velocity (Malavolta et al., 2017)⊳

Kepler–20 6-planet system, 3 sub-Neptune and 2 of Earth mass which are transiting; planet g (non-transiting) from radial velocity; three massive planets b, c, d and two low-mass candidates (Gautier et al., 2012)⊳ confirmation of the $1.0R_\oplus$ and $0.9R_\oplus$ planets e and f (Fressin et al., 2012b)⊳ analysis of phase variations over the orbit (Kane & Gelino, 2013)⊳ mapping of the interstellar medium (Johnson et al., 2015b)⊳ discovery of non-transiting planet g from radial velocity (Buchhave et al., 2016)⊳ effect of unseen additional perturber (Becker & Adams, 2017)⊳ application of scaling relations for rocky planet interiors (Zeng & Jacobsen, 2017)⊳

Kepler–21 discovery and asteroseismology (Howell et al., 2012)⊳ confirmation as single star from CHARA–PAVO (Huber et al., 2012)⊳ asteroseismology (Valliappan & Karoff, 2012)⊳ stellar companion from lucky imaging (Ginski et al., 2016)⊳ radial velocity measurements from TNG (López-Morales et al., 2016)⊳

Kepler–22 first Kepler habitable zone planet; discovery and location within habitable zone (Borucki et al., 2012)⊳ habitable zone (Neubauer et al., 2012)⊳ search for exomoons (Heller & Barnes, 2013)⊳ search for exomoons (Kipping et al., 2013)⊳ host star properties of Kepler's habitable planets (Armstrong et al., 2016b)⊳

Kepler–23 3-planet system; confirmation of planets b and c from correlated transit time variations and dynamical stability (Ford et al., 2012)⊳ host star properties from Kepler asteroseismology (Huber et al., 2013b)⊳ planet d from Kepler (Rowe et al., 2014)⊳ low eccentricity from transit duration (Van Eylen & Albrecht, 2015)⊳

Kepler–24 4-planet system; confirmation of planets b and c from transit time variations and dynamical stability (Ford et al., 2012)⊳ planets c and d from Kepler (Rowe et al., 2014)⊳

Kepler–25 3-planet system, planets b and c from transits, planet d from radial velocity; confirmation of planets b and c from correlated transit time variations and dynamical stability (Steffen et al., 2012)⊳ low stellar obliquity from Rossiter–McLaughlin effect (Albrecht et al., 2013)⊳ host star properties from Kepler asteroseismology (Huber et al., 2013b)⊳ 3d spin–orbit angle from asteroseismology, light curve, and Rossiter–McLaughlin effect (Benomar et al., 2014)⊳ planet d, and improved masses, sizes, and orbits (Marcy et al., 2014)⊳ low eccentricity from transit duration (Van Eylen & Albrecht, 2015)⊳ spin–orbit alignment from asteroseismology (Campante et al., 2016)⊳ smooth migration suggested by proximity to the periodic 2:1 mean motion resonance configuration (Migaszewski & Goździewski, 2018)⊳

Kepler–26 4-planet system; confirmation of planets b and c from correlated transit time variations and dynamical stability (Steffen et al., 2012)⊳ d and e from further light curve analysis (Rowe et al., 2014)⊳ gravitational quantisation of orbits (Geroyannis, 2015)⊳ dynamical masses from transit time variations (Jontof-Hutter et al., 2016)⊳ reversibility applied to orbital dynamics (Panichi et al., 2017)⊳

Kepler–27 2-planet system; confirmation from transit time variations and dynamical stability (Steffen et al., 2012)⊳ tidally induced radius inflation (Millholland, 2019)⊳

Kepler–28 2-planet system; confirmation from transit time variations and dynamical stability (Steffen et al., 2012)⊳

Kepler–29 2-planet system, likely in a 9:7 mean motion resonance; confirmation from transit time variations and dynamical stability (Fabrycky et al., 2012)⊳ dynamical masses from transit time variations (Jontof-Hutter et al., 2016)⊳ origin and dynamics of the 9:7 mean motion resonance (Migaszewski et al., 2017)⊳ migration-induced formation of the 9:7 resonance (Migaszewski, 2017)⊳ reversibility error method applied to orbital dynamics (Panichi et al., 2017)⊳

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Kepler–30 3-planet system with TTVs exceeding 2 d; transit time variations and dynamical stability (Fabrycky et al., 2012)⊳ transits over star spot indicates orbits aligned with stellar equator (Sanchis-Ojeda et al., 2012)⊳ mass–radius relation (Batygin & Stevenson, 2013)⊳ transits over star spot (Sanchis-Ojeda et al., 2013b)⊳ gyrochronology and isochrone ages (Maxted et al., 2015)⊳ orbit architecture, formation, long-term evolution (Panichi et al., 2018)⊳ TTV-determined masses for warm Jupiters and their close planetary companions (Wu et al., 2018)⊳

Kepler–31 3-planet system; confirmation of planets b and c from correlated transit time variations and dynamical stability (Fabrycky et al., 2012)⊳ planet d from light curve analysis (Rowe et al., 2014)⊳ tidally induced radius inflation (Millholland, 2019)⊳

Kepler–32 5-planet system; planets b and c from transit time variations and dynamical stability (Fabrycky et al., 2012)⊳ discovery of planets d, e, f, and evidence that planets formed at larger orbital radii and migrated inward (Swift et al., 2013)⊳ stellar activity from Kepler (Savanov & Dmitrienko, 2013)⊳ formation of tightly packed systems (Hands et al., 2014)⊳ host star photometric variability and rotation from Kepler (Savanov & Dmitrienko, 2015)⊳

Kepler–33 closely-packed 5-planet system; confirmation from statistics of multiple transits (Lissauer et al., 2012)⊳ analysis of phase variations over the orbit (Kane & Gelino, 2013)⊳ Titius–Bode type relation (Migaszewski et al., 2013)⊳

Kepler–34(AB) circumbinary planet; discovery (Welsh et al., 2012)⊳ difficulties with *in situ* formation (Paardekooper et al., 2012)⊳ analytic method for predicting eclipse timing variations (Armstrong et al., 2013)⊳ habitable zone (Kane & Hinkel, 2013)⊳ habitable zone (Liu et al., 2013)⊳ analytic theory for binary orbits (Leung & Lee, 2013)⊳ rotational synchronisation and the habitable zone (Mason et al., 2013)⊳ migration and gas accretion (Pierens & Nelson, 2013)⊳ climate modeling of habitable zone (Forgan, 2014)⊳ multi-orbital 'tight transits' (Liu et al., 2014b)⊳ formation models including planetesimal self-gravity exclude *in situ* formation (Lines et al., 2014)⊳ dynamical stability (Chavez et al., 2015)⊳ analytic orbit propagation for circumbinary planets (Georgakarakos & Eggl, 2015)⊳ evolution of circumbinary planets around eccentric binaries (Kley & Haghighipour, 2015)⊳ circumbinary modeling in protoplanetary disks (Lines et al., 2015)⊳ survival through post-common-envelope stage (Kostov et al., 2016a)⊳ scattering of circumbinary planets to explain orbit configuration (Gong & Ji, 2017)⊳ role of disk self-gravity in orbit evolution (Mutter et al., 2017)⊳ climate models (Wang & Cuntz, 2017)⊳ simulations of the debris disk dynamics (Demidova & Shevchenko, 2018)⊳ distinguishing polar and coplanar circumbinary orbits by eclipse timing variations (Zhang & Fabrycky, 2019)⊳

Kepler–35(AB) circumbinary planet; discovery (Welsh et al., 2012)⊳ difficulties with *in situ* formation (Paardekooper et al., 2012)⊳ analytic method for predicting eclipse timing variations (Armstrong et al., 2013)⊳ habitable zone (Kane & Hinkel, 2013)⊳ habitable zone (Liu et al., 2013)⊳ analytic theory for binary orbits (Leung & Lee, 2013)⊳ rotational synchronisation and the habitable zone (Mason et al., 2013)⊳ migration and gas accretion (Pierens & Nelson, 2013)⊳ climate modeling of habitable zone (Forgan, 2014)⊳ multi-orbital 'tight transits' (Liu et al., 2014b)⊳ dynamical stability (Chavez et al., 2015)⊳ analytic orbit propagation for circumbinary planets (Georgakarakos & Eggl, 2015)⊳ survival through the post-common-envelope stage (Kostov et al., 2016a)⊳ role of disk self-gravity in orbital evolution (Mutter et al., 2017)⊳ climate models (Wang & Cuntz, 2017)⊳ simulations of the debris disk dynamics (Demidova & Shevchenko, 2018)⊳

Kepler–36 2-planet system (rocky super-Earth and Neptune-like) near 7:6 mean motion resonance, with orbits differing by 10% but densities differing by a factor 8with orbits differing by 10% but densities differing by a factor 8 discovery and evidence for migration (Carter et al., 2012)⊳ chaotic orbits from proximity of 29:34 and first-order 6:7 resonances (Deck et al., 2012)⊳ photo-evaporation versus core mass explains small size of inner planets (Lopez & Fortney, 2013)⊳ system stability through dynamical modeling (Nagy & Ágas, 2013)⊳ anticorrelated transit time variations (Ofir & Dreizler, 2013)⊳ close spacing arises for wide range of migration parameters in turbulent disks (Paardekooper et al., 2013)⊳ orbit tuning for convergent migration to bypass mean motion resonances into 7:6 resonance (Quillen et al., 2013)⊳ effect of conjunctions on transit timing variations (Nesvorný & Vokrouhlický, 2014)⊳ superrotating atmosphere in cyclostrophic balance (Peralta et al., 2014)⊳ constraints on the interior structure of planet b from mass and radius (Dorn et al., 2015)⊳ compositional diversity between planets b and c due to giant impact devolatisation (Liu et al., 2015)⊳ torques from an anisotropic evaporative wind, and evolution of resonant pairs (Teyssandier et al., 2015)⊳ low eccentricity from transit duration (Van Eylen & Albrecht, 2015)⊳ initial planet conditions from formation models (Owen & Morton, 2016)⊳ close proximity planets and prospects for lithopanspermia (Steffen & Li, 2016)⊳ composition and structure from mass–radius models (Unterborn et al., 2016)⊳ reversibility error method applied to orbital dynamics (Panichi et al., 2017)⊳ dynamical studies focusing on grazing collisions, scatterings and mergers (Hwang et al., 2018a)⊳ constraints on spin evolution (Bryan et al., 2018)⊳

Kepler–37 4-planet system; discovery of planets b, c, d, with inferred rocky nature of planet b (Barclay et al., 2013b)⊳ planet d from transit timing variations (Hadden & Lithwick, 2014)⊳ new data providing improved masses, sizes, and orbits (Marcy et al., 2014)⊳ low eccentricity from transit duration (Van Eylen & Albrecht, 2015)⊳

Kepler–38(AB) circumbinary planet of Neptune-size; discovery (Orosz et al., 2012b)⊳ habitable zone (Liu et al., 2013)⊳ rotational synchronisation and the habitable zone (Mason et al., 2013)⊳ modeling, and sensitivity to disk structure (Kley & Haghighipour, 2014)⊳ dynamical stability (Chavez et al., 2015)⊳ analytic orbit propagation for circumbinary planets (Georgakarakos & Eggl, 2015)⊳ survival through the post-common-envelope stage (Kostov et al., 2016a)⊳ resonant capture and tidal evolution (Zoppetti et al., 2018)⊳

Kepler–39 $18M_J$ planet; discovery and confirmation from radial velocity (Bouchy et al., 2011a)⊳ photometry and new spectroscopy (Southworth, 2012)⊳ tentative detection of planetary oblateness (Zhu et al., 2014)⊳ radial velocities from SOPHIE and HARPS–N (Bonomo et al., 2015)⊳ limits on planet oblateness from transit depth variations (Biersteker & Schlichting, 2017)⊳

Kepler–40 planet transiting evolved subgiant; discovery and confirmation from radial velocity (Bouchy et al., 2011a)⊳ confirmation from radial velocity (Santerne et al., 2011b)⊳ photometry and new spectroscopy (Southworth, 2011)⊳ physical properties (Southworth, 2012)⊳ improved masses, sizes, and orbits (Marcy et al., 2014)⊳ Kepler secondary eclipse and phase curves (Angerhausen et al., 2015a)⊳

Kepler–41 non-inflated hot Jupiter; confirmation from radial velocity, secondary transit from Kepler (Santerne et al., 2011a)⊳ photometry and new spectroscopy (Southworth, 2012)⊳ confirmation via phase curve analysis (Quintana et al., 2013)⊳ Kepler secondary eclipse and phase curves (Angerhausen et al., 2015a)⊳ Kepler phase curve with beaming and ellipsoidal variations (Esteves et al., 2015)⊳ atmospheric modeling, with westward phase shift of brightest region and substellar point explained by clouds (Shporer & Hu, 2015)⊳

Kepler–42 3-planet system orbiting low-metallicity high proper motion M dwarf; confirmation from statistics of multiple transits (Muirhead et al., 2012)⊳ rare example of short-period multi-planet system with close-proximity pairs (Steffen & Farr, 2013)⊳ mapping of the interstellar medium (Johnson et al., 2015b)⊳ star and planet parameters from Hawaii Infrared Parallax Program (Mann et al., 2017a)⊳

Kepler–43 confirmation from radial velocity (Bonomo et al., 2012)⊳ photometry and new spectroscopy (Southworth, 2012)⊳ radial velocities from HET–HRS (Endl et al., 2014)⊳ Kepler secondary eclipse and phase curves (Angerhausen et al., 2015a)⊳ radial velocities from SOPHIE and HARPS–N (Bonomo et al., 2015)⊳ Kepler phase curve with beaming and ellipsoidal variations (Esteves et al., 2015)⊳

Kepler–44 confirmation from radial velocity (Bonomo et al., 2012)⊳ photometry and new spectroscopy (Southworth, 2012)⊳ Kepler secondary eclipse and phase curves (Angerhausen et al., 2015a)⊳ radial velocities from SOPHIE and HARPS–N (Bonomo et al., 2015)⊳

Kepler–45 hot Jupiter orbiting M dwarf; photometry and new spectroscopy (Southworth, 2012)⊳ confirmation from radial velocity, adaptive optics imaging, and near-infrared spectroscopy (Johnson et al., 2012)⊳ prograde versus retrograde motion from star spot transit timing (Holczer et al., 2015)⊳ stellar obliquity and magnetic activity based on transit chord correlation (Dai et al., 2018)⊳

Kepler–46 3-planet system; large transit time variations of planet b indicate non-transiting planet c, with transits of third candidate likely (Nesvorný et al., 2012)⊳ confirmation of planet d from light curve (Rowe et al., 2014)⊳ masses of planets b and c from transit timing variations (Saad-Olivera et al., 2017)⊳

Kepler–47(AB) 3-planet circumbinary system (first multiple planet system around a binary star); third planet confirmed in 2019; planets of $3R_\oplus$ (P = 49 d) and $5R_\oplus$ (P = 303 d, habitable zone) orbiting

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a P = 7.5 d eclipsing binary; discovery and characterisation (Orosz et al., 2012a)⊳ characterisation (Kostov et al., 2013)⊳ determination of habitable zone (Kane & Hinkel, 2013)⊳ determination of habitable zone (Liu et al., 2013)⊳ rotational synchronisation and the habitable zone (Mason et al., 2013)⊳ climate modeling of habitable zone (Forgan, 2014)⊳ stability regions in a multi-planet circumbinary system (Kratter & Shannon, 2014)⊳ multi-orbital 'tight transits', expected before 2025 (Liu et al., 2014b)⊳ effects of X-ray and extreme ultraviolet radiation (Sanz-Forcada et al., 2014)⊳ surface flux illumination and photosynthesis in circumbinary systems (Forgan et al., 2015)⊳ third circumbinary planet could explain one anomalous transiting event (Hinse et al., 2015)⊳ Milankovitch cycles in eccentricity, obliquity, and precession (Forgan, 2016)⊳ survival through the post-common-envelope stage (Kostov et al., 2016a)⊳ role of planet–planet scattering (Smullen et al., 2016)⊳ habitability zones versus radiation and plasma environment (Zuluaga et al., 2016)⊳ confirmation of planet d (Orosz et al., 2019)⊳

Kepler–48 4-planet system, three transiting (bcd, planets b and c near 2:1 resonance), planet e from radial velocity; confirmation of planets b and c from correlated transit time variations and dynamical stability (Steffen et al., 2013)⊳ new data confirming planet d, radial velocities for planet e, revised analysis of sizes and orbits (Marcy et al., 2014)⊳ constraints on outer planets on inclined orbits (Read et al., 2017)⊳ resonance chains explained through mass accretion and outward migration (Wang & Ji, 2017)⊳

Kepler–49 4-planet system, planets b and c near 3:2 resonance; confirmation of planets b and c from correlated transit time variations and dynamical stability (Steffen et al., 2013)⊳ discovery of planets d and e from light curve analysis (Rowe et al., 2014)⊳

Kepler–50 2-planet system near 6:5 resonance; confirmation from correlated transit time variations and dynamical stability (Steffen et al., 2013)⊳ asteroseismic obliquity determination (Chaplin et al., 2013)⊳ low eccentricity from transit duration (Van Eylen & Albrecht, 2015)⊳

Kepler–51 3-planet system with planets b and c near 2:1 resonance; confirmation from correlated transit time variations and dynamical stability (Steffen et al., 2013)⊳ three low-density planets suggested by transit time variations (Masuda, 2014)⊳ planet d confirmed from light curve analysis (Rowe et al., 2014)⊳ molecular features detectable with JWST (Kawashima et al., 2019)⊳

Kepler–52 3-planet system with planets b and c near 2:1 resonance; confirmation of planets b and c from correlated transit time variations and dynamical stability (Steffen et al., 2013)⊳ planet d from light curve analysis (Rowe et al., 2014)⊳

Kepler–53 3-planet system with planets b and c near 2:1 resonance; confirmation of planets b and c from correlated transit time variations and dynamical stability (Steffen et al., 2013)⊳ planet d from light curve analysis (Rowe et al., 2014)⊳ resonance chains explained through mass accretion and outward migration (Wang & Ji, 2017)⊳

Kepler–54 3-planet system with planets b and c near 2:1 resonance; confirmation of planets b and c from correlated transit time variations and dynamical stability (Steffen et al., 2013)⊳ planet d from light curve analysis (Rowe et al., 2014)⊳

Kepler–55 5-planet system, planets b and c near 3:2 resonance; confirmation of planets b and c from transit time variations and dynamical stability (Steffen et al., 2013)⊳ additional planets predicted from packed planetary systems hypothesis (Fang & Margot, 2012)⊳ debris disk observations from WISE (Lawler & Gladman, 2012)⊳ discovery of planets d, e, f from light curves (Rowe et al., 2014)⊳

Kepler–56 3-planet system orbiting red giant ($3.1R_\odot$), planet d non-transiting; planets b and c near 2:1 resonance, coplanar, but misaligned with stellar spin axis; planets b and c from correlated transit time variations and dynamical stability (Steffen et al., 2013)⊳ large spin–orbit misalignment from asteroseismic analysis (Huber et al., 2013a)⊳ eccentricities and densities from transit time variations (Hadden & Lithwick, 2014)⊳ large observed obliquity consistent with dynamical origin rather than disk migration (Li et al., 2014)⊳ low eccentricity from transit duration (Van Eylen & Albrecht, 2015)⊳ spin–orbit alignment from asteroseismology and confirmation as misaligned multi-planet system (Campante et al., 2016)⊳ transit time variations (Holczer et al., 2016)⊳ confirmation from probabilities (Morton et al., 2016)⊳ discovery, orbit and mass of planet d from radial velocity modelling (Otor et al., 2016)⊳ inner system tilt due to outer planet scattering (Gratia & Fabrycky, 2017)⊳ inner system tilt due to Lidov–Kozai oscillation (Mustill et al., 2017)⊳

Kepler–57 2-planets near 2:1 resonance; confirmation from correlated transit time variations and dynamical stability (Steffen et al., 2013)⊳

Kepler–58 3-planet system with planets b and c near 3:2 resonance; confirmation of planets b and c from correlated transit time variations and dynamical stability (Steffen et al., 2013)⊳ planet d from light curve analysis (Rowe et al., 2014)⊳

Kepler–59 2-planets near 3:2 resonance; confirmation from correlated transit time variations and dynamical stability (Steffen et al., 2013)⊳

Kepler–60 3-planets near 5:4 (b:c) and 4:3 (c:d) resonances; confirmation from correlated transit time variations and dynamical stability (Steffen et al., 2013)⊳ tidal constraints from the 3-body resonance (Papaloizou, 2015)⊳ nature and stability of the (generalised Laplace) 3-body resonance (Goździewski et al., 2016)⊳ dynamical masses from transit time variations (Jontof-Hutter et al., 2016)⊳ reversibility applied to orbital dynamics (Panichi et al., 2017)⊳ hydrodynamical modeling of Laplace resonance formation (Dempsey & Nelson, 2018)⊳ resonant chains via long-scale migration, short-scale migration, and/or eccentricity damping (MacDonald & Dawson, 2018)⊳

Kepler–61 stellar proxy modeling (Ballard et al., 2013)⊳ host star properties of Kepler's habitable planets (Armstrong et al., 2016b)⊳

Kepler–62 5-planet system ($1.3, 0.5, 1.9, 1.6, 1.4R_\oplus$), outer two in habitable zone; discovery (Borucki et al., 2013)⊳ habitable zone H_2O-planet candidates (Kaltenegger et al., 2013)⊳ lifetime of accompanying exomoons (Sasaki & Barnes, 2014)⊳ model for tidally-evolving multiple systems using Mercury–T (Bolmont et al., 2015)⊳ gravitational quantisation of orbits (Geroyannis, 2015)⊳ host star properties of Kepler's habitable planets (Armstrong et al., 2016b)⊳ favourable for lightning-discharge studies during transit (Hodosán et al., 2016a)⊳ orbital dynamics and mean motion resonances (Mia & Kushvah, 2016)⊳ effect of orbital configuration on climate and habitability of planet f (Shields et al., 2016)⊳ obliquity variations in planet f due to secular spin–orbit resonance (Deitrick et al., 2018)⊳ obliquity variations of habitable zone planets (Shan & Li, 2018)⊳

Kepler–63 high obliquity from Rossiter–McLaughlin effect, anomalous transits from star spots (Sanchis-Ojeda et al., 2013c)⊳ prograde versus retrograde motion from star spot transit timing (Holczer et al., 2015)⊳ gyrochronology and isochrone ages (Maxted et al., 2015)⊳ stellar magnetic cycles (Estrela & Valio, 2016)⊳

Kepler–64(AB) PH–1 in NASA; transiting circumbinary planet in a quadruple (2+2) star system; discovery by Planet Hunters (Schwamb et al., 2013)⊳ independent discovery (Kostov et al., 2013)⊳ rotational synchronisation and the habitable zone (Mason et al., 2013)⊳ climate modeling of habitable zone (Forgan, 2014)⊳ dynamical stability (Chavez et al., 2015)⊳ analytic orbit propagation for circumbinary planets (Georgakarakos & Eggl, 2015)⊳ survival through the post-common-envelope stage (Kostov et al., 2016a)⊳

Kepler–65 3-planet system; confirmation and asteroseismic determination of obliquity (Chaplin et al., 2013)⊳ superrotating atmosphere in cyclostrophic balance (Peralta et al., 2014)⊳ eccentricity from transit photometry (Van Eylen & Albrecht, 2015)⊳

Kepler–66 in cluster NGC 6811; discovery, planets can form and survive in dense clusters (Meibom et al., 2013)⊳ superrotating atmosphere in cyclostrophic balance (Peralta et al., 2014)⊳

Kepler–67 in cluster NGC 6811; discovery, planets can form and survive in dense clusters (Meibom et al., 2013)⊳ superrotating atmosphere in cyclostrophic balance (Peralta et al., 2014)⊳

Kepler–68 3-planet system, planet d non-transiting and discovered from radial velocity; confirmation and detection of planet d from radial velocity, and asteroseismology (Gilliland et al., 2013)⊳ improved masses, sizes, and orbits (Marcy et al., 2014)⊳ superrotating atmosphere in cyclostrophic balance (Peralta et al., 2014)⊳ stability of Earth-mass planets (Kane, 2015)⊳ low eccentricity from transit duration (Van Eylen & Albrecht, 2015)⊳

Kepler–69 2-planet system, with $1.7R_\oplus$ planet in habitable zone; confirmation via false positives (Barclay et al., 2013a)⊳ planet c as likely super-Venus (Kane et al., 2013)⊳

Kepler–70 KOI–55 in NASA; 2-planet compact system orbiting post-red giant, hot pulsating B subdwarf; discovery from orbital brightness variations, survival through red giant phase (Charpinet et al., 2011) ⊳ low-frequency 'reflection' signals attributed to stellar pulsation (Krzesinski, 2015)⊳

Kepler–71 KOI–217 in NASA; confirmation via false positives (Howell et al., 2010)⊳ prograde versus retrograde motion from star spot transit timing (Holczer et al., 2015)⊳ differential rotation from star spots (Zaleski et al., 2019)⊳

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Kepler–72 in preparation

Kepler–73 in preparation

Kepler–74 confirmation from radial velocity (Hébrard et al., 2013a)▷ secondary eclipse and phase curves (Angerhausen et al., 2015a)▷ radial velocities from SOPHIE and HARPS–N (Bonomo et al., 2015)▷

Kepler–75 confirmation from radial velocity (Hébrard et al., 2013a)▷ radial velocities from SOPHIE and HARPS–N (Bonomo et al., 2015)▷

Kepler–76 listed in NASA with discovery method 'orbital brightness modulation'; confirmation from beaming, ellipsoidal and reflection/emission modulations, BEER (Faigler et al., 2013)▷ Kepler secondary eclipse and phase curves (Angerhausen et al., 2015a)▷ Kepler phase curve with beaming and ellipsoidal variations (Esteves et al., 2015)▷ Kepler phase curves with beaming, ellipsoidal, and reflection phase modulation (Faigler & Mazeh, 2015)▷ atmospheric variability (Jackson et al., 2019a)▷

Kepler–77 discovery (Gandolfi et al., 2013)▷ radial velocities from HET–HRS (Endl et al., 2014)▷ Kepler secondary eclipse and phase curves (Angerhausen et al., 2015a)▷ simple transit model (Ji et al., 2017)▷ eclipse, transit and occultation geometry at exo-syzygy (Veras & Breedt, 2017)▷ transit modeling (Huang et al., 2019)▷

Kepler–78 $1.2R_\oplus$ rocky planet in 8.5-hr orbit; discovery, changing illumination from reflected and reprocessed light (Sanchis-Ojeda et al., 2013a)▷ $\rho = 5.57\,\mathrm{Mg\,m^{-3}}$ implying Fe and rock (Pepe et al., 2013)▷ rocky planet nature (Howard et al., 2013)▷ slightly lower density (Hatzes, 2014)▷ mass and density from stellar activity model (Grunblatt et al., 2015)▷ close-in orbit from Kozai–Lidov cycles (Rice, 2015)▷ magnetic properties of the host star (Moutou et al., 2016)▷ star–planet magnetic interactions (Strugarek et al., 2019)▷

Kepler–79 compact 4-planet system with periods near a 1:2:4:6 chain (13.5–81.1 d); candidates inferred from multiplicity and transit timing variations (Steffen et al., 2010)▷ models of resonance formation (Wang et al., 2012a)▷ confirmation of planets b and c (Xie, 2013)▷ superrotating atmosphere in cyclostrophic balance (Peralta et al., 2014)▷ discovery/confirmation of planets d and e from light curve analysis (Rowe et al., 2014)▷ dynamical analysis, stability, and formation (Jontof-Hutter et al., 2014)▷ tidally induced radius inflation (Millholland, 2019)▷

Kepler–80 6-planet system, with a 5-planet resonant chain; discovery of planets b and c (Xie, 2013)▷ discovery of planets d and e from light curve analysis (Rowe et al., 2014)▷ dynamical analysis (MacDonald et al., 2016)▷ planet f from light curve analysis (Morton et al., 2016)▷ planet g discovered through a convolutional neural network search (Shallue & Vanderburg, 2018)▷ resonant chains via long-scale migration, short-scale migration, and/or eccentricity damping (MacDonald & Dawson, 2018)▷

Kepler–81 3-planet system; discovery of planets b and c (Xie, 2013)▷ evidence for companion planets from transit timing variations (Steffen et al., 2010)▷ activity and differential stellar rotation (Savanov, 2011)▷ differential stellar rotation (Reinhold et al., 2013)▷ discovery of planet d from light curve analysis (Rowe et al., 2014)▷ host star photometric variability and rotation from Kepler (Savanov & Dmitrienko, 2015)▷

Kepler–82 5-planet system; discovery of planets b and c (Xie, 2013)▷ d and e from light curve analysis (Rowe et al., 2014)▷ planet f from transit timing variations (Freudenthal et al., 2019)▷

Kepler–83 3-planet system; discovery of planets b and c (Xie, 2013)▷ discovery of planet d from light curve analysis (Rowe et al., 2014)▷

Kepler–84 5-planet system; discovery of planets b and c (Xie, 2013)▷ discovery of d, e, f from light curve analysis (Rowe et al., 2014)▷

Kepler–85 4-planet system; discovery of planets b and c (Xie, 2013)▷ confirmation via transit timing variations (Ming et al., 2013)▷ discovery of planets d and e from light curve analysis (Rowe et al., 2014)▷

Kepler–86 PH–2 in NASA; discovery (Wang et al., 2013a)▷ discounted exomoon candidate (Kipping et al., 2015)▷ stellar companion from lucky imaging (Ginski et al., 2016)▷ characterisation with HARPS–N (Dubber et al., 2019)▷

Kepler–87 2-planet system including low density super-Earth; candidate (Ofir & Dreizler, 2013)▷ discovery (Ofir et al., 2014)▷ superrotating atmosphere in cyclostrophic balance (Peralta et al., 2014)▷

Kepler–88 KOI–142 in NASA; 2-planet system, with planet c inferred from transit time variations; discovery (Nesvorný et al., 2013)▷ confirmation of planet c from radial velocities (Barros et al., 2014b)▷ chaotic spin dynamics from large transit timing variations (Delisle et al., 2017)▷

Kepler–89 KOI–94 in NASA; 4-planet system, with planet–planet eclipse; radial velocities, planet d, and transit time variations (Weiss et al., 2013)▷ confirmation, Rossiter–McLaughlin effect, planet–planet eclipse (Hirano et al., 2012)▷ transit time analysis, and prediction of next planet–planet eclipse (Masuda et al., 2013)▷ obliquity from Rossiter–McLaughlin effect (Albrecht et al., 2013)▷ superrotating atmosphere in cyclostrophic balance (Peralta et al., 2014)▷ orbital stability and precession (Kane, 2019)▷

Kepler–90 KOI–351 in NASA; 8-planet system; planets d, e, and f are super-Earths close to mean motion resonance chain (2:3:4), planets b and c (both $< 2R_\oplus$) within 0.5% of 4:5 mean motion resonance, planets g and h are gas giants with exceptional transit time variations (25.7 h for planet g); identification of three planets (Batalha et al., 2013)▷ discovery of a further 4 planets, and system characterisation (Cabrera et al., 2014)▷ independent characterisation (Schmitt et al., 2014b)▷ possible exomoon is false positive (Kipping et al., 2015)▷ planet i ($P = 14$ d) discovered through a convolutional neural network search (Shallue & Vanderburg, 2018)▷ dynamics of tightly-packed planetary systems in the presence of an outer planet (Granados Contreras & Boley, 2018)▷

Kepler–91 discovery (Lillo-Box et al., 2014b)▷ secondary eclipses and phase variations (Esteves et al., 2013)▷ radial velocity confirmation with Calar Alto–CAFE (Lillo-Box et al., 2014a)▷ Kepler secondary eclipse and phase curves (Angerhausen et al., 2015a)▷ radial velocity observations and light curve noise modeling (Barclay et al., 2015a)▷ Kepler phase curve with beaming and ellipsoidal variations (Esteves et al., 2015)▷ discarded Trojan planet candidate (Placek et al., 2015)▷ radial velocity observations with Subaru–HDS (Sato et al., 2015)▷ improved mass ratios (Budding et al., 2016a)▷ effect of dynamical tides excited by gravity waves in the host star on planet's orbital evolution (Chernov et al., 2017)▷

Kepler–92 3-planet system, planets b and c from transits, planet d from radial velocity; discovery (Xie, 2014)▷ confirmation of planet d from transit time variations, and low eccentricity from transit duration (Van Eylen & Albrecht, 2015)▷

Kepler–93 2-planet system; discovery of planet b through transits, planet c by radial velocity (Marcy et al., 2014)▷ asteroseismic study and 7 Spitzer transits lead to planet size uncertainty of 120 km (Ballard et al., 2014)▷ revised mass from 86 observations with HARPS–N and 32 archival Keck–HIRES (Dressing et al., 2015)▷ planet structure from stellar chemistry (Santos et al., 2015a)▷ core mass fraction from semi-empirical mass–radius relation for 2-layer rocky planets based on PREM (Zeng et al., 2016)▷ Bayesian analysis of interior structure using stellar abundance proxies (Dorn et al., 2017)▷ application of scaling relations for rocky planet interiors (Zeng & Jacobsen, 2017)▷

Kepler–94 2-planet system; discovery of planet b through transits, planet c by radial velocity (Marcy et al., 2014)▷

Kepler–95 discovery (Marcy et al., 2014)▷

Kepler–96 discovery (Marcy et al., 2014)▷ superflare ultraviolet impact on habitability (Estrela & Valio, 2018)▷

Kepler–97 2-planet system; discovery of planet b through transits, planet c by radial velocity (Marcy et al., 2014)▷

Kepler–98 discovery (Marcy et al., 2014)▷

Kepler–99 discovery (Marcy et al., 2014)▷

Kepler–100 3-planet system; discovery (Marcy et al., 2014)▷ low eccentricity from transit duration (Van Eylen & Albrecht, 2015)▷ resonance chains explained through mass accretion and outward migration (Wang & Ji, 2017)▷

Kepler–101 2-planet system; discovery (Rowe et al., 2014)▷ confirmation with HARPS–N (Bonomo et al., 2014)▷

Kepler–102 5-planet system; discovery (Marcy et al., 2014)▷ discovery characterisation (Wang et al., 2014a)▷

Kepler–103 2-planet system; discovery (Marcy et al., 2014)▷ low eccentricity from transit duration (Van Eylen & Albrecht, 2015)▷ characterisation of the long-period planet with HARPS–N (Dubber et al., 2019)▷

Kepler–104 3-planet system; discovery (Rowe et al., 2014)▷

Kepler–105 2-planet system; discovery (Wang et al., 2014a)▷ discovery and characterisation (Rowe et al., 2014)▷ difficulty explaining 4:3 mean motion resonance (Rein et al., 2012)▷

Kepler–106 4-planet system; discovery (Marcy et al., 2014)▷

Kepler–107 4-planet system; discovery (Rowe et al., 2014)▷ low eccentricity from transit duration (Van Eylen & Albrecht, 2015)▷ giant impact as the likely origin of the different twins, planets b and c (Bonomo et al., 2019)▷

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Kepler–108 2-planet system; discovery (Rowe et al., 2014)⊳ low eccentricity from transit duration (Van Eylen & Albrecht, 2015)⊳ mutual inclination from transit time and transit duration analysis, $\Delta i = 24°$ (Mills & Fabrycky, 2017a)⊳ system architecture inner system tilt due to Lidov–Kozai oscillation (Mustill et al., 2017)⊳

Kepler–109 2-planet system; discovery (Marcy et al., 2014)⊳ low eccentricity from transit duration (Van Eylen & Albrecht, 2015)⊳

Kepler–110 2-planet system; discovery (Rowe et al., 2014)⊳

Kepler–111 2-planet system; discovery (Rowe et al., 2014)⊳ additional planets predicted from packed planetary systems hypothesis (Fang & Margot, 2012)⊳

Kepler–112 2-planet system; discovery (Rowe et al., 2014)⊳

Kepler–113 2-planet system; discovery (Marcy et al., 2014)⊳

Kepler–114 3-planet system; planet b (Rowe et al., 2014)⊳ planets c and d (Xie, 2014)⊳

Kepler–115 2-planet system; discovery (Rowe et al., 2014)⊳

Kepler–116 2-planet system; discovery (Rowe et al., 2014)⊳

Kepler–117 2-planet system; discovery (Rowe et al., 2014)⊳ joint photometric, spectroscopic, and dynamical analysis (Bruno et al., 2015)⊳ low eccentricity from transit duration (Van Eylen & Albrecht, 2015)⊳ masses and radii from photo-dynamical modeling (Almenara et al., 2015c)⊳ TTV-determined masses for warm Jupiters and their close planetary companions (Wu et al., 2018)⊳

Kepler–118 2-planet system; discovery (Rowe et al., 2014)⊳

Kepler–119 2-planet system; discovery (Rowe et al., 2014)⊳

Kepler–120 2-planet system; discovery (Rowe et al., 2014)⊳

Kepler–121 2-planet system; discovery (Rowe et al., 2014)⊳ additional planets predicted from packed planetary systems hypothesis (Fang & Margot, 2012)⊳

Kepler–122 5-planet system; discovery of planets b, c, d, e (Rowe et al., 2014)⊳ planet f from transit time variations (Hadden & Lithwick, 2014)⊳

Kepler–123 2-planet system; discovery (Rowe et al., 2014)⊳

Kepler–124 3-planet system; discovery (Rowe et al., 2014)⊳

Kepler–125 2-planet system; discovery (Rowe et al., 2014)⊳

Kepler–126 3-planet system; discovery (Rowe et al., 2014)⊳ low eccentricity from transit duration (Van Eylen & Albrecht, 2015)⊳

Kepler–127 3-planet system; discovery (Rowe et al., 2014)⊳ low eccentricity from transit duration (Van Eylen & Albrecht, 2015)⊳

Kepler–128 2-planet system; discovery (Xie, 2014)⊳ low eccentricity from transit duration (Van Eylen & Albrecht, 2015)⊳

Kepler–129 2-planet system; discovery (Rowe et al., 2014)⊳ low eccentricity from transit duration (Van Eylen & Albrecht, 2015)⊳

Kepler–130 3-planet system; discovery (Rowe et al., 2014)⊳ low eccentricity from transit duration (Van Eylen & Albrecht, 2015)⊳

Kepler–131 2-planet system; discovery (Marcy et al., 2014)⊳

Kepler–132 4-planet system; discovery (Rowe et al., 2014)⊳ confirmation and planet e (Morton et al., 2016)⊳

Kepler–133 2-planet system; discovery (Rowe et al., 2014)⊳

Kepler–134 2-planet system; discovery (Rowe et al., 2014)⊳

Kepler–135 2-planet system; discovery (Rowe et al., 2014)⊳

Kepler–136 2-planet system; discovery (Rowe et al., 2014)⊳

Kepler–137 2-planet system; discovery (Rowe et al., 2014)⊳

Kepler–138 3-planet system; discovery of planet b (Rowe et al., 2014)⊳ planets c and d, and search for exomoon (Kipping et al., 2014a)⊳ Mars-sized mass of planet b from transit timing variations (Jontof-Hutter et al., 2015)⊳ star and planet parameters from Hawaii Infrared Parallax Program (Mann et al., 2017a)⊳ stellar chemical abundances for 13 elements (Souto et al., 2017)⊳ absolute densitiesfrom photo-dynamical modelling (Almenara et al., 2018)⊳

Kepler–139 . . . Kepler–144 2- and 3-planet systems; discovery (Rowe et al., 2014)⊳

Kepler–145 2-planet system; discovery (Xie, 2014)⊳ low eccentricity from transit duration (Van Eylen & Albrecht, 2015)⊳

Kepler–146 2-planet system discovery (Rowe et al., 2014)⊳

Kepler–147 2-planet discovery (Rowe et al., 2014)⊳

Kepler–148 3-planet system; discovery of planets b and c (Rowe et al., 2014)⊳ discovery of planet d (Morton et al., 2016)⊳

Kepler–149 3–planet system; discovery (Rowe et al., 2014)⊳

Kepler–150 5–planet system; discovery (Rowe et al., 2014)⊳ discovery of planet f (Schmitt et al., 2017)⊳ independent discovery of planets b–e (Kunimoto et al., 2018)⊳

Kepler–151 2–planet system; discovery (Rowe et al., 2014)⊳

Kepler–152 2–planet system; discovery (Rowe et al., 2014)⊳

Kepler–153 2–planet system; discovery (Rowe et al., 2014)⊳

Kepler–154 5-planet system; discovery of planets b and c (Rowe et al., 2014)⊳ candidate 6-planet system from independent light curve analysis (Ofir & Dreizler, 2013)⊳ independent discovery of long-period candidate (Foreman-Mackey et al., 2016)⊳ confirmation of planets b–from light curve analysis (Morton et al., 2016)⊳

Kepler–155 2-planet system; discovery (Rowe et al., 2014)⊳

Kepler–156 2-planet system; discovery (Rowe et al., 2014)⊳

Kepler–157 3-planet system; discovery of planets b and c (Rowe et al., 2014)⊳ discovery of planet d (Morton et al., 2016)⊳

Kepler–158 2-planet system; discovery (Rowe et al., 2014)⊳

Kepler–159 2-planet system, with a planet d inferred from transit timing; discovery (Rowe et al., 2014)⊳ transit timing implies existence of planet d (Fox & Wiegert, 2019)⊳

Kepler–160 . . . Kepler–165 2- and 3-planet systems; discovery (Rowe et al., 2014)⊳

Kepler–166 3-planet system; discovery of planets b and c (Rowe et al., 2014)⊳ discovery of planet d (Morton et al., 2016)⊳

Kepler–167 4-planet system, with planet e being a first transiting Jupiter analogue ($R_p = 0.9 R_J$, $e = 0.06$, $P = 2.9$ yr, $T_{eq} = 131$ K); discovery (Rowe et al., 2014)⊳ independent discovery of planet e (Foreman-Mackey et al., 2016)⊳ nature of planet e (Kipping et al., 2016)⊳ Spitzer detection of planet e (Dalba & Tamburo, 2019)⊳

Kepler–168 . . . Kepler–173 2-, 3-, 4-, and 5-planet systems; discovery (Rowe et al., 2014)⊳ Amongst these:
Kepler–170: dynamical rearrangement of super-Earths during disk dispersal by magnetospheric rebound (Liu et al., 2017)⊳

Kepler–174 3-planet system; discovery (Rowe et al., 2014)⊳ host star properties of Kepler's habitable planets (Armstrong et al., 2016b)⊳

Kepler–175 2-planet system; discovery (Rowe et al., 2014)⊳

Kepler–176 4-planet system; discovery of planets b–d (Rowe et al., 2014)⊳ discovery of planet e (Morton et al., 2016)⊳

Kepler–177 2-planet system; discovery (Xie, 2014)⊳ dynamical masses from transit time variations (Jontof-Hutter et al., 2016)⊳

Kepler–178 3-planet system; discovery (Rowe et al., 2014)⊳

Kepler–179 2-planet system; discovery (Rowe et al., 2014)⊳

Kepler–180 2-planet system; discovery (Rowe et al., 2014)⊳ dynamical rearrangement of super-Earths during disk dispersal by magnetospheric rebound (Liu et al., 2017)⊳

Kepler–181 2-planet system; discovery (Rowe et al., 2014)⊳ difficulty explaining 4:3 mean motion resonance (Rein et al., 2012)⊳

Kepler–182 2-planet system; discovery (Rowe et al., 2014)⊳

Kepler–183 2-planet system; discovery (Rowe et al., 2014)⊳

Kepler–184 3-planet system; discovery (Rowe et al., 2014)⊳

Kepler–185 2-planet system; discovery (Rowe et al., 2014)⊳

Kepler–186 5-planet system, all roughly Earth-sized; discovery of planets b, c, d, e (Rowe et al., 2014)⊳ planet f ($1.1 R_\oplus$) in habitable zone, from additional year of Kepler data (Quintana et al., 2014)⊳ formation, tidal evolution, habitability (Bolmont et al., 2014)⊳ mapping of the interstellar medium (Johnson et al., 2015b)⊳ confirmed statistical validation of planet f, BLENDER (Torres et al., 2015)⊳ host star properties of Kepler's habitable planets (Armstrong et al., 2016b)⊳ favourable for lightning-discharge studies during transit (Hodosán et al., 2016a)⊳ variable incident flux due to obliquity and eccentricity (Kane & Torres, 2017)⊳ stellar chemical abundances for 13 elements (Souto et al., 2017)⊳ obliquity variations of habitable zone planets (Shan & Li, 2018)⊳

Kepler–187 . . . Kepler–190 2-planet systems; discovery (Rowe et al., 2014)⊳

Kepler–191 3-planet system; discovery of planets b–c (Rowe et al., 2014)⊳ discovery of planet d (Morton et al., 2016)⊳

Kepler–192 3-planet system; discovery of planets b–c (Rowe et al., 2014)⊳ discovery of planet d (Morton et al., 2016)⊳ resonance chains explained through mass accretion and outward migration (Wang & Ji, 2017)⊳

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Kepler–193 . . . Kepler–196 2- and 3-planet systems; discovery (Rowe et al., 2014)▷

Kepler–197 4-planet system; discovery (Rowe et al., 2014)▷ eccentricity from transit photometry (Van Eylen & Albrecht, 2015)▷

Kepler–198 3-planet system; discovery of planets b–c (Rowe et al., 2014)▷ discovery of planet d (Morton et al., 2016)▷

Kepler–199 . . . Kepler–207 2-, 3-, and 4-planet systems; discovery (Rowe et al., 2014)▷

Kepler–208 4-planet system; discovery (Rowe et al., 2014)▷ additional single transits (Schmitt et al., 2017)▷

Kepler–209 2-planet system; discovery (Rowe et al., 2014)▷

Kepler–210 2-planet system; discovery (Rowe et al., 2014)▷ short-period Neptune-size planets around active host star (Ioannidis et al., 2014)▷ spot evolution and differential rotation (Ioannidis & Schmitt, 2016)▷

Kepler–211 2-planet system; discovery (Rowe et al., 2014)▷

Kepler–212 2-planet system; discovery (Rowe et al., 2014)▷

Kepler–213 2-planet system; discovery (Rowe et al., 2014)▷

Kepler–214 2-planet system; discovery (Rowe et al., 2014)▷ new long-period candidate (Foreman-Mackey et al., 2016)▷

Kepler–215 4-planet system; discovery (Rowe et al., 2014)▷

Kepler–216 2-planet system; discovery (Rowe et al., 2014)▷

Kepler–217 3-planet system; discovery of planets b–c (Rowe et al., 2014)▷ discovery of planet d (Morton et al., 2016)▷

Kepler–218 3-planet system; discovery of planets b–c (Rowe et al., 2014)▷ discovery of planet d (Morton et al., 2016)▷

Kepler–219 3-planet system; discovery (Rowe et al., 2014)▷

Kepler–220 4-planet system; discovery (Rowe et al., 2014)▷ additional candidates from light curve analysis (Ofir & Dreizler, 2013)▷

Kepler–221 4-planet system; discovery (Rowe et al., 2014)▷

Kepler–222 3-planet system; discovery (Rowe et al., 2014)▷

Kepler–223 4-planet system in a 3:4:6:8 resonant chain; discovery (Rowe et al., 2014)▷ chain of first-order resonances: period ratios 3:4:6:8 to within 10^{-3} (Fabrycky et al., 2011); orbit-crossing planetesimals (Moore et al., 2013)▷ migration models yield order of multi-planet resonant capture (Delisle, 2017)▷ resonant chains via long-scale migration, short-scale migration, and/or eccentricity damping (MacDonald & Dawson, 2018)▷

Kepler–224 4-planet system; discovery (Rowe et al., 2014)▷

Kepler–225 2-planet system; discovery (Rowe et al., 2014)▷

Kepler–226 3-planet system; discovery (Rowe et al., 2014)▷ difficulty explaining 4:3 mean motion resonance (Rein et al., 2012)▷

Kepler–227 . . . Kepler–231 2- and 3-planet systems; discovery (Rowe et al., 2014)▷

Kepler–232 2-planet system; discovery (Rowe et al., 2014)▷ difficulty explaining 4:3 mean motion resonance (Rein et al., 2012)▷

Kepler–233 . . . Kepler–237 2-, 3-, and 4-planet systems; discovery (Rowe et al., 2014)▷

Kepler–238 5-planet system; discovery of planets b, c, d (Rowe et al., 2014)▷ planets e and f (Xie, 2014)▷ migration and trapping in the 4:2:1 mean motion resonance (Sun et al., 2017b)▷

Kepler–239 . . . Kepler–244 2- and 3-planet systems; discovery (Rowe et al., 2014)▷

Kepler–245 4-planet system; discovery of planets b–c (Rowe et al., 2014)▷ discovery of planets d–e (Morton et al., 2016)▷

Kepler–246 2-planet system; discovery (Rowe et al., 2014)▷

Kepler–247 3-planet system; discovery of planets b and c (Rowe et al., 2014)▷ outer non-transiting candidate from transit time variations (Nesvorný et al., 2014)▷ effect of conjunctions on transit timing variations (Nesvorný & Vokrouhlický, 2014)▷

Kepler–248 2-planet system; discovery (Rowe et al., 2014)▷ evidence for companion planets from transit timing variations (Steffen et al., 2010)▷ activity and differential stellar rotation (Savanov, 2011)▷ differential stellar rotation (Reinhold et al., 2013)▷ stellar variability and rotation from Kepler (Savanov & Dmitrienko, 2015)▷

Kepler–249 3-planet system; discovery (Rowe et al., 2014)▷

Kepler–250 3-planet system; discovery (Rowe et al., 2014)▷

Kepler–251 4-planet system; discovery (Rowe et al., 2014)▷

Kepler–252 2-planet system; discovery (Rowe et al., 2014)▷ presence and origin of high-order harmonics in Kepler light curves (Armstrong & Rein, 2015)▷

Kepler–253 3-planet system; discovery (Rowe et al., 2014)▷

Kepler–254 3-planet system; discovery (Rowe et al., 2014)▷

Kepler–255 3-planet system; discovery of planets b–c (Rowe et al., 2014)▷ discovery of planet d (Morton et al., 2016)▷

Kepler–256 . . . Kepler–260 2-, 3-, and 4-planet systems; discovery (Rowe et al., 2014)▷

Kepler–261 2-planet system; discovery (Rowe et al., 2014)▷ measurement of stellar inclination (Hirano et al., 2014)▷

Kepler–262 . . . Kepler–270 2-, 3-, and 4-planet systems; discovery (Rowe et al., 2014)▷

Kepler–271 3-planet system; discovery of planets b–c (Rowe et al., 2014)▷ discovery of planet d (Morton et al., 2016)▷

Kepler–272 . . . Kepler–275 2- and 3-planet systems; discovery (Rowe et al., 2014)▷ gravitational quantisation of orbits (Geroyannis, 2015)▷

Kepler–276 3-planet system; discovery of planet b (Rowe et al., 2014)▷ planets c, d (Xie, 2014)▷

Kepler–277 2-planet system; discovery (Xie, 2014)▷

Kepler–278 2-planet system; discovery (Rowe et al., 2014)▷ low eccentricity from transit duration (Van Eylen & Albrecht, 2015)▷

Kepler–279 3-planet system; discovery of planet b (Rowe et al., 2014)▷ confirmation via transit timing variations (Ming et al., 2013)▷ planets c and d (Xie, 2014)▷

Kepler–280 2-planet system; discovery (Rowe et al., 2014)▷

Kepler–281 2-planet system; discovery (Rowe et al., 2014)▷

Kepler–282 4-planet system; discovery of planets b and c (Rowe et al., 2014)▷ planets d and e (Xie, 2014)▷

Kepler–283 2-planet system; discovery (Rowe et al., 2014)▷ host star properties of Kepler's habitable planets (Armstrong et al., 2016b)▷

Kepler–284 . . . Kepler–288 2-, 3-, and 4-planet systems; discovery (Rowe et al., 2014)▷

Kepler–289 3-planet system; discovery of planets b and c (Rowe et al., 2014)▷ planet d (Schmitt et al., 2014a)▷

Kepler–290 . . . Kepler–295 2-, 3-, 4-, 5-planet systems; discovery (Rowe et al., 2014)▷

Kepler–296 5-planet circumprimary system; discovery (Rowe et al., 2014)▷ planets orbit the primary star (Barclay et al., 2015b)▷ confirmed statistical validation of planets e and f, BLENDER (Torres et al., 2015)▷ host star properties of Kepler's habitable planets (Armstrong et al., 2016b)▷

Kepler–297 2-planet system; discovery (Rowe et al., 2014)▷ resonance chains explained through mass accretion and outward migration (Wang & Ji, 2017)▷

Kepler–298 3-planet system; discovery (Rowe et al., 2014)▷ host star properties of Kepler's habitable planets (Armstrong et al., 2016b)▷

Kepler–299 4-planet system; discovery (Rowe et al., 2014)▷

Kepler–300 2-planet system; discovery (Rowe et al., 2014)▷

Kepler–301 3-planet system; discovery (Rowe et al., 2014)▷

Kepler–302 2-planet system; discovery (Rowe et al., 2014)▷ migration and trapping in the 4:2:1 mean motion resonance (Sun et al., 2017b)▷ TTV-determined masses for warm Jupiters and their close planetary companions (Wu et al., 2018)▷

Kepler–303 2-planet system; discovery (Rowe et al., 2014)▷

Kepler–304 4-planet system; discovery of planets b–d (Rowe et al., 2014)▷ discovery of planet e (Morton et al., 2016)▷

Kepler–305 3-planet system; discovery of planets b and c (Xie, 2014)▷ confirmation via transit timing variations (Ming et al., 2013)▷ planet d (Rowe et al., 2014)▷

Kepler–306 4-planet system; discovery (Rowe et al., 2014)▷

Kepler–307 2-planet system; discovery (Xie, 2014)▷ dynamical masses from transit time variations (Jontof-Hutter et al., 2016)▷

Kepler–308 2-planet system; discovery (Rowe et al., 2014)▷

Kepler–309 2-planet system; discovery (Rowe et al., 2014)▷ additional planets predicted from packed planetary systems hypothesis (Fang & Margot, 2012)▷

Kepler–310 . . . Kepler–327 2- and 3-planet systems; discovery (Rowe et al., 2014)▷

Kepler–328 2-planet system; discovery (Xie, 2014)▷

Kepler–329 . . . Kepler–337 2- and 3-planet systems; discovery (Rowe et al., 2014)▷

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Kepler–338 4-planet system; discovery of planets b, c, d (Rowe et al., 2014)⊳ discovery of planet e from transit timing variations (Hadden & Lithwick, 2014)⊳ eccentricity from transit photometry (Van Eylen & Albrecht, 2015)⊳

Kepler–339 3-planet system; discovery (Rowe et al., 2014)⊳

Kepler–340 2-planet system; discovery (Rowe et al., 2014)⊳

Kepler–341 4-planet system; discovery (Rowe et al., 2014)⊳

Kepler–342 4-planet system; discovery of planets b–d (Rowe et al., 2014)⊳ discovery of planet e (Morton et al., 2016)⊳

Kepler–343 . . . Kepler–349 2-planet systems; discovery (Rowe et al., 2014)⊳

Kepler–350 3-planet system; discovery of planet b (Rowe et al., 2014)⊳ planets c and d (Xie, 2014)⊳

Kepler–351 3-planet system; discovery of planets b–c (Rowe et al., 2014)⊳ discovery of planet d (Morton et al., 2016)⊳

Kepler–352 . . . Kepler–395 2-, 3-planet systems; discovery (Rowe et al., 2014)⊳

Kepler–396 2-planet system; discovery (Xie, 2014)⊳ confirmation via transit timing variations (Ming et al., 2013)⊳

Kepler–397 2-planet system; discovery (Rowe et al., 2014)⊳

Kepler–398 3-planet system; discovery of planets b–c (Rowe et al., 2014)⊳ discovery of planet d (Morton et al., 2016)⊳

Kepler–399 3-planet system; discovery (Rowe et al., 2014)⊳ resonance chains explained through mass accretion and outward migration (Wang & Ji, 2017)⊳

Kepler–400 2-planet system; discovery (Rowe et al., 2014)⊳

Kepler–401 3-planet system; discovery of planets b–c (Rowe et al., 2014)⊳ discovery of planet d (Morton et al., 2016)⊳

Kepler–402 4-planet system; discovery (Rowe et al., 2014)⊳

Kepler–403 3-planet system; discovery of planets b–c (Rowe et al., 2014)⊳ discovery of planet d (Morton et al., 2016)⊳

Kepler–404 2-planet system; discovery (Rowe et al., 2014)⊳

Kepler–405 2-planet system; discovery (Rowe et al., 2014)⊳

Kepler–406 2-planet system; discovery (Marcy et al., 2014)⊳

Kepler–407 2-planet system; planet b discovered from transits, planet d from radial velocity (Marcy et al., 2014)⊳

Kepler–408 discovery (Marcy et al., 2014)⊳ misaligned orbit from asteroseismology (Kamiaka et al., 2019)⊳

Kepler–409 discovery (Marcy et al., 2014)⊳

Kepler–410A confirmation through asteroseismology, adaptive optics imaging, and Spitzer, and transit timing variations (Van Eylen et al., 2014)⊳ transit timing variations (Mazeh et al., 2013)⊳ TTVs and properties of the perturbing body (Gajdoš et al., 2017)⊳ transit timing variations, radial velocities, and long-term dynamical stability (Gajdoš et al., 2019c)⊳

Kepler–411 4-planet system; discovery of planet b (Wang et al., 2014a)⊳ discovery of planet c (Morton et al., 2016)⊳ discovery of planets c and d from Kepler photometry and transit time variations (Sun et al., 2019)⊳

Kepler–412 discovery, and combination with radial velocities from SOPHIE (Deleuil et al., 2014)⊳ Kepler secondary eclipse and phase curves (Angerhausen et al., 2015a)⊳ Kepler phase curve with beaming and ellipsoidal variations (Esteves et al., 2015)⊳ planet radii in the presence of star spots from ingress and egress durations (Morris et al., 2018d)⊳

Kepler–413(AB) circumbinary planet orbiting eclipsing binary system, with sections of hundreds of days without transits from precession; discovery (Kostov et al., 2014)⊳ dynamical stability (Chavez et al., 2015)⊳ analytic orbit propagation for circumbinary planets (Georgakarakos & Eggl, 2015)⊳ scattering of circumbinary planets to explain the orbital configuration (Gong & Ji, 2017)⊳ dynamical stability confined by 6:1 and 7:1 mean motion resonances (Popova, 2017)⊳ climate models (Wang & Cuntz, 2017)⊳ orbital alignment of circumbinary planets that form in misaligned circumbinary disk (Pierens & Nelson, 2018)⊳

Kepler–414 2-planet system; discovery from transit time variations (Hadden & Lithwick, 2014)⊳

Kepler–415 2-planet system; discovery from transit time variations (Hadden & Lithwick, 2014)⊳

Kepler–416 2-planet system; discovery from transit time variations (Hadden & Lithwick, 2014)⊳

Kepler–417 2-planet system; discovery from transit time variations (Hadden & Lithwick, 2014)⊳

Kepler–418 discovery/confirmation based on transit colour signature (Tingley et al., 2014)⊳ TTV-determined masses for warm Jupiters and their close planetary companions (Wu et al., 2018)⊳

Kepler–419 2-planet hot Jupiter system; discovery of planet b from transits and planet c from transit time variations (Dawson et al., 2012)⊳ planet characterisation from transit time variations, with low mutual inclination, $\Delta = 9^\circ$ (Dawson et al., 2014)⊳ alternative stable orbit solution obtained by genetic algorithms (Carpintero & Melita, 2018)⊳ origin of planet b from tidal migration via four-body secular interactions (Jackson et al., 2019b)⊳ secular transport during disk dispersal (Petrovich et al., 2019)⊳ planet masses from transit timing variations (Saad-Olivera et al., 2019)⊳

Kepler–420 KOI–1257 in NASA; long-period (87 d) high eccentricity (0.77) orbit; confirmation from SOPHIE and Rossiter–McLaughlin effect (Santerne et al., 2014)⊳ climate models (Wang & Cuntz, 2017)⊳

Kepler–421 near circular orbit near snow line (P = 704 d); discovery (Kipping et al., 2014b)⊳ no timing variations in third observed transit (Dalba & Muirhead, 2016)⊳ new long-period candidate (Foreman-Mackey et al., 2016)⊳

Kepler–422 discovery/confirmation from HET–HRS (Endl et al., 2014)⊳

Kepler–423 discovery and confirmation from HET–HRS (Endl et al., 2014)⊳ radial velocities from NOT–FIES (Gandolfi et al., 2015)⊳ use as a precision clock to constrain time variation of the gravitational constant (Masuda & Suto, 2016)⊳

Kepler–424 2-planet system; discovery of planet b from transits, planet c from radial velocity with HET–HRS (Endl et al., 2014)⊳

Kepler–425 discovery and confirmation with SOPHIE and HARPS–N (Hébrard et al., 2014)⊳

Kepler–426 discovery and confirmation with SOPHIE and HARPS–N (Hébrard et al., 2014)⊳

Kepler–427 discovery and confirmation with SOPHIE and HARPS–N (Hébrard et al., 2014)⊳ precession period and planet oblateness from transit depth variations (Biersteker & Schlichting, 2017)⊳

Kepler–428 discovery and confirmation with SOPHIE and HARPS–N (Hébrard et al., 2014)⊳ transit modeling (Huang et al., 2019)⊳

Kepler–429 KIC–10001893 in NASA; 3-planet system orbiting post-red giant, hot B subdwarf; discovery from pulsation frequency modulation (Silvotti et al., 2014)⊳

Kepler–430 2-planet system; discovery and high resolution multicolour imaging (Everett et al., 2015)⊳

Kepler–431 3-planet system; discovery and high resolution multicolour imaging (Everett et al., 2015)⊳

Kepler–432 2-planet system, planet b discovered from transits, planet c from radial velocity; confirmation of planet b from CAHA–CAFE (Ciceri et al., 2015a)⊳ further analysis of CAHA–CAFE radial velocities (Ortiz et al., 2015)⊳ independent discovery of planet b, discovery of planet c, asteroseismic oscillations of host star (Quinn et al., 2015)⊳

Kepler–433 validation with SOPHIE (Almenara et al., 2015b)⊳

Kepler–434 grazing transit; validation with SOPHIE (Almenara et al., 2015b)⊳

Kepler–435 validation with SOPHIE (Almenara et al., 2015b)⊳

Kepler–436 2-planet system; statistical validation of planet b, BLENDER (Torres et al., 2015)⊳ discovery of planet c (Morton et al., 2016)⊳

Kepler–437 statistical validation, BLENDER (Torres et al., 2015)⊳ mapping of the interstellar medium (Johnson et al., 2015b)⊳

Kepler–438 statistical validation, BLENDER (Torres et al., 2015)⊳ star properties of Kepler's habitable planets (Armstrong et al., 2016b)⊳

Kepler–439 statistical validation, BLENDER (Torres et al., 2015)⊳ validation with multicolour transit photometry (Colón et al., 2015)⊳

Kepler–440 statistical validation, BLENDER (Torres et al., 2015)⊳ star properties of Kepler's habitable planets (Armstrong et al., 2016b)⊳

Kepler–441 statistical validation, BLENDER (Torres et al., 2015)⊳

Kepler–442 statistical validation, BLENDER (Torres et al., 2015)⊳ star properties of Kepler's habitable planets (Armstrong et al., 2016b)⊳

Kepler–443 statistical validation, BLENDER (Torres et al., 2015)⊳ star properties of Kepler's habitable planets (Armstrong et al., 2016b)⊳

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Kepler–444 5-planet system around primary (Kepler–444A) of a metal-poor triple star with age 11.2 ± 1.0 Gyr; discovery (Campante et al., 2015)▷ mapping of the interstellar medium (Johnson et al., 2015b)▷ confirmation from transit time variations (Van Eylen & Albrecht, 2015)▷ unresolved pair of M dwarfs (Kepler–444BC) at 66 au, and constraints on co-planarity and disk formation (Dupuy et al., 2016)▷ migration times from formation models (Papaloizou, 2016)▷ eclipse, transit and occultation geometry at exo-syzygy (Veras & Breedt, 2017)▷ Ly-α variations from the host star (Bourrier et al., 2017c)▷ transit timing variations and masses of planets d and e (Mills & Fabrycky, 2017b)▷ host star chemical analysis (Mack et al., 2018)▷ seismic modeling and inversions of stellar structure (Buldgen et al., 2019)▷

Kepler–445 3-planet system; confirmation by high contrast imaging with Keck–NIRC2 (Muirhead et al., 2015)▷ revised transit depth from Lowell–DCT identified Kepler results contaminated by stellar crowding (Dalba et al., 2017)▷ star and planet parameters from Hawaii Infrared Parallax Program (Mann et al., 2017a)▷

Kepler–446 3-planet system, metal-poor M dwarf with high space velocity; confirmation by high contrast imaging with Keck–NIRC2 (Muirhead et al., 2015)▷

Kepler–447 grazing transit; discovery from radial velocity with Calar Alto–CAFE (Lillo-Box et al., 2015)▷

Kepler–448 KOI–12 in NASA; 2-planet system; discovery, radial velocity and line-profile tomography with SOPHIE (Bourrier et al., 2015a)▷ Rossiter–McLaughlin effect (Johnson et al., 2017)▷ eccentric companion from transit timing and transit duration variations (Masuda, 2017)▷

Kepler–449 2-planet system; discovery from transit time variations (Van Eylen & Albrecht, 2015)▷

Kepler–450 3-planet system; discovery from transit time variations (Van Eylen & Albrecht, 2015)▷ resonance chains explained through mass accretion and outward migration (Wang & Ji, 2017)▷

Kepler–451 2MASS J19383260+4603591 in NASA; listed in NASA with discovery method 'eclipse timing variations'; periodic variation in timing signal attributed to $1.9 M_J$ planet in the sdB+M dwarf binary system 2M J1938+4603 (Baran et al., 2015)▷ pre-discovery of a multi-mode pulsating sdB star with an eclipsing dM companion (Østensen et al., 2010)▷ Rømer delay and binary mass ratio (Barlow et al., 2012)▷

Kepler–452 Earth-like exoplanet in the habitable zone of a Sun-like star; discovery, and Earth-like properties (Jenkins et al., 2015)▷ estimates of surface habitability (Silva et al., 2017)▷ climate and habitability from coupled atmosphere–ocean GCM (Hu et al., 2017)▷ possibility that the planet transits arise from noise (Mullally et al., 2018)▷

Kepler–453(AB) 10th Kepler circumbinary planet; discovery (Welsh et al., 2015)▷ habitability zones versus radiation and plasma environment (Zuluaga et al., 2016)▷

Kepler–454 2-planet system, planet b discovered from transits, planet c from radial velocity; discovery (Gettel et al., 2016)▷

Kepler–455 KIC–3558849 in NASA; discovery by Planet Hunters (Wang et al., 2015)▷

Kepler–456 KIC–5951458 in NASA; discovery by Planet Hunters (Wang et al., 2015)▷

Kepler–457 KOI–7892 in NASA; 2-planet system; discovery by Planet Hunters (Wang et al., 2015)▷

Kepler–458 KIC–9663113 in NASA; 2-planet system; discovery by Planet Hunters (Wang et al., 2015)▷

Kepler–459 KIC–10525077 in NASA; discovery by Planet Hunters (Wang et al., 2015)▷

Kepler–460 KIC–5437945 in NASA; 2-planet system; discovery by Planet Hunters (Wang et al., 2015)▷

Kepler–461 confirmation from false-positive probabilities (Morton et al., 2016)▷

Kepler–462 confirmation from false-positive probabilities (Morton et al., 2016)▷ possible 2-planet system, and constraints on spin–orbit misalignments (Ahlers et al., 2015)▷

Kepler–463 . . . Kepler–480 1- and 2-planet systems from false-positive probabilities (Morton et al., 2016)▷

Kepler–481 confirmation from false-positive probabilities (Morton et al., 2016)▷ evidence for companion planet(s) from transit timing variations (Steffen et al., 2010)▷

Kepler–482 confirmation from false-positive probabilities (Morton et al., 2016)▷

Kepler–483 confirmation from false-positive probabilities (Morton et al., 2016)▷

Kepler–484 confirmation from false-positive probabilities (Morton et al., 2016)▷

Kepler–485 confirmation from false-positive probabilities (Morton et al., 2016)▷ exomoon candidate from excess photometric transit scatter (Szabó et al., 2013)▷

Kepler–486 confirmation from false-positive probabilities (Morton et al., 2016)▷

Kepler–487 2-planet system from false-positive probabilities (Morton et al., 2016)▷ multiple transiting candidates (Steffen et al., 2010)▷ TTV-determined masses for warm Jupiters and their close planetary companions (Wu et al., 2018)▷

Kepler–488 . . . Kepler–490 confirmation from false-positive probabilities (Morton et al., 2016)▷

Kepler–491 confirmation from false-positive probabilities (Morton et al., 2016)▷ transit modeling (Huang et al., 2019)▷

Kepler–492 discovery (Díaz et al., 2013)▷ radial velocities from SOPHIE and HARPS–N (Bonomo et al., 2015)▷ confirmation (Morton et al., 2016)▷

Kepler–493 . . . Kepler–537 1- and 2-planet systems from false-positive probabilities (Morton et al., 2016)▷ Amongst these:
Kepler–503: object at the H-burning mass limit orbiting a subgiant star (Cañas et al., 2018)▷

Kepler–538 confirmation from false-positive probabilities (Morton et al., 2016)▷ mass estimation and orbit characterisation (Mayo et al., 2019)▷

Kepler–539 2-planet system; discovery of planet b (Morton et al., 2016)▷ discovery of planet c (Mancini et al., 2016c)▷

Kepler–540 . . . Kepler–559 1- and 2-planet systems from false-positive probabilities (Morton et al., 2016)▷ A few Kepler–NNN are absent from this sequence. Amongst these:
Kepler–553: additional planets predicted from packed planetary systems hypothesis (Fang & Margot, 2012)▷

Kepler–560 confirmation from false-positive probabilities (Morton et al., 2016)▷ star and planet parameters from Hawaii Infrared Parallax Program (Mann et al., 2017a)▷

Kepler–561 . . . Kepler–761 1- and 2-planet systems from false-positive probabilities (Morton et al., 2016)▷ with higher multiplicities in the cases of Kepler–603(3), and Kepler–758(4). Amongst these:
Kepler–598: additional planets predicted from packed planetary systems hypothesis (Fang & Margot, 2012)▷
Kepler 635: transit signals hidden in the intrinsic stellar pulsations (Sowicka et al., 2017)▷
Kepler–656: validation with multicolour transit photometry (Colón et al., 2015)▷
Kepler–693: eccentric companion from transit timing and transit duration variations (Masuda, 2017)▷
Kepler–699: transit modeling (Huang et al., 2019)▷ Kepler–706: transit modeling (Huang et al., 2019)▷ Kepler–718: exomoon candidate from photometric transit scatter (Szabó et al., 2013)▷
Kepler–730: hot Jupiter with close-in transiting Earth-size (Cañas et al., 2019b)▷ Kepler–730: transit modeling (Huang et al., 2019)▷
Kepler–736: debris disk from WISE (Lawler & Gladman, 2012)▷

Kepler–762 discovery from false-positive probabilities (Morton et al., 2016)▷ prograde versus retrograde motion from star spot transit timing (Holczer et al., 2015)▷ phase modulation due to beaming, ellipsoidal effect and reflection (Lillo-Box et al., 2016b)▷

Kepler–763 . . . Kepler–973 1- and 2-planet systems from false-positive probabilities (Morton et al., 2016)▷ with higher multiplicities in the cases of Kepler–770(3). Amongst these:
Kepler–767: debris disk from WISE (Lawler & Gladman, 2012)▷
Kepler–770: new long-period candidate (Foreman-Mackey et al., 2016)▷
Kepler–891: debris disk from WISE (Lawler & Gladman, 2012)▷

Kepler–974 confirmation of planet b from false-positive probabilities, $p = 4.1$ d (Morton et al., 2016)▷ unconfirmed $P = 4.24$ h candidate KOI–1843.03 (Ofir & Dreizler, 2013)▷ Roche limit for unconfirmed candidate KOI–1843.03 (Rappaport et al., 2013)▷

Kepler–975 . . . Kepler–1003 1- and 2-planet systems from false-positive probabilities (Morton et al., 2016)▷ Amongst these:
Kepler–989: new long-period candidate (Foreman-Mackey et al., 2016)▷

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Kepler–1004 confirmation from false-positive probabilities (Morton et al., 2016)⊳ radial velocities from Subaru–HDS (Sato et al., 2015)⊳

Kepler–1005 . . . Kepler–1114 1- and 2-planet systems from false-positive probabilities (Morton et al., 2016)⊳

Kepler–1115 discovery from false-positive probabilities (Morton et al., 2016)⊳ second super-Earth with a measured spin–orbit alignment (after 55 Cnc e), determined from rotational gravity darkening, and the first which is aligned (Barnes et al., 2015a)⊳

Kepler–1116 . . . Kepler–1318 1- and 2-planet systems from false-positive probabilities (Morton et al., 2016)⊳ with higher multiplicities in the case of Kepler–1254(3).

Kepler–1319 discovery and confirmation from false-positive probabilities (Morton et al., 2016)⊳ star and planet parameters from Hawaii Infrared Parallax Program (Mann et al., 2017a)⊳

Kepler–1320 . . . Kepler–1516 1- and 2-planet systems from false-positive probabilities (Morton et al., 2016)⊳ with higher multiplicities in the case of Kepler–1388(4)

Kepler–1517 confirmation from false-positive probabilities (Morton et al., 2016)⊳ phase modulation due to beaming, ellipsoidal effect and reflection (Lillo-Box et al., 2016b)⊳

Kepler–1518 confirmation from false-positive probabilities (Morton et al., 2016)⊳

Kepler–1519 confirmation from false-positive probabilities (Morton et al., 2016)⊳

Kepler–1520 ≡ KIC–12557548; disintegrating short-period Mercury-size planet; discovery (Rappaport et al., 2012)⊳ evidence for disintegration from detailed transit modeling (Brogi et al., 2012a)⊳ comet-like tail from light curve analysis (Budaj, 2013)⊳ star spot versus transit depth relation (Kawahara et al., 2013)⊳ implications from implied catastrophic evaporation (Perez-Becker & Chiang, 2013)⊳ multi-wavelength observations with HST–WFC3, Keck, CFHT–WIRCam (Croll et al., 2014)⊳ light curve analysis (Budaj, 2014)⊳ search for circumplanetary material and orbital period variations (Garai et al., 2014)⊳ analysis of 15 quarters of Kepler data (van Werkhoven et al., 2014a)⊳ constraints on dust composition (van Lieshout et al., 2014)⊳ direct evidence for an evolving dust cloud from ULTRACAM (Bochinski et al., 2015)⊳ relation between transit depths and stellar rotation period (Croll et al., 2015b)⊳ size and composition of dust grains, and mass loss rate, from light curve (van Lieshout et al., 2016)⊳ transit profile in the context of artificial megastructures (Wright et al., 2016b)⊳ dusty tail consistent with length and mass observed by Kepler (Schlawin et al., 2018b)⊳

Kepler–1521 . . . Kepler–1624 1- and 2-planet systems from false-positive probabilities (Morton et al., 2016)⊳ with higher multiplicities in the case of Kepler–1542(4)

Kepler–1625 first possible exomoon detection; confirmation from false-positive probabilities (Morton et al., 2016)⊳ exomoon candidate from phase-folded transit light curve (Teachey et al., 2018)⊳ tidal capture origin for the exomoon candidate (Hamers & Portegies Zwart, 2018)⊳ nature of the giant exomoon candidate (Heller, 2018)⊳ exomoon signal sensitive to the data detrending procedure (Rodenbeck et al., 2018)⊳ detectability of massive exomoons around directly imaged exoplanets via Doppler spectroscopy (Vanderburg et al., 2018)⊳ exomoon interpretation questioned (Heller et al., 2019b)⊳ possible existence of sub-moons (Kollmeier & Raymond, 2019)⊳ no evidence for lunar transit in new analysis of HST observations (Kreidberg et al., 2019b)⊳ further possible exomoon transit signatures (Martin et al., 2019)⊳

Kepler–1626 . . . Kepler–1646 1- and 2-planet systems from false-positive probabilities (Morton et al., 2016)⊳

Kepler–1647(AB) long-period (1100-d) transiting circumbinary; planet displays three transits in the Kepler light curve, one during an eclipse creating a syzygy; discovery (Kostov et al., 2016b)⊳ survival through the post-common-envelope stage (Kostov et al., 2016a)⊳ climate models (Wang & Cuntz, 2017)⊳ possibility of undetected inner planet (Hong et al., 2019)⊳

Kepler–1648 KIC–7917485 in NASA; $12 M_J$, $P = 840$ d, $e = 0.15$; discovery from pulsational phase shifts in the host A star induced by orbital motion (Murphy et al., 2016)⊳

Kepler–1649 discovery (Angelo et al., 2017)⊳

Kepler–1650 discovery and confirmation from transit timing variations (Holczer et al., 2016)⊳ star and planet parameters from Hawaii Infrared Parallax Program (Mann et al., 2017a)⊳

Kepler–1651 discovery and confirmation from transit timing variations (Holczer et al., 2016)⊳ nearby star from lucky imaging (Wöllert et al., 2015)⊳ star and planet parameters from Hawaii Infrared Parallax Program (Mann et al., 2017a)⊳

Kepler–1652 discovery and confirmation from transit timing variations (Holczer et al., 2016)⊳ confirmation from optical/near-infrared spectroscopy and high-resolution imaging (Torres et al., 2017)⊳

Kepler–1653 discovery and confirmation from transit timing variations (Holczer et al., 2016)⊳ confirmation from optical/near-infrared spectroscopy and high-resolution imaging (Torres et al., 2017)⊳

Kepler–1654 confirmation and characterisation (Beichman et al., 2018)⊳

Kepler–1655 discovery (Haywood et al., 2018)⊳

Kepler–1656 discovery (Brady et al., 2018)⊳

Kepler–1657 KOI–3680 in NASA; discovery (Hébrard et al., 2019)⊳

Kepler–1658 the first Kepler candidate detection (KOI–4.01, in 2010), but confirmed only in 2019; short-period planet orbiting a massive, evolved subgiant; confirmation from asteroseismology and radial velocities (Chontos et al., 2019)⊳

KIC

(identifiers used as default alias in NASA Exoplanet Archive)

KIC–3542116 not a planet, and not in NASA; system with probable transiting exocomets (Rappaport et al., 2018)⊳

KIC–3558849 see Kepler–455

KIC–5437945 see Kepler–460

KIC–5951458 see Kepler–456

KIC–7917485 see Kepler–1648

KIC–8462852 Boyajian's star: not an exoplanet, but may host exocomets or disrupted bodies; discovery by Planet Hunters from irregular 20% flux dips (Boyajian et al., 2016)⊳ NASA–IRTF consistent with giant comet (Lisse et al., 2015)⊳ infrared limits from Spitzer–IRAC (Marengo et al., 2015)⊳ search for optical flashes from VERITAS 2009–15 (Abeysekara et al., 2016)⊳ tidally-disrupted comet (Bodman & Quillen, 2016)⊳ accuracy of Harvard plates (Hippke et al., 2016)⊳ ATA radio flux limits at 1–10 GHz (Harp et al., 2016)⊳ constraints from Gaia distance (Hippke & Angerhausen, 2016)⊳ fading during Kepler mission (Montet & Simon, 2016)⊳ photometry/astrometry consistent with comet/planetoid swarm (Makarov & Goldin, 2016)⊳ century-long dimming from Harvard plates (Schaefer, 2016)⊳ limits on optical SETI pulses from Boquete Observatory (Schuetz et al., 2016)⊳ constraints on circumstellar dust from SCUBA–2 (Thompson et al., 2016)⊳ transit profile as artificial megastructures (Wright et al., 2016b)⊳ light curve explanations (Wright & Sigurdsson, 2016)⊳ **2017:** constancy of plates from Sonneberg 1934–95 and Sternberg 1895–1995 (Hippke et al., 2017)⊳ explained by circumsolar rings (Katz, 2017)⊳ transit signature at 928-d period, with next event 2019 October 3–8 (Kiefer et al., 2017)⊳ review of known properties (Ksanfomality, 2017)⊳ criticism of cometary hypothesis (Ksanfomality & Tavrov, 2017)⊳ dimming due to planet inspiral (Metzger et al., 2017)⊳ explanation as four dust-enshrouded objects (Neslušan & Budaj, 2017)⊳ explanation as tilted exoring disturbed by close third companion (Sucerquia et al., 2017)⊳ **2018:** explanation as ringed body with associated Trojans (Ballesteros et al., 2018)⊳ explanation as brown dwarf and associated ring system in 1601-d elliptical orbit (Bourne et al., 2018)⊳ first post-Kepler brightness dips (Boyajian et al., 2018)⊳ proper motion of faint nearby star excludes binary system (Clemens et al., 2018)⊳ Maria Mitchell Observatory photographic photometry 1922–1991 (Castelaz & Barker, 2018)⊳ non-grey dimming from GTC spectrophotometry (Deeg et al., 2018)⊳ ultraviolet variability from GALEX (Davenport et al., 2018)⊳ asymmetric or aperiodic year-long flux variations (Hippke & Angerhausen, 2018)⊳ 1574-d transit periodicity from archival photometry (Sacco et al., 2018)⊳ optical polarimetry in 2017 May–August (Steele et al., 2018)⊳ secular dimming from 800/4000-d monitoring from ASAS–SN/ASAS (Simon et al., 2018)⊳ families of solutions (Wright, 2018)⊳ explanation as circumstellar material in elliptical orbit (Wyatt et al., 2018)⊳ **2019:** unsupervised machine learning as a method for anomaly detection (Giles & Walkowicz, 2019)⊳ Breakthrough Listen search for laser line emission (Lipman et al., 2019)⊳ high-resolution spectroscopy during optical dimming (Martínez González et al., 2019)⊳ explanation as tidal detachment and evaporation following an exoplanet–star collision (Martinez et al., 2019)⊳ search for related analogues (Schmidt,

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2019)▷ detected when flagging periodic, coherent signals of arbitrary shape in time-series photometry (Wheeler & Kipping, 2019)▷

KIC–9663113 see Kepler–458

KIC–10001893 see Kepler–429

KIC–10525077 see Kepler–459

KIC–11084727 not a planet, and not in NASA; system with probable transiting exocomets (Rappaport et al., 2018)▷

KOI

(identifiers used as default alias in NASA Exoplanet Archive)

KOI–12 see Kepler–448

KOI–13 see Kepler–13

KOI–55 see Kepler–70

KOI–94 see Kepler–89

KOI–142 see Kepler–88

KOI–217 see Kepler–71

KOI–351 see Kepler–90

KOI–1257 see Kepler–420

KOI–1599 2-planet system, super-Earths in a 3:2 mean motion resonance; discovery (Panichi et al., 2019)▷ spin–orbit coupling for close-in planets (Correia & Delisle, 2019)▷

KOI–2700 not in NASA; candidate with dust on a 22-hr orbit (Rappaport et al., 2014)▷ dust composition of the dusty tail (van Lieshout et al., 2014)▷ planet with comet-like tail (Garai, 2018)▷ improved tail model (Garai, 2019)▷

KOI–3680 see Kepler–1657

KOI–7892 see Kepler–457

K2

K2–1 see WASP–28

K2–2 HIP 116454 in NASA; first discovery by K2, with radial velocity confirmation by HARPS–N, and transit confirmation by MOST (Vanderburg et al., 2015)▷

K2–3 3-planet system; discovery of planets b–d (Crossfield et al., 2015)▷ measurement with HARPS (Almenara et al., 2015a)▷ confirmation from transits (Montet et al., 2015b)▷ Spitzer observations (Beichman et al., 2016)▷ radial velocity monitoring with HARPS, PFS, and TRES (Dai et al., 2016)▷ observations with Okayama 1.88-m and MuSCAT (Fukui et al., 2016a)▷ multi-planet analysis (Sinukoff et al., 2016)▷ variable incident flux due to obliquity and eccentricity (Kane & Torres, 2017)▷ three likely sub-Neptunes characterised with HARPS–N and HARPS (Damasso et al., 2018)▷ atmospheric characterisation (Kosiarek et al., 2019b)▷

K2–4 discovery (Montet et al., 2015b)▷ validation (Crossfield et al., 2016)▷

K2–5 2-planet system; discovery (Montet et al., 2015b)▷ validation (Crossfield et al., 2016)▷ multi-planet analysis (Sinukoff et al., 2016)▷

K2–6 discovery (Montet et al., 2015b)▷ validation (Crossfield et al., 2016)▷

K2–7 discovery (Montet et al., 2015b)▷ validation (Crossfield et al., 2016)▷

K2–8 2-planet system; discovery of planet b (Montet et al., 2015b)▷ validation (Crossfield et al., 2016)▷ discovery of planet c (Sinukoff et al., 2016)▷

K2–9 discovery (Montet et al., 2015b)▷ validation (Crossfield et al., 2016)▷ spectra and adaptive optics imaging (Schlieder et al., 2016)▷

K2–10 discovery (Montet et al., 2015b)▷ validation (Crossfield et al., 2016)▷ radial velocity follow-up (Van Eylen et al., 2016b)▷

K2–11 . . . K2–15 discovery (Montet et al., 2015b)▷ validation (Crossfield et al., 2016)▷

K2–16 3-planet system; discovery (Montet et al., 2015b)▷ validation (Crossfield et al., 2016)▷ multi-planet analysis (Sinukoff et al., 2016)▷ discovery of planet d (Heller et al., 2019a)▷

K2–17 discovery (Montet et al., 2015b)▷ validation (Crossfield et al., 2016)▷

K2–18 2-planet system, planet c non-transiting; discovery of planet b (Montet et al., 2015b)▷ validation (Crossfield et al., 2016)▷ confirmation and habitable zone from Spitzer observations (Benneke et al., 2017)▷ radial velocity discovery of non-transiting planet c (Cloutier et al., 2017a)▷ follow-up observations with CARMENES (Sarkis et al., 2018b)▷ H_2O-vapour and clouds (Benneke et al., 2019)▷ confirmation of planet c with HARPS and CARMENES (Cloutier et al., 2019b)▷ atmospheric H_2O-vapour (Tsiaras et al., 2019)▷

K2–19 3-planet system; discovery of planets b and c (Montet et al., 2015b)▷ independent discovery, proximity to 3:2 resonance, and simultaneous transits (Armstrong et al., 2015)▷ photo-dynamical mass determination (Barros et al., 2015)▷ high-dispersion spectroscopy, adaptive optics imaging, and transit timing variations (Narita et al., 2015)▷ validation (Crossfield et al., 2016)▷ radial velocity monitoring with HARPS, PFS, and TRES (Dai et al., 2016)▷ multi-planet analysis (Sinukoff et al., 2016)▷ masses of planets b and c from radial velocities and transit timing variations (Nespral et al., 2017)▷

K2–20 see HAT–P–56

K2–21 2-planet system; discovery (Petigura et al., 2015)▷ validation (Crossfield et al., 2016)▷

K2–22 short-period (P = 9.1 h) disintegrating rocky planet; discovery (Sanchis-Ojeda et al., 2015a)▷ validation (Crossfield et al., 2016)▷ inferring the composition of disintegrating planet interiors from dust tails with JWST (Bodman et al., 2018)▷ transit evolution from 45 ground-based photometric observations 2016 Dec–2017 May (Colón et al., 2018)▷ search for evaporating gas (Ridden-Harper et al., 2019)▷

K2–23 see WASP–47

K2–24 2-planet system, both low-density sub-Saturn mass; discovery (Petigura et al., 2016)▷ validation (Crossfield et al., 2016)▷ radial velocity monitoring with HARPS, PFS, and TRES (Dai et al., 2016)▷ multi-planet analysis (Sinukoff et al., 2016)▷ insights on dynamics and formation of the near-resonant system from transit-timing variations and radial velocities (Petigura et al., 2018)▷

K2–25 first transiting plant in the Hyades cluster (Neptune-sized, transiting a M4.5 dwarf); discovery (Mann et al., 2016a)▷ validation (Crossfield et al., 2016)▷

K2–26 discovery (Schlieder et al., 2016)▷ Spitzer observations (Beichman et al., 2016)▷ validation (Crossfield et al., 2016)▷

K2–27 validation (Crossfield et al., 2016)▷ radial velocity follow-up (Van Eylen et al., 2016b)▷ sub-Saturnian mass diversity from Keck–HIRES (Petigura et al., 2017)▷ disentangling blended K2 photometry (Payne et al., 2018)▷

K2–28 discovery (Hirano et al., 2016a)▷ validation (Crossfield et al., 2016)▷ improved transit measurement from Spitzer (Chen et al., 2018a)▷ diffuser-assisted photometric observations (Stefansson et al., 2018)▷

K2–29 ≡ WASP–152; deep transit (20 mmag), detected by Super–WASP, then by K2; discovery by K2 (Johnson et al., 2016b)▷ discovery and Rossiter–McLaughlin effect from WASP (Santerne et al., 2016)▷

K2–30 discovery (Johnson et al., 2016b)▷ validation (Crossfield et al., 2016)▷ radial velocities from SOPHIE, HARPS–N and CAFE (Lillo-Box et al., 2016a)▷ independent discovery (Brahm et al., 2016a)▷

K2–31 first transiting hot Jupiter from K2, with grazing transit; joint discovery (as EPIC–204129699) and radial velocity monitoring with HARPS, PFS, and TRES (Dai et al., 2016)▷ joint discovery, radial velocity monitoring with FIES and HARPS, and grazing transit (Grziwa et al., 2016)▷ validation (Crossfield et al., 2016)▷

K2–32 4-planet system; discovery and radial velocity monitoring with HARPS, PFS, and TRES (Dai et al., 2016)▷ validation (Crossfield et al., 2016)▷ multi-planet analysis (Sinukoff et al., 2016)▷ sub-Saturnian mass diversity from Keck–HIRES (Petigura et al., 2017)▷ discovery of planet e near the 1:2:5:7 resonance (Heller et al., 2019c)▷ atmospheric evolution and rotation history (Kubyshkina et al., 2019a)▷

K2–33 in Upper Sco; discovery (David et al., 2016)▷ validation (Crossfield et al., 2016)▷ confirmation and characterisation from MEarth (Mann et al., 2016b)▷ limits on low-frequency radio emission (Lynch et al., 2017)▷

K2–34 discovery, Rossiter–McLaughlin effect, and faint companion candidate (Hirano et al., 2016b)▷ validation (Crossfield et al., 2016)▷ radial velocities from SOPHIE, HARPS–N and CAFE (Lillo-Box et al., 2016a)▷ independent discovery (Brahm et al., 2016a)▷ recovery from K2SC pipeline processing (Pope et al., 2016)▷

K2–35 2-planet system; discovery (Sinukoff et al., 2016)▷ validation (Crossfield et al., 2016)▷

K2–36 2-planet system; discovery (Sinukoff et al., 2016)▷ validation (Crossfield et al., 2016)▷ characterisation with HARPS–N (Damasso et al., 2019)▷

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K2–37 3-planet system discovery (Sinukoff et al., 2016)▷ validation (Crossfield et al., 2016)▷

K2–38 2-planet system discovery (Sinukoff et al., 2016)▷ validation (Crossfield et al., 2016)▷

K2–39 discovery (Van Eylen et al., 2016a)▷ validation (Crossfield et al., 2016)▷ sub-Saturnian mass diversity from Keck–HIRES (Petigura et al., 2017)▷

K2–40 see WASP–75

K2–41 see WASP–157

K2–42 validation (Crossfield et al., 2016)▷

K2–43 2-planet system; discovery and validation of planet b (Crossfield et al., 2016)▷ discovery of planet c (Hedges et al., 2019)▷

K2–44 validation (Crossfield et al., 2016)▷ radial velocity follow-up (Van Eylen et al., 2016b)▷

K2–45 . . . K2–49 discovery (Crossfield et al., 2016)▷

K2–50 2-planet system; discovery (Crossfield et al., 2016)▷ discovery of planet c (Heller et al., 2019a)▷

K2–51 not in NASA; discovery (Crossfield et al., 2016)▷ re-classified as low-mass (binary) star (Shporer et al., 2017b)▷

K2–52 discovery (Crossfield et al., 2016)▷ Spitzer transit follow-up (Livingston et al., 2019a)▷

K2–53 discovery (Crossfield et al., 2016)▷ Spitzer transit follow-up (Livingston et al., 2019a)▷

K2–54 discovery (Crossfield et al., 2016)▷

K2–55 warm Neptune; discovery (Crossfield et al., 2016)▷ high mass and low envelope fraction (Dressing et al., 2018)▷

K2–56 BD+20 594 in NASA; discovery (Espinoza et al., 2016b)▷

K2–57 discovery (Crossfield et al., 2016)▷

K2–58 3-planet system; discovery (Crossfield et al., 2016)▷

K2–59 2-planet system; discovery (Crossfield et al., 2016)▷

K2–60 discovery (Crossfield et al., 2016)▷ independent discovery (Eigmüller et al., 2017)▷

K2–61 . . . K2–92 1-, 2-, 3-, and 4-planet systems (Crossfield et al., 2016)▷
Amongst these:
K2–66: mass and density measurements (Sinukoff et al., 2017a)▷
K2–67: re-classified as low-mass (binary) star (Shporer et al., 2017b)▷
K2–76: re-classified as low-mass (binary) star (Shporer et al., 2017b)▷
K2–77: in the Pleiades (Campaign 4) field, but not considered a cluster member (Gaidos et al., 2017a)▷
K2–78: re-classified as eclipsing binary (Cabrera et al., 2017)▷
K2–80: 3-planet system confirmation (Mayo et al., 2018)▷
K2–82: re-classified as eclipsing binary (Cabrera et al., 2017)▷
K2–87: Spitzer transit follow-up (Livingston et al., 2019a)▷
K2–90: Spitzer transit follow-up (Livingston et al., 2019a)▷
K2–92: re-classified as eclipsing binary (Cabrera et al., 2017)▷

K2–93 HIP 41378 in NASA; 5-planet system; discovery (Vanderburg et al., 2016a)▷ discrete set of transit ephemerides (Becker et al., 2019)▷ K2 and Spitzer follow-up (Berardo et al., 2019)▷ asteroseismology (Lund et al., 2019)▷

K2–94 see WASP–85A

K2–95 in Praesepe; M-dwarf (JS 183) with Neptune-sized planet; discovery (Obermeier et al., 2016)▷ stellar parameters and cluster membership (Mann et al., 2017b)▷ independent discovery (Pepper et al., 2017a)▷

K2–96 HD 3167 in NASA; 3-planet system, planet d non-transiting; discovery of 2 super-Earths (Vanderburg et al., 2016b)▷ planet d from radial velocity, and planet masses (Christiansen et al., 2017)▷ radial velocities with NOT–FIES (Gandolfi et al., 2017)▷ nearly polar orbit of planet c (Dalal et al., 2019)▷

K2–97 discovery around a red giant (Grunblatt et al., 2016)▷ revise mass (Grunblatt et al., 2017)▷

K2–98 discovery (Barragán et al., 2016)▷

K2–99 discovery (Smith et al., 2017)▷

K2–100 in Praesepe; discovery, stellar parameters and cluster membership (Mann et al., 2017b)▷ diffuser-assisted photometric observations (Stefansson et al., 2018)▷ radial velocity confirmation (Barragán et al., 2019)▷

K2–101 in Praesepe; discovery, stellar parameters and cluster membership (Mann et al., 2017b)▷

K2–102 in Praesepe; discovery, stellar parameters and cluster membership (Mann et al., 2017b)▷

K2–103 EPIC–211822797 in NASA; in Praesepe; discovery, stellar parameters and cluster membership (Mann et al., 2017b)▷

K2–104 in Praesepe; discovery, stellar parameters and cluster membership (Mann et al., 2017b)▷

K2–105 discovery (Narita et al., 2017)▷

K2–106 EPIC–220674823 in NASA; 2-planet system, periods 0.57 d and 13.3 d; discovery (Adams et al., 2017)▷ mass and density measurements (Guenther et al., 2017)▷ mass and density measurements (Sinukoff et al., 2017a)▷

K2–107 discovery (Eigmüller et al., 2017)▷

K2–108 discovery, and sub-Saturnian mass diversity from Keck–HIRES (Petigura et al., 2017)▷

K2–109 HD 106315 in NASA; 2-planet system; discovery (Crossfield et al., 2017)▷ independent discovery (Rodriguez et al., 2017)▷ ground-based photometry of planet c with 1.2-m Euler telescope (Lendl et al., 2017b)▷ improved masses from HARPS radial velocity observations (Barros et al., 2017)▷ constraints on outer planets on inclined orbits (Read et al., 2017)▷ both 'warm Neptunes' have low stellar obliquities (Zhou et al., 2018)▷

K2–110 discovery (Osborn et al., 2017)▷

K2–111 discovery (Fridlund et al., 2017)▷

K2–112 see TRAPPIST–1

K2–113 discovery (Espinoza et al., 2017)▷

K2–114 discovery (Shporer et al., 2017a)▷

K2–115 discovery (Shporer et al., 2017a)▷

K2–116 discovery (Dressing et al., 2017)▷

K2–117 2-planet system; discovery (Dressing et al., 2017)▷ follow-up observations (Hirano et al., 2018a)▷

K2–118 . . . K2–130 1-planet systems; discovery (Dressing et al., 2017)▷
Amongst these:
K2–122: follow-up observations (Hirano et al., 2018a)▷
K2–123: follow-up observations (Hirano et al., 2018a)▷
K2–124: Spitzer transit follow-up (Livingston et al., 2019a)▷

K2–131 discovery (Dai et al., 2017a)▷

K2–132 discovery (Grunblatt et al., 2017)▷ independent discovery (Jones et al., 2018)▷

K2–133 4-planet system around the M dwarf LP 358–499; discovery of planets b–d (Wells et al., 2018)▷ discovery of planet e (Wells et al., 2019)▷

K2–134 see WASP–151

K2–135 GJ 9827 in NASA; 3-planet super-Earth system close to a 1:3:5 mean motion resonance (Niraula et al., 2017)▷ mass determination (Prieto-Arranz et al., 2018)▷ independent discovery (Rodriguez et al., 2018b)▷ Magellan–PFS radial velocities (Teske et al., 2018)▷ masses and radii (Rice et al., 2019)▷

K2–136 3-planet circumprimary system (Earth, mini-Neptune and super-Earth) orbiting a Hyades cluster K dwarf; first multiple transiting planets in a cluster; discovery (Mann et al., 2018)▷ independent discovery of planet c (Ciardi et al., 2018)▷ independent discovery (Livingston et al., 2018b)▷

K2–137 ultra-short period (4.3-h) planet around an M dwarf; discovery (Smith et al., 2018)▷

K2–138 5-planet system of sub-Neptune mass, discovered by Citizen Scientists, in an unbroken chain of near 3:2 resonances; discovery (Christiansen et al., 2018)▷ characterisation of the resonant chain from HARPS (Lopez et al., 2019)▷

K2–139 discovery (Barragán et al., 2018b)▷

K2–140 discovery (Giles et al., 2018a)▷ ephemeris refinement (Močnik et al., 2018a)▷ system characterisation (Korth et al., 2019)▷

K2–141 2-planet system; discovery (Malavolta et al., 2018)▷ independent discovery (Barragán et al., 2018a)▷

K2–146 2-planet system; discovery of planet b (Hirano et al., 2018a)▷ discovery of planet c (Hamann et al., 2019)▷

K2–147 . . . K2–154 1-, 2-, and 3-planet systems; discovery (Hirano et al., 2018a)▷

K2–155 discovery (Hirano et al., 2018b)▷

K2–156 . . . K2–230 1-, 2-, 3-, and 4-planet systems; (Mayo et al., 2018)▷
Amongst these:
K2–158: discovery of planet c (Livingston et al., 2018c)▷
K2–161: system characterisation (Brahm et al., 2019)▷
K2–166: discovery of planet c (Heller et al., 2019a)▷

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K2–168: discovery of planet c (Heller et al., 2019a)▷
K2–174: Spitzer transit follow-up (Livingston et al., 2019a)▷
K2–180: system characterisation (Korth et al., 2019)▷
K2–198: discovery of planets c and d (Hedges et al., 2019)▷
K2–216: confirmation and follow-up (Persson et al., 2018)▷
K2–224: discovery of planet c (Livingston et al., 2018c)▷

K2–231 sub-Neptune transiting a solar twin in the cluster Ruprecht 147; discovery (Curtis et al., 2018)▷
K2–232 discovery (Brahm et al., 2018a)▷
K2–233 3-planet system; discovery (David et al., 2018a)▷
K2–234 HD 89345 in NASA; discovery(Van Eylen et al., 2018)▷
K2–235 see WASP–107
K2–236 EPIC–211945201 in NASA; discovery (Chakraborty et al., 2018)▷
K2–237 discovery (Soto et al., 2018)▷ independent discovery (Smith et al., 2019)▷
K2–238 discovery (Soto et al., 2018)▷
K2–239 3-planet system; discovery (Díez Alonso et al., 2018)▷
K2–240 2-planet system; discovery (Díez Alonso et al., 2018)▷
K2–241 . . . K2–259 1- and 2-planet systems; discovery (Livingston et al., 2018c)▷
K2–260 discovery (Johnson et al., 2018a)▷
K2–261 discovery (Johnson et al., 2018a)▷
K2–262 in preparation
K2–263 50-d orbital period; discovery (Mortier et al., 2018)▷
K2–264 2-planet system in Praesepe; second known system of multiple planets transiting a cluster star; discovery (Rizzuto et al., 2018)▷ independent discovery (Livingston et al., 2019b)▷
K2–265 discovery (Lam et al., 2018)▷ binary star companion resolved by VLT–SPHERE (Ligi et al., 2018)▷
K2–266 compact 4-planet system with a significantly misaligned ultra-short period planet; discovery (Rodriguez et al., 2018a)▷
K2–267 EPIC–246851721 in NASA; discovery (Yu et al., 2018)▷
K2–268 . . . K2–281 1- and 2-planet systems; discovery (Livingston et al., 2018a)▷
K2–282 discovery (Livingston et al., 2018a)▷ confirmation (Heller et al., 2019a)▷
K2–283 discovery (Livingston et al., 2018a)▷
K2–284 discovery (David et al., 2018b)▷
K2–285 4-planet system; discovery (Palle et al., 2019)▷
K2–286 discovery (Díez Alonso et al., 2019)▷
K2–287 discovery (Jordán et al., 2019)▷
K2–288B discovery by Citizen Scientists (Feinstein et al., 2019)▷
K2–289 discovery and Spitzer follow-up (Livingston et al., 2019a)▷
K2–290 2-planet system in a triple star system (Hjorth et al., 2019b)▷
K2–291 discovery (Kosiarek et al., 2019a)▷
K2–292 HD 119130 in NASA; discovery (Luque et al., 2019a)▷
K2–293 discovery from deep learning (Dattilo et al., 2019)▷
K2–294 discovery from deep learning (Dattilo et al., 2019)▷
K2–295 discovery (Smith et al., 2019)▷
K2–296 EPIC–201238110 in NASA; discovery (Heller et al., 2019a)▷
K2–297 EPIC–201497682 in NASA; discovery (Heller et al., 2019a)▷
K2–298 EPIC–201841433 in NASA; discovery (Heller et al., 2019a)▷
K2–299 EPIC–206024342 in NASA; discovery (Heller et al., 2019a)▷
K2–300 EPIC–206032309 in NASA; discovery (Heller et al., 2019a)▷
K2–301 EPIC–206042996 in NASA; discovery (Heller et al., 2019a)▷
K2–302 EPIC–206215704 in NASA; discovery (Heller et al., 2019a)▷
K2–303 EPIC–206317286 in NASA; discovery (Heller et al., 2019a)▷
K2–304 EPIC–212297394 in NASA; discovery (Heller et al., 2019a)▷
K2–305 EPIC–212424622 in NASA; discovery (Heller et al., 2019a)▷
K2–306 EPIC–212499991 in NASA; discovery (Heller et al., 2019a)▷
K2–307 EPIC–212587672 in NASA; discovery (Heller et al., 2019a)▷
K2–308 discovery (Rampalli et al., 2019)▷
K2–309 in preparation
K2–310 EPIC–212737443 in NASA; 2-planet system; discovery (Herath et al., 2019)▷
K2–311 EPIC–248847494 in NASA; discovery (Giles et al., 2018b)▷

KPS (Kourovka Planet Search)

KPS–1 discovery (Burdanov et al., 2018)▷

L, LHS, LP, LTT, Lupus

L98–59 3-planet system; discovery from TESS (Kostov et al., 2019)▷ characterisation with HARPS (Cloutier et al., 2019a)▷
LHS 1140 2-planet system; discovery of planet b (Dittmann et al., 2017b)▷ discovery of planet c (Ment et al., 2019)▷ search for technosignatures with the Green Bank Telescope (Pinchuk et al., 2019)▷ high-energy radiation environment (Spinelli et al., 2019)▷
LHS 3844 discovery from TESS (Vanderspek et al., 2019)▷ absence of a thick atmosphere (Kreidberg et al., 2019a)▷
LTT 1445A terrestrial planet in a triple M dwarf system; discovery from TESS (Winters et al., 2019)▷
Lupus–TR–3 discovery (Weldrake et al., 2008)▷

MASCARA

MASCARA–1 first discovery with MASCARA north (La Palma); hot Jupiter orbiting a $V = 8.3$ mag A star; discovery and Rossiter–McLaughlin effect (Talens et al., 2017)▷
MASCARA–2 see KELT–20
MASCARA–3 not in NASA; discovery (Hjorth et al., 2019a)▷

NGTS

NGTS–1 short-period high-mass planet ($P = 2.674$-d, $M_{\rm p} = 0.8 M_{\rm J}$) with deep (2.5%) grazing transits around an M-dwarf; discovery (Bayliss et al., 2018a)▷ exoplanet-induced radio emission (Turnpenney et al., 2018)▷
NGTS–2 discovery (Raynard et al., 2018)▷
NGTS–3A hot Jupiter in an unresolved binary system; discovery (Günther et al., 2018)▷
NGTS–4 discovery (West et al., 2019)▷
NGTS–5 highly inflated; discovery (Eigmüller et al., 2019)▷
NGTS–6 ultra-short period; discovery (Vines et al., 2019)▷
NGTS–7 in preparation
NGTS–8 discovery (Costes et al., 2019)▷
NGTS–9 discovery (Costes et al., 2019)▷

OGLE

OGLE–TR–10 identification from spectroscopy (Dreizler et al., 2002)▷ confirmation from radial velocity (Konacki et al., 2005)▷ stellar age from Li, Ca II, and rotation (Melo et al., 2006)▷ stellar parameters from spectroscopy (Santos et al., 2006a)▷ stellar parameters (Santos et al., 2006b)▷ additional transits and improved system parameters (Holman et al., 2007a)▷ planet radius from photometry (Pont et al., 2007b)▷ homogeneous analysis and light curve properties (Southworth, 2008)▷ flare during transit, inferred high X-ray luminosity (Bentley et al., 2009)▷ light curve properties (Southworth, 2009)▷ light curve properties (Southworth, 2010)▷
OGLE–TR–56 near-grazing transit; discovery and radial velocity (Konacki et al., 2003)▷ tidal dissipation, planet migration, atmospheric stability (Sasselov, 2003)▷ theoretical planet radius (Burrows et al., 2004)▷ tidal locking and magnetosphere/atmosphere evolution (Grießmeier et al., 2004)▷ tidal dissipation and inspiraling (Pätzold et al., 2004)▷ radial velocities and OGLE photometry (Torres et al., 2004)▷ exclusion of blending (Torres et al., 2005)▷ photometry and radial velocity Wilson–Devinney fitting (Vaccaro & Van Hamme, 2005)▷ stellar age from Li, Ca II, and rotation (Melo et al., 2006)▷ stellar parameters from spectroscopy (Santos et al., 2006a)▷ stellar parameters (Santos et al., 2006b)▷ tidal dissipation and stellar spin-up (Carone & Pätzold, 2007)▷ mass loss by hydrodynamic escape (Erkaev et al., 2007)▷ radius from photometry (Pont et al., 2007b)▷ homogeneous analysis and light curve properties (Southworth, 2008)▷ apsidal precession due to planet tidal bulge (Ragozzine & Wolf, 2009)▷ light curve properties (Southworth, 2009)▷ secondary eclipse from ground photometry (Sing & López-Morales, 2009)▷ homogeneous analysis and light curve properties (Southworth, 2010)▷ 19 transits between 2003–09 (Adams et al., 2011a)▷ transit duration variations due to apsidal and nodal precession (Damiani & Lanza, 2011)▷ tidal effects on radial velocity (Arras et al., 2012)▷ photometry and spectroscopy (Southworth, 2012)▷

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OGLE–TR–111 discovery, radial velocity (Pont et al., 2004)▷ stellar age from Li, Ca II, and rotation (Melo et al., 2006)▷ stellar parameters from spectroscopy (Santos et al., 2006a)▷ stellar parameters (Santos et al., 2006b)▷ ground photometry (Minniti et al., 2007)▷ two additional transits (Winn et al., 2007b)▷ transit time variations (Díaz et al., 2008)▷ homogeneous analysis and light curve properties (Southworth, 2008)▷ light curve properties (Southworth, 2009)▷ transit time variations questioned (Adams et al., 2010a)▷ light curve properties (Southworth, 2010)▷ five new transits from ESO–FORS, dynamical modeling (Hoyer et al., 2011)▷ photometry and new spectroscopy (Southworth, 2012)▷

OGLE–TR–113 discovery, radial velocity (Bouchy et al., 2004)▷ independent confirmation from radial velocity (Konacki et al., 2004)▷ tidal dissipation (Pätzold et al., 2004)▷ transit light curves (Gillon et al., 2006)▷ stellar age from Li, Ca II, and rotation (Melo et al., 2006)▷ stellar parameters from spectroscopy (Santos et al., 2006a)▷ stellar parameters (Santos et al., 2006b)▷ additional transits and improved parameters (Díaz et al., 2007)▷ infrared transits and possible secondary eclipse from NTT–SOFI (Snellen & Covino, 2007)▷ additional transits 2007–09 and limits on transit time variations (Adams et al., 2010b)▷ homogeneous analysis and light curve properties (Southworth, 2010)▷ photometry and new spectroscopy (Southworth, 2012)▷ transits negate rapid orbital decay (Hoyer et al., 2016a)▷ dynamical tides excited by gravity waves in host star affecting planet's orbital evolution (Chernov et al., 2017)▷

OGLE–TR–132 discovery, radial velocity (Bouchy et al., 2004)▷ improved photometry and system parameters (Moutou et al., 2004)▷ tidal dissipation (Pätzold et al., 2004)▷ stellar abundances from spectroscopy (Santos et al., 2006a)▷ improved photometry (Gillon et al., 2007c)▷ homogeneous analysis and light curve properties (Southworth, 2008)▷ light curve properties (Southworth, 2009)▷ light curve properties (Southworth, 2010)▷ seven new transits, limits on transit time variations (Adams et al., 2011b)▷ photometry and new spectroscopy (Southworth, 2012)▷

OGLE–TR–182 discovery, radial velocity (Pont et al., 2008b)▷ homogeneous analysis and light curve (Southworth, 2010)▷

OGLE–TR–211 discovery, radial velocity (Udalski et al., 2008)▷ homogeneous analysis and light curve (Southworth, 2010)▷

OGLE2–TR–L9 discovery, radial velocity (Snellen et al., 2009b)▷ 5 transits and possible transit time variations (Lendl et al., 2010)▷ homogeneous analysis and light curve properties (Southworth, 2010)▷ predicted transit duration variations due to apsidal and nodal precession (Damiani & Lanza, 2011)▷ tidal effects on radial velocity (Arras et al., 2012)▷ photometry and spectroscopy (Southworth, 2012)▷

PH (Planet Hunters)

PH–1 see Kepler–64

PH–2 see Kepler–86

POTS

POTS–1 discovery from Pre-OmegaCam Transit Survey (Koppenhoefer et al., 2013)▷

PTFO

PTFO 8–8695 ≡ CVSO 30; planet(s) are not confirmed, and not in NASA archive; claimed orbital periods are 0.45 d and 27 000 yr, suggestive of formation by planet–planet scattering; transit profiles are of unusual shape, and variable; young hot Jupiter candidate, $M_p \sim 3M_J$, P = 0.45 d, around a T Tauri star; discovery (van Eyken et al., 2012)▷ spin–orbit misalignment and nodal precession (Barnes et al., 2013a)▷ planet not confirmed (Ciardi et al., 2015)▷ precession period of 199 d from photometry for a non-spin–orbit synchronous orbit (Kamiaka et al., 2015)▷ photometric variability described by rotating star spots (Koen, 2015)▷ tests of planetary hypothesis (Yu et al., 2015)▷ reappraisal of planet parameters (Howarth, 2016)▷ variable Hα emission favours planet interpretation (Johns-Krull et al., 2016b)▷ 33 fading events from 144 nights observations over three years (Raetz et al., 2016)▷ imaging discovery of second planet candidate at 1.85 arcsec or 660 au (Schmidt et al., 2016)▷ Roche lobe overflow model and mass-loss for short-period gaseous planets (Jackson et al., 2017)▷ 3-colour photometry favours circumstellar dust clump or occultation of accretion hotspot (Onitsuka et al., 2017)▷ evidence that planet c is a background star (Lee & Chiang, 2018)▷

Qatar

Qatar–1 discovery, radial velocity (Alsubai et al., 2011)▷ Rossiter–McLaughlin effect, revised system parameters (Covino et al., 2013)▷ transit time variations from OLT and PTST (von Essen et al., 2013)▷ chromospheric activity (Kuznyetsova et al., 2014)▷ secondary eclipse with CFHT–WIRCam and limits on ground-based systematics (Croll et al., 2015a)▷ no variation in transit times (Maciejewski et al., 2015)▷ high-precision multicolour time series photometry (Mislis et al., 2015)▷ secondary eclipse in the Ks band with Calar Alto–OMEGA2000 (Cruz et al., 2016)▷ limits on transit timing variations (Collins et al., 2017)▷ photometry and transit times (Püsküllü et al., 2017)▷ ground-based transmission spectrum with GEMINI-N–GMOS (von Essen et al., 2017)▷ Spitzer secondary eclipses (Garhart et al., 2018)▷ transit observations (Thakur et al., 2018)▷

Qatar–2 discovery, radial velocity, evidence of second planet in outer orbit (Bryan et al., 2012)▷ 17 light curves of five transits with obliquity from star spots (Mancini et al., 2014c)▷ gyrochronology and isochrone ages (Maxted et al., 2015)▷ recovery from K2SC pipeline processing (Pope et al., 2016)▷ orbital obliquity, planet mass, and very low albedo from K2 photometry (Dai et al., 2017b)▷ Rossiter–McLaughlin effect and orbital obliquity from HARPS–N (Esposito et al., 2017)▷ recurring sets of recurring star spot occultations (Močnik et al., 2017c)▷

Qatar–3 discovery, radial velocity (Alsubai et al., 2017)▷

Qatar–4 discovery, radial velocity (Alsubai et al., 2017)▷

Qatar–5 discovery, radial velocity (Alsubai et al., 2017)▷

Qatar–6 not in NASA; grazing transit orbiting a bright V = 11.4 K dwarf with P = 3.5 d; discovery (Alsubai et al., 2018)▷

Qatar–7 discovery (Alsubai et al., 2019a)▷

Qatar–8 discovery (Alsubai et al., 2019b)▷

Qatar–9 discovery (Alsubai et al., 2019b)▷

Qatar–10 discovery (Alsubai et al., 2019b)▷

SWEEPS

SWEEPS–4 identification and confirmation from radial velocity (Sahu et al., 2006)▷

SWEEPS–11 identification and confirmation from radial velocity (Sahu et al., 2006)▷ tidal effects on radial velocity (Arras et al., 2012)▷

TESS

TESS discoveries are designated by their star names (see also TOI)

TOI: TESS Object of Interest

TOI–125 2-planet system, with evidence for up to five planets; discovery (Quinn et al., 2019)▷

TOI–150 discovery (Cañas et al., 2019a)▷ independent discovery (Kossakowski et al., 2019)▷

TOI–163 discovery (Kossakowski et al., 2019)▷

TOI–172 discovery (Rodriguez et al., 2019b)▷

TOI–216 2-planet system; discovery (Kipping et al., 2019)▷ confirmation and characterisation (Dawson et al., 2019)▷

TOI–270 discovery (Günther et al., 2019)▷

TRAPPIST

TRAPPIST–1 ≡ K2–112; 7-planet system around an ultracool (T < 2700 K, M8) dwarf star at 12 pc, all of terrestrial mass, orbiting within the (habitable zone) orbital radius of Mercury, and with three-body resonances linking each planet; discovery of 3-planet system with TRAPPIST (Gillon et al., 2016)▷ prospects for detection of O_3 with JWST (Barstow & Irwin, 2016)▷ prospects for detection of Rossiter–McLaughlin effect (Cloutier & Triaud, 2016)▷ combined HST transmission of planets b and c excludes cloud-free H_2-atmosphere (de Wit et al., 2016b)▷ recovery prospects with K2 (Demory et al., 2016b)▷ speckle imaging excludes low-mass companions (Howell et al., 2016)▷ **2017:** climate–vegetation energy-balance habitability

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model (Alberti et al., 2017)⊳ updated astrometry and photometric variability over 12 years (Bartlett et al., 2017)⊳ H_2O loss during the hot early phase of stellar cooling (Bolmont et al., 2017)⊳ trigonometric distance and mass constraints (Boss et al., 2017)⊳ H_2O loss during the hot early phase of stellar cooling (Bourrier et al., 2017b)⊳ system Ly-α emission from HST–STIS (Bourrier et al., 2017e)⊳ biased transit depths from overlapping stellar and planetary lines (Deming & Sheppard, 2017)⊳ stellar wind, and magnetic and plasma environment (Garraffo et al., 2017)⊳ discovery of four further planets with TRAPPIST (Gillon et al., 2017b)⊳ probable absence of exomoons (Kane, 2017)⊳ litho-panspermia $10^4 - 10^5$ faster than solar system (Krijt et al., 2017)⊳ litho-panspermia propagation and observational metrics (Lingam & Loeb, 2017a)⊳ reduced diversity of life around M dwarfs from atmospheric erosion (Lingam & Loeb, 2017b)⊳ K2 observations constrain orbit for planet h, and confirm 7-planet resonant chain (Luger et al., 2017c)⊳ planet–planet occultations outside of transit observable with JWST (Luger et al., 2017a)⊳ suitability for JWST (Morley et al., 2017b)⊳ ultraviolet surface environment models and habitability (O'Malley-James & Kaltenegger, 2017)⊳ formation through pebble-accretion at the H_2O-ice line (Ormel et al., 2017)⊳ Earth-like compositions confirmed from N-body simulations (Quarles et al., 2017)⊳ stellar activity and likely ultraviolet atmospheric erosion (Roettenbacher & Kane, 2017)⊳ system longevity as a result of convergent migration (Tamayo et al., 2017)⊳ eclipse, transit and occultation geometry at exo-syzygy (Veras & Breedt, 2017)⊳ stellar flaring from K2 observations and implications for habitability (Vida et al., 2017)⊳ XMM–Newton X-ray observations and high L_X/L_{bol} (Wheatley et al., 2017)⊳ habitability from 3d climate models (Wolf, 2017)⊳ as an example of anti-correlation between multiplicity and eccentricity (Zinzi & Turrini, 2017)⊳ **2018:** interior structures and tidal heating (Barr et al., 2018)⊳ the truncated circumstellar disk of V410 X-ray 1 as a precursor (Boneberg et al., 2018)⊳ stratospheric circulation and O_3 production in tidally locked planets (Carone et al., 2018)⊳ energy dissipation in the upper planetary atmospheres (Cohen et al., 2018)⊳ refined transit parameters from Spitzer–IRAC and limits on stellar variability (Delrez et al., 2018a)⊳ hydrodynamical modeling of Laplace resonance formation (Dempsey & Nelson, 2018)⊳ atmospheric reconnaissance of the habitable zone planet (de Wit et al., 2018)⊳ activity of the host star (Dmitrienko & Savanov, 2018)⊳ atmospheric escape and habitability (Dong et al., 2018)⊳ interior characterisation in multi-planetary systems (Dorn et al., 2018)⊳ 0.8–4.5 μm broadband transmission spectra (Ducrot et al., 2018)⊳ dimensionality and integrals of motion show that the system is atypical but stable (Floß et al., 2018)⊳ planet masses and densities from transit timing variations (Grimm et al., 2018)⊳ mass constraints on precursor disks (Haworth et al., 2018)⊳ dynamical constraints on non-transiting planets (Jontof-Hutter et al., 2018)⊳ detectability of oceans from polarisation modeling (Kopparla et al., 2018)⊳ effect of cometary impactors on planetary atmospheres (Kral et al., 2018)⊳ detectability of biosignatures in anoxic atmospheres with JWST (Krissansen-Totton et al., 2018)⊳ evolved climates and observational discriminants (Lincowski et al., 2018)⊳ resonant chains via long-scale migration, short-scale migration, and/or eccentricity damping (MacDonald & Dawson, 2018)⊳ spin–orbital tidal dynamics and tidal heating (Makarov et al., 2018)⊳ limits on clouds and hazes (Moran et al., 2018)⊳ possible bright star spots (Morris et al., 2018a)⊳ photometric analysis and transit times of planets b and c (Morris et al., 2018b)⊳ non-detection of contamination by stellar activity with Spitzer (Morris et al., 2018c)⊳ consequences for radius inflation and planetary habitability of magnetic fields on the flare star (Mullan et al., 2018)⊳ orbital evolution, tidal dissipation, formation and habitability (Papaloizou et al., 2018)⊳ deep radio limit at 4–8 GHz with VLA (Pineda & Hallinan, 2018)⊳ polarisation due to planetary transits (Sengupta, 2018)⊳ climate diversity, tidal dynamics and the fate of volatiles (Turbet et al., 2018)⊳ exoplanet-induced radio emission (Turnpenney et al., 2018)⊳ inward planetary migration inferred from H_2O-rich compositions (Unterborn et al., 2018)⊳ stellar parameters (Van Grootel et al., 2018)⊳ near-infrared transmission spectra and stellar contamination (Zhang et al., 2018b)⊳ **2019:** resonance breaking and tidal parameters (Brasser et al., 2019)⊳ constraints on transit depth variations in the infrared (Burdanov et al., 2019)⊳ pebble versus planetesimal accretion, and resulting water content (Coleman et al., 2019)⊳ water delivery via late heavy bombardment events (Dencs & Regály, 2019)⊳ tidal heating and habitability (Dobos et al., 2019)⊳ observability of H-rich exosphere (dos Santos et al., 2019a)⊳ impact of clouds and hazes on simulated JWST transmission spectra (Fauchez et al., 2019)⊳ stellar energetic particles in the magnetically turbulent habitable zones (Fraschetti et al., 2019)⊳ stellar parameters and age (Gonzales et al., 2019)⊳ planet–planet tidal heating (Hay & Matsuyama, 2019)⊳ optimised transit detection algorithm (Hippke & Heller, 2019)⊳ constraints on radio emission (Hughes et al., 2019)⊳ simulation of radial velocities with SPIRou (Klein & Donati, 2019)⊳ detectability and characterisation of planet atmospheres with JWST (Lustig-Yaeger et al., 2019)⊳ atmospheric temperature profiles (Malik et al., 2019)⊳ extreme ultraviolet radiation environment (Peacock et al., 2019b)⊳ search for technosignatures with the Green Bank Telescope (Pinchuk et al., 2019)⊳ innermost planets formed by planetesimal accretion, outermost by pebble accretion (Schoonenberg et al., 2019)⊳ chaotic nature of the planet spin states (Vinson et al., 2019)⊳ disentangling atmospheric transmission of star and planets (Wakeford et al., 2019)⊳ influence of inclinations on dynamical stability (Wang et al., 2019b)⊳

TrES

TrES–1 discovery, radial velocity (Alonso et al., 2004)⊳ spectroscopic determination of stellar parameters, chemical abundances, age (Sozzetti et al., 2004)⊳ secondary eclipses and atmospheric modeling from Spitzer (Burrows et al., 2005)⊳ detection of thermal emission with Spitzer (Charbonneau et al., 2005)⊳ secondary eclipses and atmospheric modeling from Spitzer (Fortney et al., 2005)⊳ humps in AAVSO egress (Price et al., 2005)⊳ limits on transit time variations (Steffen & Agol, 2005)⊳ stellar age from Li, Ca II, and rotation (Melo et al., 2006)⊳ stellar parameters and abundances from spectroscopy (Santos et al., 2006a)⊳ stellar parameters (Santos et al., 2006b)⊳ stellar parameters (Sozzetti et al., 2006b)⊳ mass loss through hydrodynamic escape (Erkaev et al., 2007)⊳ limits on secondary eclipse from ground (Knutson et al., 2007b)⊳ Rossiter–McLaughlin effect (Narita et al., 2007)⊳ improved photometry and absence of star spots (Winn et al., 2007d)⊳ homogeneous analysis and light curve properties (Southworth, 2008)⊳ possible star spots (Dittmann et al., 2009b)⊳ star spots or second transiting planet from HST photometry (Rabus et al., 2009a)⊳ limits on transit time variations (Rabus et al., 2009b)⊳ additional transits (Raetz et al., 2009b)⊳ light curve properties (Southworth, 2009)⊳ homogeneous analysis and light curve properties (Southworth, 2010)⊳ transits observed with Shandong/Weihai 1-m (Zhang et al., 2011)⊳ stellar companion from lucky imaging (Faedi et al., 2013b)⊳ reanalysis of Spitzer transits and eclipses (Cubillos et al., 2014)⊳ compilation of light curves and transit timing (Baluev et al., 2015)⊳

TrES–2 ≡ Kepler–1; discovered in pre-operational Kepler field; near-grazing transit, very low albedo; discovery, radial velocity (O'Donovan et al., 2006)⊳ additional transits and improved system parameters (Holman et al., 2007b)⊳ additional transits and improved system parameters (Sozzetti et al., 2007)⊳ homogeneous analysis and light curve properties (Southworth, 2008)⊳ Rossiter–McLaughlin effect (Winn et al., 2008e)⊳ stellar binary (Daemgen et al., 2009)⊳ orbit stability (Freistetter et al., 2009)⊳ change in transit duration due to change in orbit inclination (Mislis & Schmitt, 2009)⊳ limits on transit time variations (Rabus et al., 2009b)⊳ additional transits (Raetz et al., 2009a)⊳ light curve properties (Southworth, 2009)⊳ transit observations with GTC (Colón et al., 2010)⊳ secondary eclipse from CFHT (Croll et al., 2010a)⊳ effects of data binning (Kipping, 2010)⊳ additional transits (Mislis et al., 2010)⊳ thermal inversion and molecular abundances (Madhusudhan & Seager, 2010)⊳ secondary eclipses from Spitzer (O'Donovan et al., 2010)⊳ limits on changes in orbit inclination (Scuderi et al., 2010)⊳ atmospheric models from Spitzer and Kepler (Spiegel & Burrows, 2010)⊳ homogeneous analysis and light curve properties (Southworth, 2010)⊳ search for additional planets from EPOXI (Ballard et al., 2011a)⊳ possible star spots from EPOXI (Christiansen et al., 2011)⊳ 18 transits from Kepler, system parameters, limits on albedo (Kipping & Bakos, 2011b)⊳ limits on transit time variations and albedo (Kipping & Spiegel, 2011)⊳ photometry and new spectroscopy (Southworth, 2011)⊳ 2.7-yr of Kepler data, asteroseismology, ellipsoidal variations, Doppler beaming, albedo, secondary eclipse, and atmospheric constraints (Barclay et al., 2012)⊳ tidal effects and spin–orbit alignment from orbit eccentricity (Husnoo et al., 2012)⊳ possible change in orbit inclination (Schröter et al., 2012)⊳ modeling from 15 quarters of Kepler (Esteves et al., 2013)⊳ confirmed stellar companion from lucky imaging (Faedi et al., 2013b)⊳ atmospheric disequilibrium diagnostics (Line & Yung, 2013)⊳ atmospheric disequilibrium

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diagnostics (Line et al., 2014)⊳ transit times from 490 transits (Raetz et al., 2014)⊳ atmospheric characterisation with HST–WFC3 (Ranjan et al., 2014)⊳ Kepler secondary eclipse and phase curves (Angerhausen et al., 2015a)⊳ Kepler phase curve with beaming and ellipsoidal variations (Esteves et al., 2015)⊳ Kepler phase curves with beaming, ellipsoidal, and reflection phase modulation (Faigler & Mazeh, 2015)⊳ nearby star from lucky imaging (Wöllert et al., 2015)⊳ photometric analysis of all Kepler data (Budding et al., 2016b)⊳ use as a precision clock to constrain time variation of the gravitational constant (Masuda & Suto, 2016)⊳ no asymmetry in ground-based ultraviolet transits (Turner et al., 2016b)⊳ heat recirculation and albedo from comparison of optical phase curve and secondary eclipse (von Paris et al., 2016b)⊳ simple transit model (Ji et al., 2017)⊳ climate models (Wang & Cuntz, 2017)⊳ transit modeling (Huang et al., 2019)⊳ new photometric analysis (Öztürk & Erdem, 2019)⊳

TrES–3 discovery, radial velocity confirmation (O'Donovan et al., 2007)⊳ limits on secondary eclipse (Winn et al., 2008c)⊳ secondary eclipse from WHT/UKIRT (de Mooij & Snellen, 2009)⊳ 9 transits from RISE, limits on transit time variations (Gibson et al., 2009)⊳ apsidal precession due to planetary tidal bulge (Ragozzine & Wolf, 2009)⊳ photometry, spectroscopy, and revised system parameters (Sozzetti et al., 2009)⊳ transit observations with GTC (Colón et al., 2010)⊳ secondary eclipse in Ks from CFHT (Croll et al., 2010b)⊳ broadband infrared emission spectrum (Fressin et al., 2010)⊳ homogeneous analysis and light curve properties (Southworth, 2010)⊳ search for additional planets from EPOXI (Ballard et al., 2011a)⊳ 7 transits from EPOXI, possible star spots (Christiansen et al., 2011)⊳ polarisation studies (Kostogryz et al., 2011)⊳ ephemeris from 109 transits, possible star spots (Lee et al., 2011c)⊳ photometry and new spectroscopy (Southworth, 2011)⊳ prospects for detecting bow shocks (Vidotto et al., 2011)⊳ transits observed with Shandong/Weihai 1-m (Zhang et al., 2011)⊳ possible transit time variations from 23 light curves (Jiang et al., 2013)⊳ transits from Apache Point–APOSTLE (Kundurthy et al., 2013b)⊳ atmospheric disequilibrium diagnostics (Line & Yung, 2013)⊳ transit times from 2009–2013 consistent with linear ephemeris (Maciejewski et al., 2013c)⊳ constraints on magnetic field from near ultraviolet transits (Turner et al., 2013)⊳ no transit time variations (Vaňko et al., 2013)⊳ atmospheric disequilibrium diagnostics (Line et al., 2014)⊳ atmospheric characterisation with HST–WFC3 (Ranjan et al., 2014)⊳ Rayleigh scattering from GTC–OSIRIS (Parviainen et al., 2016)⊳ improved orbit from HARPS–N (Bonomo et al., 2017a)⊳ improved spectroscopy favours a flat spectrum (Mackebrandt et al., 2017)⊳ photometry and transit times (Püsküllü et al., 2017)⊳ linear ephemeris over 9 yr (Ricci et al., 2017a)⊳ improved ground-based transit photometry using beam-shaping diffusers (Stefansson et al., 2017)⊳ photometric follow-up and transit timing analysis with the Xuyi Near-Earth Object Survey Telescope (Zhao et al., 2018b)⊳ photometry and transit timing variations (Sun et al., 2018)⊳

TrES–4 hot Jupiter with large radius ($1.8R_J$); discovery, radial velocity (Mandushev et al., 2007)⊳ modeling of radius (Liu et al., 2008a)⊳ stellar binary (Daemgen et al., 2009)⊳ secondary eclipses and atmospheric temperature inversion from Spitzer (Knutson et al., 2009a)⊳ stellar proper motion and transit timing (Rafikov, 2009)⊳ photometry, spectroscopy, and revised system parameters (Sozzetti et al., 2009)⊳ inflation through Ohmic dissipation (Batygin & Stevenson, 2010)⊳ tidal heating (Ibgui et al., 2010)⊳ thermal inversion and molecular abundances (Madhusudhan & Seager, 2010)⊳ Rossiter–McLaughlin effect and additional radial velocity variability (Narita et al., 2010c)⊳ homogeneous analysis and light curve properties (Southworth, 2010)⊳ transits and improved ephemeris (Chan et al., 2011)⊳ predicted transit duration variations due to apsidal and nodal precession (Damiani & Lanza, 2011)⊳ coupled radius–orbit evolutionary models (Ibgui et al., 2011)⊳ new transits confirming large radius (Chan et al., 2012)⊳ photometry and new spectroscopy (Southworth, 2012)⊳ lucky imaging confirmation of common proper motion companion (Bergfors et al., 2013)⊳ confirmed stellar companion from lucky imaging (Faedi et al., 2013b)⊳ atmospheric characterisation with HST–WFC3 (Ranjan et al., 2014)⊳ significantly lower mass from HARPS–N, and very low density (Sozzetti et al., 2015)⊳ nearby star from lucky imaging (Wöllert et al., 2015)⊳ no asymmetry in ground-based ultraviolet transits (Turner et al., 2016b)⊳ secondary eclipse from CFHT–WIRCam (Martioli et al., 2018)⊳

TrES–5 discovery, radial velocity (Mandushev et al., 2011)⊳ high-precision multicolour time series photometry (Mislis et al., 2015)⊳ photometry with a DSLR camera (Miller, 2015)⊳ additional transit observations (Maciejewski et al., 2016b)⊳ transit timing analysis and possible existence of planet c (Sokov et al., 2018)⊳

WASP

1SWASP J1407 (1SWASP J140747.93–394542.6); not in NASA; although not attributed directly to a planet, the star shows long, deep, eclipses, modeled as a system of circumstellar or circumplanetary disks; discovery of the transiting ring system (Mamajek et al., 2012)⊳ eclipse fine-structure and hints of exomoons (van Werkhoven et al., 2014b)⊳ ring possibly sculpting by exomoons (Kenworthy & Mamajek, 2015)⊳ mass and period limits on the ringed companion (Kenworthy et al., 2015)⊳ constraints on size/dynamics (Rieder & Kenworthy, 2016)⊳ anomalous light curves of young tilted exorings (Sucerquia et al., 2017)⊳ constraints on disks/rings (Zanazzi & Lai, 2017)⊳ photographic plate constraints on the period of the ringed secondary companion (Mentel et al., 2018)⊳

WASP–1 discovery, radial velocity (Collier Cameron et al., 2007)⊳ photometry and planet radius (Charbonneau et al., 2007)⊳ two transits (Shporer et al., 2007)⊳ stellar spectroscopy, Li abundance, age (Stempels et al., 2007)⊳ homogeneous analysis and light curve properties (Southworth, 2008)⊳ light curve properties (Southworth, 2009)⊳ light curve properties (Southworth, 2010)⊳ limits on Rossiter–McLaughlin effect from Magellan, Subaru, Keck (Albrecht et al., 2011)⊳ mass loss rate from extreme ultraviolet and X-ray radiation (Ehrenreich & Désert, 2011)⊳ Rossiter–McLaughlin effect from OHP–SOPHIE (Simpson et al., 2011c)⊳ transits observed with Shandong/Weihai 1-m (Zhang et al., 2011)⊳ Rossiter–McLaughlin effect from Magellan, Keck (Albrecht et al., 2012b)⊳ tidal effects on radial velocity (Arras et al., 2012)⊳ photometry and new spectroscopy (Southworth, 2012)⊳ new transits from Asiago–TASTE, linear ephemeris (Granata et al., 2014)⊳ 13 new transits, revised parameters, linear ephemeris (Maciejewski et al., 2014b)⊳ no asymmetry in ground-based ultraviolet transits (Turner et al., 2016b)⊳

WASP–2 discovery, radial velocity (Collier Cameron et al., 2007)⊳ improved photometry and planet radius (Charbonneau et al., 2007)⊳ homogeneous analysis and light curve properties (Southworth, 2008)⊳ stellar binary (Daemgen et al., 2009)⊳ stellar proper motion and transit timing (Rafikov, 2009)⊳ light curve properties (Southworth, 2009)⊳ three transits and atmospheric modeling (Southworth et al., 2010)⊳ homogeneous analysis and light curve properties (Southworth, 2010)⊳ Rossiter–McLaughlin effect from ESO–HARPS and CORALIE (Triaud et al., 2010)⊳ limits on Rossiter–McLaughlin effect from Magellan, Subaru, Keck (Albrecht et al., 2011)⊳ transits observed with Shandong/Weihai 1-m (Zhang et al., 2011)⊳ Rossiter–McLaughlin effect from Magellan, Keck (Albrecht et al., 2012b)⊳ tidal effects and spin–orbit alignment from orbit eccentricity (Husnoo et al., 2012)⊳ photometry and new spectroscopy (Southworth, 2012)⊳ lucky imaging confirmation of stellar companion (Bergfors et al., 2013)⊳ transits from Apache Point–APOSTLE and limits on transit time variations (Becker et al., 2013)⊳ compilation of light curves and transit timing (Baluev et al., 2015)⊳ nearby star from lucky imaging (Wöllert et al., 2015)⊳ Ks-band secondary eclipse observations with AAT–IRIS2 (Zhou et al., 2015b)⊳ photometry and atmospheric models (Turner et al., 2017)⊳ constraints on co-orbiting Trojans (Lillo-Box et al., 2018)⊳

WASP–3 discovery, radial velocity (Pollacco et al., 2008)⊳ 9 transits from RISE and improved ephemeris (Gibson et al., 2008)⊳ line-profile tomography (Miller et al., 2010)⊳ sinusoidal transit time variations (Maciejewski et al., 2010)⊳ homogeneous analysis and light curve properties (Southworth, 2010)⊳ Rossiter–McLaughlin effect (Simpson et al., 2010)⊳ Rossiter–McLaughlin effect (Tripathi et al., 2010)⊳ search for additional planets from EPOXI (Ballard et al., 2011a)⊳ 8 transits from EPOXI and limits on secondary eclipse (Christiansen et al., 2011)⊳ predicted transit duration variations due to apsidal and nodal precession (Damiani & Lanza, 2011)⊳ sinusoidal transit time variations (Littlefield, 2011)⊳ photometry and new spectroscopy (Southworth, 2011)⊳ transits observed with Shandong/Weihai 1-m (Zhang et al., 2011)⊳ tidal effects on radial velocity (Arras et al., 2012)⊳ possible transit duration variations (Eibe et al., 2012)⊳ new transits and limits on transit time variations (Montalto et al., 2012)⊳ secondary eclipse in Ks from Palomar–WIRC (Zhao et al., 2012a)⊳ 17 radial velocity measurements and 32 transit light curves confirm linear ephemeris (Maciejewski et al., 2013b)⊳ new transits and limits on transit time variations (Nascimbeni et al., 2013a)⊳ 11 new transits, and homogeneous treatment of a further 38, confirm lin-

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ear ephemeris (Nascimbeni et al., 2013a)▷ modelling of light curve and radial velocity of transits and spots using SOAP–T (Oshagh et al., 2013a)▷ rapid atmospheric heat redistribution from Spitzer (Rostron et al., 2014)▷ secondary eclipse with CFHT–WIRCam and limits on ground-based systematics (Croll et al., 2015a)▷ new transit timing observations (Maciejewski et al., 2018b)▷

WASP–4 discovery, radial velocity (Wilson et al., 2008)▷ radial velocities and improved parameters (Gillon et al., 2009c)▷ apsidal precession due to planetary tidal bulge (Ragozzine & Wolf, 2009)▷ four transits from defocused observations (Southworth et al., 2009a)▷ two transits and limits on transit time variations (Winn et al., 2009a)▷ tidal heating models (Ibgui et al., 2010)▷ homogeneous analysis and light curve properties (Southworth, 2010)▷ Rossiter–McLaughlin effect (Triaud et al., 2010)▷ secondary eclipse and atmosphere modeling from Spitzer (Beerer et al., 2011)▷ secondary eclipse from ground near-infrared photometry (Cáceres et al., 2011)▷ TERMS photometry (Dragomir et al., 2011)▷ coupled radius–orbit evolutionary models (Ibgui et al., 2011)▷ polarisation studies (Kostogryz et al., 2011)▷ star spots and constraints on spin–orbit alignment (Sanchis-Ojeda et al., 2011)▷ prospects for detecting bow shocks (Vidotto et al., 2011)▷ tidal effects on radial velocity (Arras et al., 2012)▷ tidal effects and spin–orbit alignment from orbit eccentricity (Husnoo et al., 2012)▷ three transits and limits on transit time variations (Nikolov et al., 2012)▷ photometry and new spectroscopy (Southworth, 2012)▷ 12 transits from TraMoS confirm linear ephemeris, star spots give 34 d rotation (Hoyer et al., 2013)▷ 6 transits and 28 archival confirm linear ephemeris (Petrucci et al., 2013)▷ atmospheric characterisation with HST–WFC3 (Ranjan et al., 2014)▷ thermal emission versus orbit phase with HST indicate large day/night variations (Stevenson et al., 2014d)▷ orbital decay driven by tidal dissipation (Valsecchi & Rasio, 2014)▷ compilation of light curves and transit timing (Baluev et al., 2015)▷ transits with a 0.4-m telescope (Kjurkchieva et al., 2015)▷ gyrochronology and isochrone ages (Maxted et al., 2015)▷ Ks-band secondary eclipse observations with AAT–IRIS2 (Zhou et al., 2015b)▷ Gemini–GMOS transmission spectrum 440–940 nm (Huitson et al., 2017)▷ flat optical spectrum (and first results) from Michigan–MOPSS (May et al., 2018)▷ transit timings (Baluev et al., 2019)▷ ground-based optical transmission spectroscopy (Bixel et al., 2019)▷ tidal orbital decay or apsidal precession as explanations for early TESS transit times (Bouma et al., 2019)▷ transit timing variations (Southworth et al., 2019)▷

WASP–5 discovery, radial velocity (Anderson et al., 2008)▷ radial velocities and improved parameters (Gillon et al., 2009c)▷ two transits from defocused observations (Southworth et al., 2009c)▷ homogeneous analysis and light curve properties (Southworth, 2010)▷ Rossiter–McLaughlin effect (Triaud et al., 2010)▷ TERMS photometry (Dragomir et al., 2011)▷ 7 transits and possible transit time variations (Fukui et al., 2011)▷ prospects for detecting bow shocks (Vidotto et al., 2011)▷ 9 transits with TraMoS confirm linear ephemeris (Hoyer et al., 2012)▷ tidal effects and spin–orbit alignment from orbit eccentricity (Husnoo et al., 2012)▷ photometry and new spectroscopy (Southworth, 2012)▷ atmospheric pressure–temperature profile from secondary eclipse with Spitzer–IRAC (Baskin et al., 2013)▷ secondary eclipse from MPG–GROND (Chen et al., 2014a)▷ compilation of light curves and transit timing (Baluev et al., 2015)▷ gyrochronology and isochrone ages (Maxted et al., 2015)▷ Ks-band secondary eclipse observations with AAT–IRIS2 (Zhou et al., 2015b)▷ multicolour characterisation (Moyano et al., 2017)▷ constraints on co-orbiting Trojans (Lillo-Box et al., 2018)▷

WASP–6 discovery, radial velocity, and Rossiter–McLaughlin effect (Gillon et al., 2009a)▷ tidal heating (Ibgui et al., 2010)▷ TERMS photometry (Dragomir et al., 2011)▷ coupled radius–orbit evolutionary models (Ibgui et al., 2011)▷ tidal effects and spin–orbit alignment from orbit eccentricity (Husnoo et al., 2012)▷ featureless ground transmission spectrum from Baade–IMACS (Jordán et al., 2013)▷ Spitzer secondary eclipse observations at 3.6 and 4.5 μm (Kammer et al., 2015)▷ atmospheric haze (Nikolov et al., 2015)▷ H_2O in clear/cloudy atmospheres from infrared transit spectroscopy (Sing et al., 2016)▷ transits and star spots (Tregloan-Reed et al., 2015)▷ atmospheric circulation (Kataria et al., 2016)▷ atmospheric retrieval analysis with NEMESIS (Barstow et al., 2017)▷

WASP–7 discovery, radial velocity (Hellier et al., 2009b)▷ transit from defocused observations, revised radius (Southworth et al., 2011)▷ photometry and new spectroscopy (Southworth, 2011)▷ Rossiter–McLaughlin effect and stellar jitter (Albrecht et al., 2012a)▷ tidal effects and spin–orbit alignment from eccentricity (Husnoo et al., 2012)▷ physical properties (Southworth, 2012)▷

WASP–8 2-planet system, planet b discovered from transits, planet c from radial velocity; discovery of planet b, radial velocity, Rossiter–McLaughlin effect and retrograde orbit (Queloz et al., 2010)▷ 6 secondary eclipses and atmosphere modeling from Spitzer (Cubillos et al., 2013)▷ discovery/confirmation of planet c from radial velocity with Keck–HIRES (Knutson et al., 2014c)▷ Rossiter–McLaughlin effect and refined architecture (Bourrier et al., 2017a)▷ atmospheric modeling with HELIOS (Malik et al., 2017)▷

WASP–9 unpublished (false positive)

WASP–10 discovery, radial velocity (Christian et al., 2009)▷ transits and revised radius (Johnson et al., 2009b)▷ transits and revised radius (Dittmann et al., 2010)▷ transits and revised radius (Krejčová et al., 2010)▷ homogeneous analysis and light curve properties (Southworth, 2010)▷ transits, star spots, transit time variations (Maciejewski et al., 2011a)▷ transits, star spots, transit time variations (Maciejewski et al., 2011c)▷ tidal effects and spin–orbit alignment from orbit eccentricity (Husnoo et al., 2012)▷ transits, star spots, transit time variations (Barros et al., 2013)▷ radial velocity search for massive long-period companion (Knutson et al., 2014c)▷ secondary eclipse in the Ks band with Calar Alto–OMEGA2000 (Cruz et al., 2015)▷ Spitzer secondary eclipse observations at 3.6 and 4.5 μm (Kammer et al., 2015)▷ gyrochronology and isochrone ages (Maxted et al., 2015)▷ transits from Monterrey observatory (Sada & Ramón-Fox, 2016)▷

WASP–11 ≡ HAT–P–10; discovery, radial velocity (West et al., 2009b)▷ independently as HAT–P–10 (Bakos et al., 2009b)▷ infrared transits, star spots (Sada et al., 2012)▷ radial velocity search for massive long-period companion (Knutson et al., 2014c)▷ transits from Yunnan confirm linear ephemeris (Wang et al., 2014c)▷ Rossiter–McLaughlin effect (Mancini et al., 2015a)▷

WASP–12 short period (P = 1.09 d, a = 0.2 au), orbits primary of hierarchical triple system, irradiated and inflated, with early ultraviolet ingress due to bow shocks or Roche lobe overflow; discovery, radial velocity (Hebb et al., 2009)▷ apsidal precession due to planetary tidal bulge (Ragozzine & Wolf, 2009)▷ **2010:** ultraviolet secondary eclipse, exospheric metal absorption, and early ultraviolet ingress from HST (Fossati et al., 2010b)▷ stellar abundances, limits on stellar magnetic field (Fossati et al., 2010a)▷ tidal heating (Ibgui et al., 2010)▷ early ultraviolet transit ingress due to bow shock and Roche lobe overflow/disk accretion (Lai et al., 2010)▷ mass loss, possible perturbing planet (Li et al., 2010)▷ secondary eclipse and atmospheric modeling (López-Morales et al., 2010)▷ early transit ingress due to bow shock (Vidotto et al., 2010)▷ **2011:** reflection effect (Budaj, 2011)▷ secondary eclipse in near infrared from CFHT–WIRCam (Croll et al., 2011b)▷ additional transits (Chan et al., 2011)▷ secondary eclipses and limits on eccentricity and apsidal precession from Spitzer (Campo et al., 2011)▷ predicted transit duration variations due to apsidal and nodal precession (Damiani & Lanza, 2011)▷ high mass loss from extreme ultraviolet and X-ray radiation (Ehrenreich & Désert, 2011)▷ limits on eccentricity from radial velocities (Husnoo et al., 2011)▷ bow shock (Llama et al., 2011)▷ transit time variations and possible perturbing planet (Maciejewski et al., 2011b)▷ CO, H_2O, and CH_4 abundances (Madhusudhan et al., 2011b)▷ models of C-rich atmospheric chemistry, thermal inversions, and formation (Madhusudhan et al., 2011c)▷ C/O ratio arising from effects of the snow line (Öberg et al., 2011)▷ consideration of bow shocks (Vidotto et al., 2011)▷ **2012:** tidal effects on radial velocity (Arras et al., 2012)▷ Rossiter–McLaughlin effect from Magellan, Keck (Albrecht et al., 2012b)▷ transits, improved ephemeris (Chan et al., 2012)▷ secondary eclipse and atmospheric modeling from IRTF (Crossfield et al., 2012b)▷ ellipsoidal variations at 3.6 and 4.5μm (Cowan et al., 2012)▷ narrow-band secondary eclipse photometry and atmospheric modeling (Crossfield et al., 2012a)▷ wavelength-dependent astrometric motion (Coughlin & López-Morales, 2012)▷ near-ultraviolet absorption, chromospheric activity, star–planet interactions (Haswell et al., 2012)▷ tidal effects and spin–orbit alignment from orbit eccentricity (Husnoo et al., 2012)▷ C_2H_2 versus CH_4 abundances (Kopparapu et al., 2012)▷ C/O ratio as a characterisation of atmospheres (Madhusudhan, 2012)▷ photometry and new spectroscopy (Southworth, 2012)▷ possible star spots or satellites from Pulkovo (Sokov et al., 2012)▷ Ks-band secondary eclipse from ground (Zhao et al., 2012b)▷ plasma interactions between planet and host star (Bisikalo et al., 2013)▷ **2013:** stellar companion from

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lucky imaging (Bergfors et al., 2013)⊳ Rayleigh scattering from high-altitude haze from WHT–ULTRACAM (Copperwheat et al., 2013)⊳ absorbing gas from stellar irradiation responsible for low stellar activity index (Fossati et al., 2013a)⊳ C-rich atmosphere from WHT–ULTRACAM (Föhring et al., 2013)⊳ atmospheric disequilibrium diagnostics (Line & Yung, 2013)⊳ 61 transits with transit time variations and possible perturbing planet (Maciejewski et al., 2013a)⊳ C/O modeling and confirmation of C-rich atmosphere (Moses et al., 2013b)⊳ H_2O absorption at 1.4 μm from HST–WFC3 (Mandell et al., 2013)⊳ atmospheric heat redistribution efficiency drops as stellar insolation rises (Perez-Becker & Showman, 2013)⊳ spectroscopy from HST, identification of hot spot near substellar point (Swain et al., 2013)⊳ CO constraints from HST–WFC3 (Swain et al., 2013)⊳ aerosols and lack of TiO from HST–WFC3 (Sing et al., 2013)⊳ **2014:** C-rich planet formation in a solar-composition disk (Ali-Dib et al., 2014)⊳ planet orbits primary of hierarchical triple system from Keck imaging (Bechter et al., 2014)⊳ detecting exomoons via a transiting plasma torus (Ben-Jaffel & Ballester, 2014)⊳ atmospheric disequilibrium diagnostics (Line et al., 2014)⊳ orbit parameters versus atmospheric species (Miguel & Kaltenegger, 2014)⊳ H_2O from HST–WFC3 (Madhusudhan et al., 2014)⊳ exclusion of cloud-free H_2 atmosphere from Gemini–GMOS (Stevenson et al., 2014c)⊳ C-rich atmosphere from HST and Spitzer secondary eclipses (Stevenson et al., 2014b)⊳ **2015:** defocused transmission spectroscopy, and possible detection of Na (Burton et al., 2015)⊳ maximum size of stationary quasi-closed gaseous envelope (Bisikalo et al., 2015)⊳ secondary eclipse with CFHT–WIRCam and limits on ground-based systematics (Croll et al., 2015a)⊳ detection of H_2O with HST–WFC3 (Kreidberg et al., 2015)⊳ impact of stellar activity on X-ray and ultraviolet transits (Llama & Shkolnik, 2015)⊳ near ultraviolet transit with HST (Nichols et al., 2015)⊳ constraints on Bond albedo and day–night heat transport from secondary eclipse depths (Schwartz & Cowan, 2015)⊳ **2016:** magnetospheric models, bow shocks, and near-ultraviolet absorption (Alexander et al., 2016)⊳ C/O ratio, and CO, CO_2, and H_2O abundances (Heng & Lyons, 2016)⊳ ultraviolet light curves attributed to outgassing from Trojan satellites on tadpole orbits (Kislyakova et al., 2016)⊳ new transit times from 2012–16 suggestive of tidal decay (Maciejewski et al., 2016a)⊳ H_2O in clear/cloudy atmospheres from infrared transit spectroscopy (Sing et al., 2016)⊳ near ultraviolet transit depth attributed to planet atmosphere (Turner et al., 2016a)⊳ envelope enrichment and predicted H_2O abundance (Venturini et al., 2016)⊳ **2017:** reduction of mass loss due to magnetic field (Arakcheev et al., 2017)⊳ atmospheric retrieval analysis with NEMESIS (Barstow et al., 2017)⊳ very low albedo, $A_g < 0.064$, from spectral eclipse with HST–STIS (Bell et al., 2017)⊳ effect of dynamical tides excited by gravity waves in the host star on planet's orbital evolution (Chernov et al., 2017)⊳ limits on transit timing variations (Collins et al., 2017)⊳ Roche lobe overflow model and mass-loss for short-period gaseous planets (Jackson et al., 2017)⊳ atmospheric modeling with HELIOS (Malik et al., 2017)⊳ sensitivity of atmospheric models to prior assumptions (Oreshenko et al., 2017)⊳ transit/secondary eclipse favour tidal decay ($\dot{P} = 29 \pm 3\,\mathrm{ms\,yr^{-1}}$) over apsidal precession (Patra et al., 2017)⊳ phase offsets and energy budgets (Schwartz et al., 2017)⊳ atmospheric clouds associated with metal-rich host star (Wakeford et al., 2017c)⊳ tidal decay model suggest planet is in the last 0.1% of its life (Weinberg et al., 2017)⊳ **2018:** atmospheric properties from thermal model of Spitzer data (Adams & Laughlin, 2018)⊳ generation of a circumstellar gas disk by the hot Jupiter (Debrecht et al., 2018)⊳ H and Na absorption in the optical transmission spectrum (Jensen et al., 2018)⊳ refined orbital decay rate from transit timing (Maciejewski et al., 2018a)⊳ secondary eclipse from CFHT–WIRCam (Martioli et al., 2018)⊳ rapid orbital decay driven by obliquity tides (Millholland & Laughlin, 2018)⊳ **2019:** signatures of obliquity in thermal phase curves (Adams et al., 2019)⊳ dynamical tides and orbit precession (Bailey & Goodman, 2019)⊳ transit timings (Baluev et al., 2019)⊳ mass loss inferred from Spitzer phase curves (Bell et al., 2019)⊳ photometric transit follow-up (Chakrabarty & Sengupta, 2019)⊳ modelling atmospheric escape and Mg II near-ultraviolet absorption (Dwivedi et al., 2019)⊳ changing secondary eclipse depths (Hooton et al., 2019)⊳ planet–star tidal interactions from precise transit timing (Maciejewski, 2019)⊳ new photometric analysis (Öztürk & Erdem, 2019)⊳ time variability of optical eclipse depth from engineered diffusers (von Essen et al., 2019b)⊳

WASP–13 discovery, radial velocity (Skillen et al., 2009)⊳ four transits from RISE, improved ephemeris (Barros et al., 2012)⊳ photometry and new spectroscopy (Southworth, 2012)⊳ parameters from HoSTS (Gómez Maqueo Chew et al., 2013a)⊳ Rossiter–McLaughlin effect from OHP–SOPHIE (Brothwell et al., 2014)⊳ far ultraviolet spectroscopy of host star, irradiance, and planet mass-loss (Fossati et al., 2015)⊳ low chromospheric activity attributed to intervening ISM absorption (Fossati et al., 2017)⊳ 4.5 μm secondary eclipse depths with Spitzer–IRAC (Kilpatrick et al., 2017)⊳

WASP–14 discovery, radial velocity confirmation, high density, and Rossiter–McLaughlin effect (Joshi et al., 2009)⊳ Rossiter–McLaughlin effect (Johnson et al., 2009a)⊳ radial velocities, non-zero eccentricity (Husnoo et al., 2011)⊳ tidal effects on radial velocity (Arras et al., 2012)⊳ tidal effects and spin–orbit alignment from orbit eccentricity (Husnoo et al., 2012)⊳ C/O ratio as a characterisation of atmospheres (Madhusudhan, 2012)⊳ photometry and new spectroscopy (Southworth, 2012)⊳ secondary eclipse from Spitzer (Blecic et al., 2013)⊳ spectroscopic inferences from high-resolution V-band spectrum (Czekala et al., 2015)⊳ transit time analysis of 19 light curves (Raetz et al., 2015)⊳ full-orbit phase curves at 3.6 and 4.5 μm with Spitzer (Wong et al., 2015)⊳ nearby star from lucky imaging (Wöllert et al., 2015)⊳ phase curve from sparsely-sampled Spitzer–IRAC observations (Krick et al., 2016)⊳ radial velocity with low-cost échelle spectroscopy at 0.6-m Stará Lesná Observatory, Slovakia (Garai et al., 2017)⊳ atmospheric modeling with HELIOS (Malik et al., 2017)⊳ secondary eclipse from CFHT–WIRCam (Martioli et al., 2018)⊳

WASP–15 discovery, radial velocity confirmation (West et al., 2009a)⊳ tidal heating (Ibgui et al., 2010)⊳ Rossiter–McLaughlin effect (Triaud et al., 2010)⊳ transits with WHT–ULTRACAM (Bento & Wheatley, 2011)⊳ coupled radius–orbit evolutionary models (Ibgui et al., 2011)⊳ defocused transits from MPG–GROND (Southworth et al., 2013)⊳ 4.5 μm secondary eclipse depths with Spitzer–IRAC (Kilpatrick et al., 2017)⊳

WASP–16 host star solar analogue; discovery, radial velocity confirmation (Lister et al., 2009)⊳ Rossiter–McLaughlin effect from Magellan, Keck (Albrecht et al., 2012b)⊳ Rossiter–McLaughlin effect (Brown et al., 2012a)⊳ defocused transits from MPG–GROND (Southworth et al., 2013)⊳ 4.5 μm secondary eclipse depths with Spitzer–IRAC (Kilpatrick et al., 2017)⊳

WASP–17 retrograde orbit, low density, inflated atmospheric scale height; discovery, radial velocity confirmation, Rossiter–McLaughlin effect, probable retrograde orbit (Anderson et al., 2010b)⊳ Rossiter–McLaughlin effect, confirmed retrograde orbit (Bayliss et al., 2010)⊳ planetary structure in a tidally-relaxed inclined system (Mardling, 2010)⊳ Rossiter–McLaughlin effect, confirmed retrograde orbit (Triaud et al., 2010)⊳ secondary eclipse and marginally eccentric orbit from Spitzer (Anderson et al., 2011e)⊳ transits with ULTRACAM (Bento & Wheatley, 2011)⊳ models of thermal phase variations for eccentric orbits (Cowan & Agol, 2011a)⊳ predicted transit duration variations due to apsidal and nodal precession (Damiani & Lanza, 2011)⊳ high mass loss from extreme ultraviolet and X-ray radiation (Ehrenreich & Désert, 2011)⊳ Na absorption with VLT–GIRAFFE (Wood et al., 2011)⊳ tidal effects and spin–orbit alignment from orbit eccentricity (Husnoo et al., 2012)⊳ four transits confirming large radius and circular orbit (Southworth et al., 2012b)⊳ Na absorption with Magellan–MIKE (Zhou & Bayliss, 2012)⊳ broad H_2O absorption at 1.4 μm from HST–WFC3 (Mandell et al., 2013)⊳ transmission spectrophotometry from NTT–ULTRACAM (Bento et al., 2014)⊳ cloudiness index based on transit radii associated with line centre/wing of Na/K (Heng, 2016)⊳ atmospheric circulation (Kataria et al., 2016)⊳ K detection from transmission spectroscopy with VLT–FORS2 (Sedaghati et al., 2016)⊳ H_2O in clear/cloudy atmospheres from infrared transit spectroscopy (Sing et al., 2016)⊳ atmospheric retrieval analysis with NEMESIS (Barstow et al., 2017)⊳ limits on low-frequency radio emission (Lynch et al., 2017)⊳ optical high-resolution transmission spectroscopy (Khalafinejad et al., 2018)⊳

WASP–18 2-planet system (planet c discovered in 2019); massive, hot, short-period planet: discovery, radial velocity, tidal decay (Hellier et al., 2009a)⊳ 5 transits (Southworth et al., 2009b)⊳ homogeneous analysis and light curve properties (Southworth, 2010)⊳ Rossiter–McLaughlin effect (Triaud et al., 2010)⊳ transit time variations due to stellar quadrupole (Watson & Marsh, 2010)⊳ tidal interaction and stellar spin-up (Brown et al., 2011)⊳ reflection effect (Budaj, 2011)⊳ predicted transit duration variations due to apsidal and nodal precession (Damiani & Lanza, 2011)⊳ secondary eclipse from Spitzer (Nymeyer et al., 2011)⊳ prospects for detecting bow shocks (Vidotto et al., 2011)⊳ tidal effects on radial velocity (Arras et al., 2012)⊳ Rossiter–McLaughlin effect from Magellan, Keck (Albrecht et al.,

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2012b)▷ tidal effects and spin–orbit alignment from orbit eccentricity (Husnoo et al., 2012)▷ non-detection of star–planet interactions (Miller et al., 2012)▷ photometry and new spectroscopy (Southworth, 2012)▷ atmospheric heat redistribution (Iro & Maxted, 2013)▷ orbit and secondary eclipse from Spitzer (Maxted et al., 2013b)▷ atmospheric heat redistribution efficiency drops as stellar insolation rises (Perez-Becker & Showman, 2013)▷ predicted shift in transit mid-time due to tidal decay of 36 s yr^{-1} (Birkby et al., 2014)▷ absorbing gas from stellar irradiation responsible for low stellar activity index (Fossati et al., 2014)▷ observations from ASTEP, Antarctic (Fruth et al., 2014)▷ age and activity from X-ray limits from Chandra (Pillitteri et al., 2014b)▷ limits on radio emission at 154 MHz from the Murchison Widefield Array (Murphy et al., 2015)▷ constraints on Bond albedo and day–night heat transport from secondary eclipse depths (Schwartz & Cowan, 2015)▷ Ks-band secondary eclipse observations with AAT–IRIS2 (Zhou et al., 2015b)▷ magnetospheric models, bow shocks, and near-ultraviolet absorption (Alexander et al., 2016)▷ effect of dynamical tides excited by gravity waves in the host star on planet's orbital evolution (Chernov et al., 2017)▷ evidence for day-side thermal inversion from HST and Spitzer secondary eclipse (Sheppard et al., 2017)▷ no signature of rapid orbital decay (Wilkins et al., 2017)▷ **2018:** atmospheric properties from thermal models of Spitzer data (Adams & Laughlin, 2018)▷ H^- opacity and water dissociation in the day-side atmosphere (Arcangeli et al., 2018)▷ stellar polarisation (Bott et al., 2018)▷ suppressed far-UV stellar activity and low planetary mass loss (Fossati et al., 2018)▷ pre-discovery transits from Hipparcos (McDonald & Kerins, 2018)▷ **2019:** spectroscopic phase curve with HST–WFC3 (Arcangeli et al., 2019)▷ k2 Love number (Csizmadia et al., 2019)▷ formation of clouds and emergence of ionosphere (Helling et al., 2019a)▷ ground-based secondary eclipse measurements (Kedziora-Chudczer et al., 2019)▷ discovery of planet c and evidence for non-transiting companion from TESS (Pearson, 2019)▷ TESS full orbital phase curve (Shporer et al., 2019)▷

WASP–19 very short-period (P = 0.79 d) planet; discovery, radial velocity confirmation, stellar rotation, tidal spin-up (Hebb et al., 2010)▷ secondary eclipse from VLT–HAWK–I (Anderson et al., 2010a)▷ secondary eclipse from VLT–HAWK–I (Gibson et al., 2010a)▷ tidal interaction and stellar spin-up (Brown et al., 2011)▷ reflection effect (Budaj, 2011)▷ TERMS photometry (Dragomir et al., 2011)▷ predicted transit duration variations due to apsidal and nodal precession (Damiani & Lanza, 2011)▷ Rossiter–McLaughlin effect, third-body interactions, tidal decay (Hellier et al., 2011a)▷ prospects for detecting bow shocks (Vidotto et al., 2011)▷ tidal effects on radial velocity (Arras et al., 2012)▷ Rossiter–McLaughlin effect from Magellan, Keck (Albrecht et al., 2012b)▷ secondary eclipse from NTT–ULTRACAM (Burton et al., 2012)▷ tidal effects and spin–orbit alignment from orbit eccentricity (Husnoo et al., 2012)▷ C/O ratio as a characterisation of atmospheres (Madhusudhan, 2012)▷ evidence of secondary eclipse from Antarctic ASTEP 400 (Abe et al., 2013)▷ Spitzer–IRAC confirms temperature inversions suppressed in hot Jupiters orbiting active stars (Anderson et al., 2013)▷ transmission and emission spectra from Magellan–MMIRS (Bean et al., 2013)▷ H_2O and TiO limits from HST–STIS (Huitson et al., 2013)▷ 14 transits and improved system parameters (Lendl et al., 2013)▷ atmospheric disequilibrium diagnostics (Line & Yung, 2013)▷ broad 1.4 μm H_2O absorption from HST–WFC3 (Mandell et al., 2013)▷ multicolour photometry from Perth–PEST and MPG–GROND (Mancini et al., 2013a)▷ star spots and spin–orbit projection (Tregloan-Reed et al., 2013)▷ secondary eclipse from Faulkes South (Zhou et al., 2013)▷ effects of planet tidal distortion (Burton et al., 2014)▷ atmospheric disequilibrium diagnostics (Line et al., 2014)▷ orbital decay driven by tidal dissipation (Valsecchi & Rasio, 2014)▷ Ks-band secondary eclipse from AAT–IRIS2 (Zhou et al., 2014b)▷ **2015:** gyrochronology and isochrone ages (Maxted et al., 2015)▷ transmission spectroscopy using VLT–KMOS (Parviainen et al., 2015)▷ optical ground-based transmission spectroscopy with VLT–FORS2 (Sedaghati et al., 2015)▷ orbital decay due to non-linear tidal dissipation, with expected detection within 2–3 yr (Essick & Weinberg, 2016)▷ atmospheric circulation (Kataria et al., 2016)▷ H_2O in clear/cloudy atmospheres from infrared transit spectroscopy (Sing et al., 2016)▷ 3.6 and 4.5 μm Spitzer phase curves (Wong et al., 2016)▷ atmospheric retrieval analysis with NEMESIS (Barstow et al., 2017)▷ unsupervised correlated noise removal for transit light curve fitting (Dehghan Firoozabadi et al., 2017)▷ atmospheric properties from thermal model of Spitzer data (Adams & Laughlin, 2018)▷ empirical tidal dissipation in exoplanet hosts from tidal spin-up (Penev et al., 2018)▷ featureless optical spectrum (Espinoza et al., 2019c)▷

WASP–20 close visual binary with a transiting hot Jupiter; discovery, Rossiter–McLaughlin effect (Anderson et al., 2015a)▷ stellar binary with separation 0.26 arcsec (60 au) with planet probably orbiting the primary (Evans et al., 2016a)▷

WASP–21 discovery, radial velocity confirmation (Bouchy et al., 2010)▷ transits and ephemeris from RISE (Barros et al., 2011b)▷ photometry and spectroscopy (Southworth, 2012)▷ transits with two telescopes (Ciceri et al., 2013)▷ ground-based transits (Seeliger et al., 2015)▷

WASP–22 discovery, radial velocity confirmation, probable orbit around one component of stellar binary (Maxted et al., 2010b)▷ Rossiter–McLaughlin effect from ESO–HARPS and others (Anderson et al., 2011b)▷ high-precision photometry from defocussed observations with ESO–DFOSC (Southworth et al., 2016)▷

WASP–23 discovery, radial velocity confirmation, Rossiter–McLaughlin effect (Triaud et al., 2011)▷ optical-infrared spectrum from MPG–GROND (Nikolov et al., 2013)▷

WASP–24 discovery, radial velocity (Street et al., 2010)▷ Rossiter–McLaughlin effect from OHP–SOPHIE (Simpson et al., 2011c)▷ secondary eclipse and atmospheric modeling from Spitzer (Smith et al., 2012b)▷ defocused transits, lucky imaging excludes nearby stars (Southworth et al., 2014)▷ new photometry and atmospheric models (Turner et al., 2017)▷

WASP–25 discovery, radial velocity (Enoch et al., 2011b)▷ polarisation studies (Kostogryz et al., 2011)▷ Rossiter–McLaughlin effect (Brown et al., 2012a)▷ defocused transit observations, lucky imaging excludes nearby stars (Southworth et al., 2014)▷

WASP–26 discovery, radial velocity (Smalley et al., 2010)▷ Rossiter–McLaughlin effect from HARPS and others (Anderson et al., 2011b)▷ Rossiter–McLaughlin effect from Magellan, Keck (Albrecht et al., 2012b)▷ transmission photometry with Spitzer (Mahtani et al., 2013)▷ defocused transits, lucky imaging excludes nearby stars (Southworth et al., 2014)▷

WASP–27 see HAT–P–14

WASP–28 ≡ K2–1; discovery and Rossiter–McLaughlin effect (Anderson et al., 2015a)▷ transit timing analysis (Petrucci et al., 2015)▷ additional transit observations (Maciejewski et al., 2016b)▷ star spots and obliquity from K2 (Močnik et al., 2017a)▷

WASP–29 discovery, radial velocity (Hellier et al., 2010)▷ TERMS photometry (Dragomir et al., 2011)▷ transmission spectroscopy from Gemini–MOS (Gibson et al., 2013a)▷

WASP–30 not in NASA; brown dwarf, 61M_J (Anderson et al., 2011c)▷ Rossiter–McLaughlin effect (Triaud et al., 2013b)▷

WASP–31 discovery, radial velocity (Anderson et al., 2011d)▷ TERMS photometry (Dragomir et al., 2011)▷ Rossiter–McLaughlin effect from Magellan, Keck (Albrecht et al., 2012b)▷ Rossiter–McLaughlin effect (Brown et al., 2012a)▷ transmission spectral survey in optical with HST and infrared with Spitzer, and detection of K (Sing et al., 2015)▷ cloudiness index based on transit radii associated with line centre/wing of Na/K (Heng, 2016)▷ atmospheric circulation (Kataria et al., 2016)▷ cloud deck and Rayleigh scattering, but no K, from VLT–FORS2 transmission spectroscopy (Gibson et al., 2017)▷ H_2O in clear/cloudy atmospheres from infrared transit spectroscopy (Sing et al., 2016)▷ atmospheric retrieval analysis with NEMESIS (Barstow et al., 2017)▷ evidence of N chemistry (NH_3) from HST–WFC3 (MacDonald & Madhusudhan, 2017b)▷ secondary eclipse from CFHT–WIRCam (Martioli et al., 2018)▷ K feature at high spectral resolution (Gibson et al., 2019)▷

WASP–32 discovery, radial velocity (Maxted et al., 2010a)▷ Rossiter–McLaughlin effect (Brown et al., 2012b)▷ Rossiter–McLaughlin effect from OHP–SOPHIE (Brothwell et al., 2014)▷ transit timing and homogeneous studies (Sun et al., 2015)▷ spectroscopic transit observations with Russian BTA telescope (Grauzhanina et al., 2017)▷

WASP–33 short period (P = 1.2 d) hot planet orbiting δ Scu star; discovery, radial velocity confirmation, line-profile tomography, projected obliquity, tidal excitation of stellar pulsations (Collier Cameron et al., 2010b)▷ reflection effect (Budaj, 2011)▷ predicted transit duration variations due to apsidal and nodal precession (Damiani & Lanza, 2011)▷ 68 min pulsations of host star (Herrero et al., 2011)▷ nodal precession (Iorio, 2011)▷ possible companion from Keck adaptive optics (Moya et al., 2011)▷ secondary eclipse, stellar pulsations (Smith et al., 2011)▷ tidal effects on radial velocity (Arras et al., 2012)▷ secondary eclipses and atmospheric modeling from Spitzer (Deming

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et al., 2012)▷ C/O ratio as a characterisation of atmospheres (Madhusudhan, 2012)▷ secondary eclipses from WHT–LIRIS (de Mooij et al., 2013b)▷ pulsation, orbit periods, possible star spots (Kovács et al., 2013)▷ host star pulsations from 457 h of small telescope photometry, limits on star–planet interactions (von Essen et al., 2014)▷ favourable for polarisation studies (Wiktorowicz & Laughlin, 2014)▷ **2015:** transit observations with WHT–pt5m (Hardy et al., 2015)▷ spectroscopic evidence for temperature inversion in day-side atmosphere (Haynes et al., 2015)▷ nodal precession from Doppler tomography (Johnson et al., 2015a)▷ pulsation frequency analysis and revised mass (Lehmann et al., 2015)▷ temperature inversion from secondary eclipse with LBT (von Essen et al., 2015)▷ stellar and orbit parameters from orbital dynamics (Iorio, 2016)▷ no asymmetry in ground-based ultraviolet transits (Turner et al., 2016b)▷ atmospheric modeling with HELIOS (Malik et al., 2017)▷ inversion and TiO molecular absorption from Subaru–HDS (Nugroho et al., 2017)▷ atmospheric properties from thermal model of Spitzer data (Adams & Laughlin, 2018)▷ constraints on orbital decay from transit timing (Maciejewski et al., 2018a)▷ pre-discovery transits from Hipparcos (McDonald & Kerins, 2018)▷ correlation between phase curve offset and irradiation temperature (Zhang et al., 2018a)▷ photometric transit follow-up (Chakrabarty & Sengupta, 2019)▷ aluminium oxide from optical transmission spectrum (von Essen et al., 2019a)▷ atmospheric ionised calcium (Yan et al., 2019)▷

WASP–34 near-grazing transit, in hierarchical triple system; discovery, radial velocity (Smalley et al., 2011)▷ favourable for polarisation studies (Wiktorowicz & Laughlin, 2014)▷

WASP–35 discovery, radial velocity (Enoch et al., 2011a)▷

WASP–36 discovery, radial velocity (Smith et al., 2012a)▷ Ks-band secondary eclipse observations with AAT–IRIS2 (Zhou et al., 2015b)▷ new transit observations (Maciejewski et al., 2016b)▷ 5 new multicolour transits and constraints on transmission spectrum (Mancini et al., 2016b)▷ orbital decay due to non-linear tidal dissipation (Essick & Weinberg, 2016)▷ no asymmetry in ground-based ultraviolet transits (Turner et al., 2016b)▷ constraints on co-orbiting Trojans (Lillo-Box et al., 2018)▷

WASP–37 low-metallicity star; radial velocity (Simpson et al., 2011b)▷

WASP–38 discovery, radial velocity (Barros et al., 2011a)▷ predicted transit duration variations due to apsidal and nodal precession (Damiani & Lanza, 2011)▷ Rossiter–McLaughlin effect from OHP–SOPHIE (Simpson et al., 2011c)▷ Rossiter–McLaughlin effect from OHP–SOPHIE (Brown et al., 2012b)▷

WASP–39 discovery, radial velocity (Faedi et al., 2011)▷ Spitzer secondary eclipse observations at 3.6 and 4.5 μm (Kammer et al., 2015)▷ multicolour transit observations (Ricci et al., 2015)▷ Rayleigh scattering with Na and K absorption from HST–STIS (Fischer et al., 2016)▷ atmospheric circulation (Kataria et al., 2016)▷ additional transit observations (Maciejewski et al., 2016b)▷ improved transit ephemeris (Maciejewski et al., 2016c)▷ transmission spectroscopy with Na absorption from VLT–FORS2 (Nikolov et al., 2016)▷ H_2O in clear/cloudy atmospheres from infrared transit spectroscopy (Sing et al., 2016)▷ atmospheric retrieval analysis with NEMESIS (Barstow et al., 2017)▷ three near-infrared H_2O-absorption features and $T_{\rm eq} = 1030^{+30}_{-20}$ K from HST–WFC3 (Wakeford et al., 2018)▷ Rossiter–McLaughlin effect from HARPS–N (Mancini et al., 2018)▷ complete transmission spectrum with a precise H_2O constrain (Wakeford et al., 2018)▷ transmission spectroscopy and retrieval analysis (Kirk et al., 2019)▷

WASP–40 see HAT–P–27

WASP–41 2-planet system, inner (planet b) discovered from transits, outer (planet c) from radial velocity; discovery of planet b and radial velocity confirmation with CORALIE (Maxted et al., 2011)▷ gyrochronology and isochrone ages (Maxted et al., 2015)▷ refined physical properties (Vaňko et al., 2015)▷ discovery of planet c from radial velocity, and Rossiter–McLaughlin effect (Neveu-VanMalle et al., 2016)▷ high-precision photometry from defocussed observations with ESO–DFOSC (Southworth et al., 2016)▷ modeling of star spots using `PyTranSpot` (Juvan et al., 2018)▷

WASP–42 discovery, radial velocity (Lendl et al., 2012)▷ high-precision photometry from defocussed observations with ESO–DFOSC (Southworth et al., 2016)▷

WASP–43 very short-period (P = 0.81 d) hot Jupiter orbiting cool low-mass star; discovery, radial velocity (Hellier et al., 2011b)▷ tidal effects on radial velocity (Arras et al., 2012)▷ 23 transits and 7 secondary eclipses from TRAPPIST (Gillon et al., 2012b)▷ tidal effects and spin–orbit alignment from orbit eccentricity (Husnoo et al., 2012)▷ X-ray emission and inferred mass loss from XMM–Newton (Czesla et al., 2013)▷ atmospheric disequilibrium diagnostics (Line & Yung, 2013)▷ transit times from 2009–2013 consistent with linear ephemeris (Maciejewski et al., 2013c)▷ secondary eclipse from CFHT–WIRCam (Wang et al., 2013b)▷ constraints from Spitzer secondary eclipse (Blecic et al., 2014)▷ transit and secondary eclipse from MPG–GROND (Chen et al., 2014b)▷ tidal evolution (Dong, 2014)▷ H_2O content from HST–WFC3 consistent with solar composition (Kreidberg et al., 2014a)▷ atmospheric disequilibrium (Line et al., 2014)▷ transit spectroscopy from GTC–OSIRIS (Murgas et al., 2014)▷ emission spectroscopy over three planet rotations from HST–WFC3 (Stevenson et al., 2014d)▷ Ks-band secondary eclipse from AAT–IRIS2 (Zhou et al., 2014b)▷ **2015:** atmospheric circulation (Kataria et al., 2015)▷ multicolour transit observations (Ricci et al., 2015)▷ high-energy irradiation and mass-loss rates (Salz et al., 2015)▷ constraints on Bond albedo and day–night heat transport from secondary eclipse depths (Schwartz & Cowan, 2015)▷ transits observed with SAO 1-m telescope (Valyavin et al., 2015b)▷ effect of non-uniform thermal structure on emission spectrum (Feng et al., 2016)▷ 15 new transits constrain negate rapid orbital decay (Hoyer et al., 2016b)▷ orbital period decay rate -0.029 ± 0.007 s yr^{-1} (Jiang et al., 2016)▷ envelope enrichment and predicted H_2O abundance (Venturini et al., 2016)▷ effect of dynamical tides excited by gravity waves in the host star on planet's orbital evolution (Chernov et al., 2017)▷ Rossiter–McLaughlin effect and orbital obliquity from HARPS–N (Esposito et al., 2017)▷ models of day–night temperature contrast (Keating & Cowan, 2017)▷ phase curve and secondary eclipse modeled with SPIDERMAN, and the inference of clouds (Louden & Kreidberg, 2018)▷ atmospheric modeling with HELIOS (Malik et al., 2017)▷ chromospheric activity, mass loss, and star–planet interaction (Staab et al., 2017)▷ Spitzer phase curve constraints at 3.6 and 4.5 μm (Stevenson et al., 2017)▷ atmospheric structure and dynamics from Doppler-shifted emission spectra (Zhang et al., 2017)▷ confronting re-analysed Spitzer data with cloudy atmospheres (Mendonça et al., 2018a)▷ atmospheric properties from thermal model of Spitzer data (Adams & Laughlin, 2018)▷ SPIDERMAN open-source code to model phase curves and secondary eclipses (Louden & Kreidberg, 2018)▷ confronting re-analysed Spitzer data with cloudy atmospheres (Mendonça et al., 2018a)▷ 3d-circulation driving chemical disequilibrium(Mendonça et al., 2018b)▷ transit timing variations (Sun et al., 2018)▷ photometric follow-up and transit timing analysis with the Xuyi Near-Earth Object Survey Telescope (Zhao et al., 2018b)▷ independent analysis of Spitzer phase curves (Morello et al., 2019)▷

WASP–44 discovery, radial velocity (Anderson et al., 2012)▷ multicolour photometry and improved radius (Mancini et al., 2013b)▷ multicolour characterisation (Moyano et al., 2017)▷

WASP–45 discovery, radial velocity (Anderson et al., 2012)▷ system properties from multi-colour photometry (Ciceri et al., 2016b)▷

WASP–46 discovery, radial velocity (Anderson et al., 2012)▷ thermal day-side emission from MPG–GROND (Chen et al., 2014c)▷ transits with 0.4-m telescope (Kjurkchieva et al., 2015)▷ gyrochronology and isochrone ages (Maxted et al., 2015)▷ Ks-band secondary eclipse observations with AAT–IRIS2 (Zhou et al., 2015b)▷ system properties from multi-colour photometry (Ciceri et al., 2016b)▷ multicolour characterisation (Moyano et al., 2017)▷ limits on transit timing variations and orbit decay (Petrucci et al., 2018)▷

WASP–47 ≡ K2–23; 4-planet system, planet b transiting, planet c from radial velocity, and planets d and e also transiting; discovery of planet b and radial velocity confirmation with CORALIE (Hellier et al., 2012)▷ two additional transiting planets (d and e) from K2, transit time variations (Becker et al., 2015)▷ radial velocity monitoring with Magellan–PFS (Dai et al., 2015)▷ Rossiter–McLaughlin effect and low stellar obliquity (Sanchis-Ojeda et al., 2015b)▷ densities, masses and radii from dynamical modeling (Almenara et al., 2016)▷ representing the extended tail of *in situ* formation warm Jupiters into the hot Jupiter region (Huang et al., 2016)▷ discovery/confirmation of planet c from radial velocity (Neveu-VanMalle et al., 2016)▷ effect of unseen additional perturber (Becker & Adams, 2017)▷ mass constraints from radial velocities (Sinukoff et al., 2017b)▷ precise masses from HARPS–N (Vanderburg et al., 2017)▷ hot Jupiter migration attributed to disk interactions (Wang et al., 2017a)▷ analysis of radial velocities and transit timing variations (Weiss et al., 2017)▷ formation from high-temperature condensates (Dorn et al., 2019)▷

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WASP–48 discovery, radial velocity (Enoch et al., 2011a)▷ secondary eclipses and eccentricity from Spitzer–IRAC and Palomar–WFIRCam (O'Rourke et al., 2014)▷ physical properties from multicolour photometry (Ciceri et al., 2015b)▷ no asymmetry in ground-based ultraviolet transits (Turner et al., 2016b)▷ transmission spectrum from GCT–OSIRIS (Murgas et al., 2017)▷ thermal emission in the K_s-band (Clark et al., 2018b)▷

WASP–49 discovery, radial velocity (Lendl et al., 2012)▷ atmospheric properties from transmission spectroscopy with VLT–FORS2 (Lendl et al., 2016)▷ aerosol constraints (Cubillos et al., 2017)▷ transmission spectroscopy and Rossiter–McLaughlin effect from HARPS (Wyttenbach et al., 2017)▷ transit light curves with simultaneous fit to stellar specific intensity and planetary radius (Aronson & Piskunov, 2018)▷

WASP–50 discovery, radial velocity (Gillon et al., 2011b)▷ tidal evolution (Dong & Ji, 2012)▷ defocused transits with NTT–EFOSC2 (Tregloan-Reed & Southworth, 2013)▷ gyrochronology and isochrone ages (Maxted et al., 2015)▷ photometric transit follow-up (Chakrabarty & Sengupta, 2019)▷

WASP–51 see HAT–P–30

WASP–52 discovery, radial velocity, Rossiter–McLaughlin effect (Hébrard et al., 2013b)▷ compilation of light curves and transit timing (Baluev et al., 2015)▷ transit observations with MINERVA (Swift et al., 2015)▷ transmission spectrum with WHT–ULTRACAM indicates stellar bright spot (Kirk et al., 2016)▷ orbital alignment and star-spot properties (Mancini et al., 2017)▷ atmospheric Na absorption with GTC–OSIRIS (Chen et al., 2017b)▷ optical transmission spectrum 400–875 nm from WHT (Louden et al., 2017b)▷ Na I and evidence of a cloudy atmosphere from HST (Alam et al., 2018)▷ star spot occultations in infrared transit spectroscopy (Bruno et al., 2018b)▷ flat optical spectrum (and first results) from Michigan–MOPSS (May et al., 2018)▷ new photometric analysis (Öztürk & Erdem, 2019)▷

WASP–53 2-planet system: transiting hot Jupiter with additional transiting brown dwarf (planet c, $> 16 M_J$) on highly-eccentric ($e = 0.84$) orbit; discovery and Rossiter–McLaughlin effect (Triaud et al., 2017)▷

WASP–54 discovery, radial velocity (Faedi et al., 2013a)▷ improved orbit from HARPS–N (Bonomo et al., 2017a)▷

WASP–55 discovery, radial velocity (Hellier et al., 2012)▷ recovery from K2SC pipeline processing (Pope et al., 2016)▷ high-precision photometry from defocussed observations with ESO–DFOSC (Southworth et al., 2016)▷ variability, star spots and rotation from K2 (Clark et al., 2018a)▷

WASP–56 discovery, radial velocity (Faedi et al., 2013a)▷ nearby star from lucky imaging (Wöllert & Brandner, 2015)▷

WASP–57 discovery, radial velocity (Faedi et al., 2013a)▷ revised properties and shorter orbital period (Southworth et al., 2015b)▷

WASP–58 discovery, radial velocity (Hébrard et al., 2013b)▷ nearby star from lucky imaging (Wöllert et al., 2015)▷

WASP–59 discovery, radial velocity (Hébrard et al., 2013b)▷

WASP–60 discovery, radial velocity (Hébrard et al., 2013b)▷ new photometry and atmospheric models (Turner et al., 2017)▷ Rossiter–McLaughlin effect from HARPS–N (Mancini et al., 2018)▷

WASP–61 discovery, radial velocity (Hellier et al., 2012)▷ Rossiter–McLaughlin models and their effect on estimates of stellar rotation (Brown et al., 2017)▷

WASP–62 discovery, radial velocity (Hellier et al., 2012)▷ favourable for lightning-discharge studies (Hodosán et al., 2016a)▷ candidate for JWST (Stevenson et al., 2016b)▷ Rossiter–McLaughlin models and effect on stellar rotation estimates (Brown et al., 2017)▷ 4.5 μm secondary eclipse depths with Spitzer–IRAC (Kilpatrick et al., 2017)▷

WASP–63 discovery, radial velocity (Hellier et al., 2012)▷ N chemistry (HCN) from HST–WFC3 (MacDonald & Madhusudhan, 2017b)▷ evaluation for JWST early release science programme (Kilpatrick et al., 2018)▷

WASP–64 discovery, radial velocity (Gillon et al., 2013)▷

WASP–65 discovery, radial velocity (Gómez Maqueo Chew et al., 2013b)▷

WASP–66 discovery, radial velocity (Hellier et al., 2012)▷ Rossiter–McLaughlin effect from AAT–UCLES (Addison et al., 2016)▷

WASP–67 discovery, radial velocity (Hellier et al., 2012)▷ grazing transits and multicolour photometry with MPG–GROND (Mancini et al., 2014b)▷ Spitzer secondary eclipse at 3.6 and 4.5 μm (Kammer et al., 2015)▷ cloud model from HST–WFC3 (Bruno et al., 2018a)▷

WASP–68 discovery, radial velocity (Delrez et al., 2014)▷

WASP–69 discovery, radial velocity, X-ray induced high evaporation rate (Anderson et al., 2014b)▷ gyrochronology and isochrone ages (Maxted et al., 2015)▷ favourable for lightning-discharge studies (Hodosán et al., 2016a)▷ atmospheric Na, and Rossiter–McLaughlin effect from HARPS–N (Casasayas-Barris et al., 2017)▷ ground-based detection of extended He atmosphere (Nortmann et al., 2018)▷ secondary eclipses at 0.35–0.5 μm (Wallack et al., 2019)▷

WASP–70A planet orbits the evolved primary of a G4+K3 binary; discovery, radial velocity (Anderson et al., 2014b)▷

WASP–71 discovery, radial velocity, and Rossiter–McLaughlin effect (Smith et al., 2013)▷ Rossiter–McLaughlin models and their effect on estimates of stellar rotation (Brown et al., 2017)▷

WASP–72 discovery, radial velocity (Gillon et al., 2013)▷ chromospheric activity, mass loss, and star–planet interaction (Staab et al., 2017)▷ spin–orbit measurements (Addison et al., 2018)▷

WASP–73 discovery, radial velocity (Delrez et al., 2014)▷

WASP–74 discovery, radial velocity (Hellier et al., 2015)▷ transmission spectrum and physical properties (Mancini et al., 2019)▷

WASP–75 ≡ K2–40; discovery, radial velocity (Gómez Maqueo Chew et al., 2013b)▷ independent discovery by K2 (Crossfield et al., 2016)▷ variability, star spots and rotation from K2 (Clark et al., 2018a)▷

WASP–76 discovery, radial velocity (West et al., 2016)▷ nearby star from lucky imaging (Wöllert & Brandner, 2015)▷ Ks-band secondary eclipse observations with AAT–IRIS2 (Zhou et al., 2015b)▷ confirmed stellar companion from lucky imaging (Ginski et al., 2016)▷ Rossiter–McLaughlin models and their effect on estimates of stellar rotation (Brown et al., 2017)▷ population study of gaseous exoplanets (Tsiaras et al., 2018)▷ broadened Na feature (Seidel et al., 2019)▷ high-resolution transmission spectroscopy (Žák et al., 2019)▷

WASP–77A discovery, radial velocity (Maxted et al., 2013a)▷ possible radio detection with VLA FIRST (Sirothia et al., 2014)▷ gyrochronology and isochrone ages (Maxted et al., 2015)▷ high-energy irradiation and mass-loss rates (Salz et al., 2015)▷ no asymmetry in ground-based ultraviolet transits (Turner et al., 2016b)▷ constraints on co-orbiting Trojans (Lillo-Box et al., 2018)▷

WASP–78 very hot Jupiter; discovery, radial velocity (Smalley et al., 2012)▷ Rossiter–McLaughlin models and their effect on estimates of stellar rotation (Brown et al., 2017)▷

WASP–79 largest WASP planet ($2.1 R_J$); discovery, radial velocity (Smalley et al., 2012)▷ Rossiter–McLaughlin effect indicating near-polar orbit from AAT–UCLES (Addison et al., 2013)▷ favourable for polarisation studies (Wiktorowicz & Laughlin, 2014)▷ Rossiter–McLaughlin models and estimates of stellar rotation (Brown et al., 2017)▷ Rossiter–McLaughlin effect (Johnson et al., 2017)▷

WASP–80 M dwarf host star and large transit depth; discovery, radial velocity, Rossiter–McLaughlin effect (Triaud et al., 2013a)▷ five transits (Fukui et al., 2014)▷ transmission spectrum from multicolour photometry (Mancini et al., 2014a)▷ high-energy irradiation and mass-loss rates (Salz et al., 2015)▷ transit, secondary eclipse, cool day-side temperature, aligned orbit from Spitzer (Triaud et al., 2015)▷ atmospheric escape of hot gas coupling plasma, photoionisation and Ly-α emission (Salz et al., 2016)▷ photometric observations and transit solutions (Kjurkchieva et al., 2017)▷ atmospheric properties from VLT–FORS2 transmission spectrum (Sedaghati et al., 2017)▷ new photometry and atmospheric models (Turner et al., 2017)▷ transmission spectrum from WHT–ACAM consistent with haze (Kirk et al., 2018)▷ flat transmission spectrum from GTC–OSIRIS (Parviainen et al., 2018)▷ maps, retrieved composition, and constraints predicted for JWST (Schlawin et al., 2018a)▷

WASP–81 transiting hot Jupiter with additional brown dwarf on eccentric orbit (Triaud et al., 2017)▷

WASP–82 discovery, radial velocity (West et al., 2016)▷ revised properties (Smith, 2015)▷

WASP–83 discovery, radial velocity (Hellier et al., 2015)▷

WASP–84 long period; discovery, radial velocity (Anderson et al., 2014b)▷ Rossiter–McLaughlin effect and implications for migration history from HARPS–N (Anderson et al., 2015b)▷ gyrochronology and isochrone ages (Maxted et al., 2015)▷

WASP–85A ≡ K2–94; discovery and occultation of star spots (Močnik et al., 2016b)▷ gyrochronology and isochrone ages (Maxted et al., 2015)▷ improved ground-based transit photometry using beam-shaping diffusers (Stefansson et al., 2017)▷ disentangling blended K2 photometry (Payne et al., 2018)▷

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WASP–86 in preparation

WASP–87 not in NASA; discovery (Anderson et al., 2014a)▷ Rossiter–McLaughlin effect from AAT–UCLES (Addison et al., 2016)▷

WASP–88 discovery, radial velocity (Delrez et al., 2014)▷

WASP–89 discovery, radial velocity, star spots (Hellier et al., 2015)▷ gyrochronology and isochrone ages (Maxted et al., 2015)▷

WASP–90 discovery, radial velocity (West et al., 2016)▷

WASP–91 discovery, radial velocity (Anderson et al., 2017)▷

WASP–92 discovery (Hay et al., 2016)▷ transit timing variations and long-term stability (Gajdoš et al., 2019a)▷

WASP–93 discovery (Hay et al., 2016)▷ transit timing variations and long-term stability (Gajdoš et al., 2019a)▷

WASP–94A two hot-Jupiters, each orbiting one component of 15 arcsec binary (WASP–94A and WASP–94B); WASP–94A b transits, WASP–94B b does not transit and discovered from radial velocity; mutual inclination indicates at least one inclined to stellar binary plane; discovery of both planets, radial velocities, and Rossiter–McLaughlin effect for WASP–94A b (Neveu-VanMalle et al., 2014)▷ unexplained stellar elemental abundance differences (Teske et al., 2016a)▷

WASP–95 discovery, radial velocity (Hellier et al., 2014)▷

WASP–96 discovery, radial velocity (Hellier et al., 2014)▷ absolute Na abundance for a cloud-free planet (Nikolov et al., 2018a)▷

WASP–97 discovery, radial velocity (Hellier et al., 2014)▷

WASP–98 hot Jupiter orbiting a metal-poor main-sequence star; discovery, radial velocity (Hellier et al., 2014)▷ optical transmission spectrum (Mancini et al., 2016a)▷

WASP–99 discovery, radial velocity (Hellier et al., 2014)▷

WASP–100 discovery, radial velocity (Hellier et al., 2014)▷ spin–orbit measurements (Addison et al., 2018)▷

WASP–101 discovery, radial velocity (Hellier et al., 2014)▷ absence of H_2O from HST–PanCET programme, and candidate for JWST (Wakeford et al., 2017b)▷

WASP–102 in preparation

WASP–103 short period (0.93 d) large radius planet close tidal disruption; discovery, radial velocity (Gillon et al., 2014a)▷ high-precision photometry by telescope defocusing (Southworth et al., 2015a)▷ nearby star from lucky imaging (Wöllert & Brandner, 2015)▷ Rossiter–McLaughlin effect from AAT–UCLES (Addison et al., 2016)▷ anomalous transmission spectrum (Southworth & Evans, 2016)▷ near-infrared emission spectrum with HST–WFC3 (Cartier et al., 2017)▷ strong Na and K absorption from Gemini–GMOS (Lendl et al., 2017a)▷ chromospheric activity, mass loss, and star–planet interaction (Staab et al., 2017)▷ new photometry and atmospheric models (Turner et al., 2017)▷ high-precision multi-wavelength photometry for 3 transits and 16 secondary eclipses (Delrez et al., 2018b)▷ global climate and atmospheric composition from HST and Spitzer phase curves (Kreidberg et al., 2018a)▷ constraints on orbital decay from transit timing (Maciejewski et al., 2018a)▷ detectability of shape deformation (Akinsanmi et al., 2019)▷

WASP–104 discovery, radial velocity (Smith et al., 2014)▷ transits observed with SAO 1-m telescope (Valyavin et al., 2015b)▷ low albedo from K2 short-cadence data (Močnik et al., 2018b)▷

WASP–105 discovery, radial velocity (Anderson et al., 2017)▷

WASP–106 discovery, radial velocity (Smith et al., 2014)▷

WASP–107 ≡ K2–235; discovery, radial velocity (Anderson et al., 2017)▷ oblique orbit from K2 photometry and star spots (Dai & Winn, 2017)▷ star spots and rotational period (Močnik et al., 2017b)▷ He in the planetary tail (Deming, 2018)▷ H_2O, high-altitude condensates, and possible methane depletion (Kreidberg et al., 2018b)▷ maps, retrieved composition, and constraints predicted for JWST (Schlawin et al., 2018a)▷ He in the eroding atmosphere (Spake et al., 2018)▷ high-resolution confirmation of extended He atmosphere (Allart et al., 2019)▷

WASP–108 not in NASA; discovery (Anderson et al., 2014a)▷

WASP–109 not in NASA; discovery (Anderson et al., 2014a)▷ spin–orbit measurements (Addison et al., 2018)▷

WASP–110 not in NASA; discovery (Anderson et al., 2014a)▷

WASP–111 not in NASA; discovery and Rossiter–McLaughlin effect (Anderson et al., 2014a)▷

WASP–112 not in NASA; discovery (Anderson et al., 2014a)▷

WASP–113 discovery (Barros et al., 2016)▷

WASP–114 discovery (Barros et al., 2016)▷

WASP–115 in preparation

WASP–116 in preparation

WASP–117 long period (10 d) eccentric ($e = 0.3$) orbit; discovery, radial velocity, Rossiter–McLaughlin effect (Lendl et al., 2014)▷ ephemeris refinement (Mallonn et al., 2019)▷

WASP–118 discovery (Hay et al., 2016)▷ star spots and rotational period (Močnik et al., 2017b)▷ further analysis (Gajdoš et al., 2019b)▷ transit timing variations and long-term stability (Gajdoš et al., 2019a)▷

WASP–119 discovery (Maxted et al., 2016)▷

WASP–120 discovery (Turner et al., 2016c)▷

WASP–121 highly-irradiated hot Jupiter; discovery and Rossiter–McLaughlin effect (Delrez et al., 2016)▷ detection of H_2O and evidence for TiO/VO from HST–WFC3 transit spectroscopy (Evans et al., 2016b)▷ distinguishing clouds and haze (Kempton et al., 2017)▷ HST optical transmission spectrum (Evans et al., 2018)▷ from thermal dissociation to atmospheric condensation (Parmentier et al., 2018)▷ population study of gaseous exoplanets (Tsiaras et al., 2018)▷ detectability of shape variations (Akinsanmi et al., 2019)▷ secondary eclipse at 2 μm (Kovács & Kovács, 2019)▷ HST emission spectrum at 0.8–1.1 μm (Mikal-Evans et al., 2019)▷ Swift UVOT near-UV transit observations (Salz et al., 2019)▷ exospheric Mg II and Fe II in the near-ultraviolet transmission spectrum with HST (Sing et al., 2019)▷

WASP–122 see KELT–14

WASP–123 discovery (Turner et al., 2016c)▷

WASP–124 discovery (Maxted et al., 2016)▷

WASP–125 in preparation

WASP–126 discovery (Maxted et al., 2016)▷ search for multi-planet systems (Pearson, 2019)

WASP–127 low-density sub-Saturn planet; discovery (Lam et al., 2017)▷ Rayleigh slope at blue wavelengths, TiO and VO at redder, from NOT–ALFOSC (Palle et al., 2017)▷ haze, Na, K, and Li from GTC transit spectroscopy (Chen et al., 2018b)▷ high-resolution transmission spectroscopy (Žák et al., 2019)▷

WASP–128 not in NASA; transiting brown dwarf in the dynamical-tide regime (Hodžić et al., 2018)▷

WASP–129 discovery (Maxted et al., 2016)▷

WASP–130 . . . WASP–132 discovery (Hellier et al., 2017)▷

WASP–133 discovery (Maxted et al., 2016)▷

WASP–134 in preparation

WASP–135 discovery, radial velocity, star spin-up (Spake et al., 2016)▷

WASP–136 discovery (Lam et al., 2017)▷

WASP–137 in preparation

WASP–138 discovery (Lam et al., 2017)▷

WASP–139 . . . WASP–142 discovery (Hellier et al., 2017)▷

WASP–143 in preparation

WASP–144 discovery (Hellier et al., 2019b)▷

WASP–145A discovery (Hellier et al., 2019b)▷

WASP–146 in preparation

WASP–147 discovery (Lendl et al., 2019)▷

WASP–148 . . . WASP–150 in preparation

WASP–151 ≡ K2–134; discovery (Demangeon et al., 2018)▷ rotational modulation and star spots from K2 (Močnik et al., 2017a)▷

WASP–152 see K2–29

WASP–153 discovery (Demangeon et al., 2018)▷ new observations and transit solutions (Kjurkchieva et al., 2019)▷

WASP–154 in preparation

WASP–155 in preparation

WASP–156 discovery (Demangeon et al., 2018)▷

WASP–157 ≡ K2–41; discovery (Močnik et al., 2016a)▷

WASP–158 discovery (Hellier et al., 2019b)▷

WASP–159 discovery (Hellier et al., 2019b)▷

WASP–160B discovery (Lendl et al., 2019)▷

WASP–161 discovery (Barkaoui et al., 2019)▷

WASP–162 discovery (Hellier et al., 2019b)▷

WASP–163 discovery (Barkaoui et al., 2019)▷

WASP–164 discovery (Lendl et al., 2019)▷

WASP–165 discovery (Lendl et al., 2019)▷

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WASP–166 discovery (Hellier et al., 2019c)▷ high-resolution transmission spectroscopy (Žák et al., 2019)▷

WASP–167 ≡ KELT–13; retrograde orbit; discovery and Rossiter–McLaughlin effect (Temple et al., 2017)▷

WASP–168 discovery (Hellier et al., 2019b)▷

WASP–169 discovery (Nielsen et al., 2019)▷

WASP–170 discovery (Barkaoui et al., 2019)▷

WASP–171 discovery (Nielsen et al., 2019)▷

WASP–172 discovery (Hellier et al., 2019b)▷

WASP–173A discovery (Hellier et al., 2019b)▷

WASP–174 discovery (Temple et al., 2018)▷

WASP–175 discovery (Nielsen et al., 2019)▷

WASP–176 in preparation

WASP–177 discovery (Turner et al., 2019)▷

WASP–178 discovery (Hellier et al., 2019a)▷

WASP–179 in preparation

WASP–180A discovery and Doppler tomography (Temple et al., 2019b)▷

WASP–181 discovery (Turner et al., 2019)▷

WASP–182 discovery (Nielsen et al., 2019)▷

WASP–183 discovery (Turner et al., 2019)▷

WASP–184 discovery (Hellier et al., 2019a)▷

WASP–185 discovery (Hellier et al., 2019a)▷

WASP–186 . . . WASP–189 in preparation

WASP–190 discovery and Doppler tomography (Temple et al., 2019a)▷

WASP–191 in preparation

WASP–192 discovery (Hellier et al., 2019a)▷

WTS

WTS–1 discovery, radial velocity (Cappetta et al., 2012)▷

WTS–2 1.0 d planet close to tidal destruction, and predicted orbit decay; discovery (Birkby et al., 2014)▷ tidal interactions of a Maclaurin spheroid (Braviner & Ogilvie, 2015)

XO

XO–1 discovery, radial velocity (McCullough et al., 2006)▷ four transits, improved parameters (Holman et al., 2006)▷ SuperWasp transits from 2004 (Wilson et al., 2006)▷ secondary eclipse and atmospheric modeling from Spitzer (Machalek et al., 2008)▷ homogeneous analysis and light curve properties (Southworth, 2008)▷ limits on transit time variations (Cáceres et al., 2009)▷ transits (Raetz et al., 2009b)▷ light curve properties (Southworth, 2009)▷ transits from HST–NICMOS (Burke et al., 2010)▷ homogeneous analysis and light curve properties (Southworth, 2010)▷ terminator region probed with emission spectroscopy (Tinetti et al., 2010)▷ atmospheric constraints from archival HST–NICMOS (Gibson et al., 2011)▷ C/O ratio as a characterisation of atmospheres (Madhusudhan, 2012)▷ H_2O absorption from HST–WFC3 spatial scanning (Deming et al., 2013)▷ C/O modeling, confirmation of C-rich atmosphere (Moses et al., 2013b)▷ orbit parameters versus atmospheric species (Miguel & Kaltenegger, 2014)▷ physical properties and optical-infrared transmission spectrum (Southworth et al., 2018)▷

XO–2N and **XO–2S** binary star system; discovered as hot Jupiter transiting binary component XO–2N (XO–2N planet b); two further planets orbiting XO–2S (planets b and c) discovered from radial velocity monitoring in 2014; discovery, radial velocity and Galactic origin (Burke et al., 2007)▷ 6 transits (Fernandez et al., 2009)▷ secondary eclipse and atmospheric models from Spitzer (Machalek et al., 2009)▷ homogeneous analysis and light curve properties (Southworth, 2010)▷ transit from IRTF–MORIS (Gulbis et al., 2011)▷ Rossiter–McLaughlin effect, possible third planet (Narita et al., 2011)▷ 3 transits and atmospheric K from GTC–OSIRIS (Sing et al., 2011a)▷ transits observed with Shandong/Weihai 1-m (Zhang et al., 2011)▷ limits on H_2O from HST–NICMOS (Crouzet et al., 2012)▷ tidal effects and spin–orbit alignment from orbit eccentricity (Husnoo et al., 2012)▷ transits and atmospheric Na from GTC–OSIRIS (Sing et al., 2012)▷ photometry and new spectroscopy (Southworth, 2012)▷ 10 transits, limits on transit time variations, dynamical stability from Apache Point–APOSTLE (Kundurthy et al., 2013a)▷ host star abundances (Teske et al., 2013b)▷ two further planets orbiting binary component XO–2S from radial velocity with HARPS–N (Desidera et al., 2014)▷ radial velocity search for massive long-period companion (Knutson et al., 2014c)▷ effects of photoionisation on transit depth in K (Lavvas et al., 2014)▷ compilation of light curves and transit timing (Baluev et al., 2015)▷ abundance differences in the binary components from HARPS–N (Biazzo et al., 2015)▷ comprehensive analysis with HARPS–N (Damasso et al., 2015a)▷ abundance differences through early metal depletion or late stage accretion (Ramírez et al., 2015)▷ abundance differences as a probe of giant planet formation (Teske et al., 2015)▷ host star variability (Zellem et al., 2015)▷ photometric observations and transit solutions (Kjurkchieva et al., 2017)▷ new transit timing observations (Maciejewski et al., 2018b)▷ ground-based spectroscopy (Pearson et al., 2019)▷

XO–3 high mass and large eccentricity; discovery, radial velocity (Johns-Krull et al., 2008)▷ Rossiter–McLaughlin effect (Hébrard et al., 2008)▷ modeling of radius (Liu et al., 2008a)▷ 13 transits and improved radius (Winn et al., 2008d)▷ Rossiter–McLaughlin effect (Winn et al., 2009e)▷ secondary eclipse, eccentricity, atmospheric modeling from Spitzer (Machalek et al., 2010)▷ homogeneous analysis and light curve properties (Southworth, 2010)▷ thermal phase variations for eccentric orbits (Cowan & Agol, 2011a)▷ predicted transit duration variations due to apsidal and nodal precession (Damiani & Lanza, 2011)▷ Rossiter–McLaughlin effect, possible third planet, stellar differential rotation (Hirano et al., 2011a)▷ tidal effects on radial velocity (Arras et al., 2012)▷ post-Newtonian effects (Li, 2012)▷ stellar magnetic field topology (Fares et al., 2013)▷ 12 secondary eclipses and limits on pericentre precession from Spitzer–IRC (Wong et al., 2014)▷ re-analysis of Spitzer–IRAC secondary eclipse observations, and comparison of analysis methods (Ingalls et al., 2016)▷ radial velocity with low-cost échelle spectroscopy at 0.6-m Stará Lesná Observatory, Slovakia (Garai et al., 2017)▷ new photometry and atmospheric models (Turner et al., 2017)▷

XO–4 discovery, radial velocity (McCullough et al., 2008)▷ Rossiter–McLaughlin effect (Narita et al., 2010a)▷ homogeneous analysis and light curve properties (Southworth, 2010)▷ photometry and new spectroscopy (Southworth, 2011)▷ atmospheric constraints from Spitzer–IRAC (Todorov et al., 2012)▷ 7 new transits from DEMONEX (Villanueva et al., 2016)▷

XO–5 high Safronov number, high surface gravity; discovery, radial velocity (Burke et al., 2008)▷ confirmation from spectral bisector (Pál et al., 2009)▷ stellar proper motion and transit timing (Rafikov, 2009)▷ homogeneous analysis and light curve properties (Southworth, 2010)▷ infrared excess suggesting debris disk from WISE (Krivov et al., 2011)▷ transits and system parameters (Maciejewski et al., 2011d)▷ revised properties (Smith, 2015)▷ new observations and transit solutions (Kjurkchieva et al., 2018)▷

XO–6 hot Jupiter on an oblique orbit around a fast-rotating F star; discovery (Crouzet et al., 2017)▷

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Appendix E. Lensing exoplanets

This (updated) appendix includes objects appearing in the online NASA Exoplanet Archive as of 31 December 2019.

These notes list some key attributes of the system to underline its particular interest, give some indication of the attention the object has received (through the length of the bibliography), and provide a concise note on each paper to serve as a guide to the literature and a narrative of the progress in understanding the system. It makes no claim for completeness, and CDS–SIMBAD should be consulted for more details.

It includes only cross-identifications which are relevant in context, e.g., as used in the early discovery literature. CDS–SIMBAD or the NASA Exoplanet Archive should be consulted for other aliases. If a different alias was used in the NASA Exoplanet Archive, this is explicitly noted.

The electronic version includes three classes of hyperlink: the object identifier (in bold) is linked to the host star page of the NASA Exoplanet Archive (it will be invalid if their syntax changes); each citation is linked to the bibliography; and the ▷ icon following the citation links to the relevant ADS page.

Ordering is by the designated system/planet name, generally related to the event occurrence. The discovery reference can be some years following the event.

Notes on individual systems

KMT identifiers

KMT–2016–BLG–0212L not a confirmed planet, and not in NASA Exoplanet Archive; short, incompletely covered anomaly, possibly consistent with planetary mass companion (Hwang et al., 2018b)▷

KMT–2016–BLG–1107L 'Hollywood' planet with close/wide degeneracy (Hwang et al., 2019)▷

KMT–2016–BLG–1397L KMTNet-only discovery of a microlens giant planet (Zang et al., 2018)▷

KMT–2016–BLG–1820L brief anomaly indicates very low mass primary (Jung et al., 2018a)▷

KMT–2016–BLG–2142L brief anomaly indicates very low mass primary (Jung et al., 2018a)▷

KMT–2017–BLG–0165L super-Neptune-mass planet orbiting a Sun-like host star (Jung et al., 2019b)▷

KMT–2017–BLG–1038L Jupiter-mass planet (Shin et al., 2019)▷

KMT–2017–BLG–1146L Jupiter-mass planet (Shin et al., 2019)▷

KMT–2018–BLG–1990L nearby Jovian planet from a low-cadence microlensing field (Ryu et al., 2019)▷

MOA identifiers

MOA–2007–BLG–192L inclusion of parallax and finite source effects, and VLT–NACO imaging (Bennett et al., 2008)▷ photometric alignment of multi-site microlensing light curves (Gould et al., 2010)▷ detection of light from host star with VLT–NACO (Kubas et al., 2012)▷

MOA–2007–BLG–197L not in NASA Exoplanet Archive; brown dwarf companion in the brown dwarf desert; discovery (Ranc et al., 2015)▷

MOA–2007–BLG–400L $A_{\rm max} \sim 600$ (Dong et al., 2009a)▷

MOA–2008–BLG–310L $D_{\rm L} \gtrsim 6$ kpc implying the first planet found within the Galactic bulge (Janczak et al., 2010)▷ 2-epoch HST observations show that the star blended with the source is not the lens star (Bhattacharya et al., 2017)▷

MOA–2008–BLG–379L faint source star crossing the large resonant caustic (Suzuki et al., 2014)▷

MOA–2009–BLG–266L system masses from microlens parallax light curve distortion due to orbital motion of Earth and EPOXI satellite (Muraki et al., 2011)▷

MOA–2009–BLG–319L discovered from MOA–II survey monitoring, with identification as a high-magnification event 24 h prior to its peak (Miyake et al., 2011)▷

MOA–2009–BLG–387L M star host with pronounced deviations over 12 d with mass from Earth orbital motion (Batista et al., 2011)▷

MOA–2010–BLG–073L long event crossing time, $t_{\rm E} = 44.3$ d, allowing detection of orbital motion (Street et al., 2013) ▷

MOA–2010–BLG–117L the first planetary microlensing event ($M_{\rm p} = 0.5 M_{\rm J}$, $M_\star = 0.6 M_\odot$) with a binary source star (Bennett et al., 2018b)▷

MOA–2010–BLG–328L sub-Neptune-mass planet orbiting a very late M dwarf (Furusawa et al., 2013) ▷

MOA–2010–BLG–353L Saturn-mass planet orbiting an M dwarf (Rattenbury et al., 2015)▷

MOA–2010–BLG–477L high-magnification event modeled with Bayesian priors on Galactic model and planet orbit (Bachelet et al., 2012)▷

MOA–2011–BLG–028L Neptune-mass planet orbiting a $0.8 M_\odot$ star in the Galactic bulge (Skowron et al., 2016)▷

MOA–2011–BLG–262L first free-floating exoplanet–exomoon candidate (Bennett et al., 2014)▷ determination of source proper motion (Skowron et al., 2014)▷

MOA–2011–BLG–291L planetary microlensing event with an unusually red source star (Bennett et al., 2018a)▷

MOA–2011–BLG–293L first lensing planet based on second-generation survey (Yee et al., 2012)▷ Keck adaptive optics placing planet in habitable zone (Batista et al., 2014)▷

MOA–2011–BLG–322L first microlensing planet based solely on second-generation survey data (Shvartzvald et al., 2014)▷

MOA–2012–BLG–006L planet or brown dwarf mass companion on a wide orbit (Poleski et al., 2017)▷

MOA–2012–BLG–505L super-Earth-mass planet probably in the Galactic bulge (Nagakane et al., 2017)▷

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MOA–2013–BLG–605L Neptune or super-Earth planet in a Neptune-like orbit (Sumi et al., 2016)⊳

MOA–2015–BLG–337L system with low-mass brown dwarf/planet boundary host, or brown dwarf binary (Miyazaki et al., 2018)⊳

MOA–2016–BLG–227L large planet/host mass ratio, located near to K2 Campaign 9 (microlensing) field, observed with Keck AO imaging (Koshimoto et al., 2017a)⊳

MOA–2016–BLG–319L planet with rare minor-image perturbation degeneracy in determining planet parameters (Han et al., 2018a)⊳

MOA–bin–1L wide separation planet, found as by-product of a search for short time scale single lens events due to free-floating planets (Bennett et al., 2012)⊳

MOA–bin–29L gas-giant planet orbiting a low-mass host star (Kondo et al., 2019)⊳

OGLE identifiers

OGLE–2003–BLG–235L first lensing planet (Bond et al., 2004)⊳ HST identification (Bennett et al., 2006)⊳ retrospective (Bond, 2012)⊳

OGLE–2005–BLG–071L second lensing planet, and first high-magnification event (Udalski et al., 2005)⊳ HST astrometry and photometry (Dong et al., 2009b)⊳

OGLE–2005–BLG–169L extremely high-magnification event, $A \sim 800$ (Gould et al., 2006)⊳ characterisation of the resonant caustic (Chung, 2009)⊳ HST confirmation of proper motion (Bennett et al., 2015) ⊳

OGLE–2005–BLG–390L low-mass planet (Beaulieu et al., 2006)⊳ inferences on surface properties (Ehrenreich et al., 2006)⊳ limits on companions (Kubas et al., 2008)⊳

OGLE–2006–BLG–109L first two-planet lensing system, with orbital motion of the outer planet (Gaudi et al., 2008)⊳ habitability (Malhotra & Minton, 2008)⊳ formation and dynamical stability (Wang et al., 2009)⊳ improved parameters and orbit analysis (Bennett et al., 2010)⊳ terrestrial planet formation in inclined systems (Jin & Ji, 2011)⊳ mean motion resonances and migration (Wang, 2011)⊳ formation and habitability (Wang & Zhou, 2011)⊳

OGLE–2007–BLG–349LAB first circumbinary planet microlensing event, $80M_\oplus$, orbiting a pair of M dwarfs with masses $0.4M_\odot$ and $0.3M_\odot$ (Bennett et al., 2016)⊳

OGLE–2007–BLG–368L Neptune-mass planet, and frequency constraints beyond the snow line (Sumi et al., 2010)⊳

OGLE–2008–BLG–092L binary lens with circumprimary planet (Poleski et al., 2014a)⊳

OGLE–2008–BLG–355L $4.6M_J$ planet at a projected 1.7 au from a low-mass star (Koshimoto et al., 2014)⊳

OGLE–2011–BLG–173L evidence for a massive ice giant desert at wide separation (Poleski et al., 2018)⊳

OGLE–2011–BLG–251L planet orbiting M dwarf host beyond the snow line (Kains et al., 2013)⊳

OGLE–2011–BLG–265L $0.6M_J$ planet orbiting M dwarf host beyond the snow line, with prospects for future follow-up (Skowron et al., 2015)⊳

OGLE–2012–BLG–026L second two-planet system: two Jovian mass planets beyond the snow line (Han et al., 2013b)⊳ revised event model based on Keck/Subaru imaging (Beaulieu et al., 2016)⊳

OGLE–2012–BLG–358L $1.9M_J$ planet orbiting a field brown dwarf (Han et al., 2013a)⊳

OGLE–2012–BLG–406L $3.9M_J$ mass planet beyond the snow line (Poleski et al., 2014b)⊳ re-analysis including parallax and lens orbital motion (Tsapras et al., 2014)⊳

OGLE–2012–BLG–563L Saturn-mass planet around an M dwarf; mass constrained by Subaru adaptive optics imaging (Fukui et al., 2015)⊳

OGLE–2012–BLG–724L short-duration event; Saturn-mass planet around an M dwarf (Hirao et al., 2016)⊳

OGLE–2012–BLG–950L $35M_\oplus$ planet; long-term distortion in the MOA and OGLE light curve attributed to microlens parallax; planet mass estimated from parallax and high-resolution Keck AO flux (Koshimoto et al., 2017b)⊳ planet mass estimated from HST and Keck–AO (Bhattacharya et al., 2018)⊳

OGLE–2013–BLG–102L planet around low-magnification binary lens of $0.1M_\odot$ and $0.01M_\odot$ separated by 0.8 au (Jung et al., 2015)⊳

OGLE–2013–BLG–132L Saturn-mass planet orbiting an M-dwarf, covered with high cadence by OGLE and MOA (Mróz et al., 2017b)⊳

OGLE–2013–BLG–341LB $2M_\oplus$ circumprimary planet, binary separation ∼15 au (Gould et al., 2014)⊳

OGLE–2013–BLG–446L not in NASA Exoplanet Archive; high-magnification event attributed to red noise (Bachelet et al., 2015)⊳

OGLE–2013–BLG–723L not in NASA Exoplanet Archive; Venus-mass planet orbiting brown dwarf (Udalski et al., 2015a)⊳ non-planetary interpretation (Han et al., 2016a)⊳

OGLE–2013–BLG–1721L Saturn-mass planet orbiting an M-dwarf, covered with high cadence by OGLE and MOA (Mróz et al., 2017b)⊳

OGLE–2013–BLG–1761L massive planet around an M/K dwarf; discovery (Hirao et al., 2017)⊳

OGLE–2014–BLG–124L planet in the near- to mid-disk, and microlens parallax from Spitzer (first space-based microlensing parallax) (Udalski et al., 2015b)⊳ sensitivity analysis for simultaneous observations from space and ground (Zhu et al., 2015)⊳

OGLE–2014–BLG–676L cold gas giant (Rattenbury et al., 2017)⊳

OGLE–2014–BLG–1722L two-planet system in a low-magnification event (Suzuki et al., 2018)⊳

OGLE–2014–BLG–1760L $0.5M_J$ planet, with high relative proper motion (Bhattacharya et al., 2016)⊳

OGLE–2015–BLG–051L ≡ KMT–2015–BLG–048; $0.7M_J$ orbiting M dwarf (Han et al., 2016b)⊳

OGLE–2015–BLG–954L $4M_J$ planet orbiting a relatively nearby (0.6 kpc) M dwarf; detected by 2 of the 3 KMTNet telescopes during commissioning (Shin et al., 2016)⊳ MOA data covering the caustic exit, finite source effect and lens–source relative motion (Bennett et al., 2017)⊳

OGLE–2015–BLG–966L cold Neptune planet in the near- to mid-disk, and (second) microlens parallax from Spitzer (Street et al., 2016)⊳

OGLE–2015–BLG–1459L not a confirmed planet, and not in NASA Exoplanet Archive; various possible solutions include a planetary mass companion (Hwang et al., 2018c)⊳

OGLE–2015–BLG–1649L gas giant around low-mass dwarf (Nagakane et al., 2019)⊳

OGLE–2015–BLG–1670L cold Neptune beyond the snow line in the provisional WFIRST microlensing survey field (Ranc et al., 2019)⊳

OGLE–2016–BLG–263L discovered as a 'repeating event', in which the companion produced its own single-mass light curve after the event produced by the primary had ended (Han et al., 2017a)⊳

OGLE–2016–BLG–596L not in NASA Exoplanet Archive; high mass ratio planet from a high-magnification event; (Mróz et al., 2017a)⊳

OGLE–2016–BLG–0613L planetary companion to a binary lens, with separate resolution of lens and source expected around 2024; discovery (Han et al., 2017b)⊳

OGLE–2016–BLG–1067L sub-Jupiter orbiting a disk M dwarf, and Spitzer parallax (Calchi Novati et al., 2019)⊳

OGLE–2016–BLG–1190L massive planet ($13.4M_J$), probably in the Galactic bulge/bar; dense coverage from OGLE, MOA, KMTNet, with K2 campaign 9 data; discovery (Ryu et al., 2018)⊳

OGLE–2016–BLG–1195L lowest mass planet found by microlensing; planet orbits an ultracool dwarf (Bond et al., 2017)⊳ KMTNet with Spitzer yield $M_p = 1.4 \pm 0.3 M_\oplus$ (Shvartzvald et al., 2017)⊳

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OGLE–2016–BLG–1540 not in NASA Exoplanet Archive; candidate free-floating planet of Neptune mass, with mass constrained by the ultra-short duration ($t_E = 0.320 \pm 0.003$ d), combined with a measured angular Einstein ring size (Mróz et al., 2018)▷

OGLE–2017–BLG–0173L low mass ratio planet, with event arising from a (large) bright source passing over and enveloping the planetary caustic, termed a 'Hollywood' event; discovery (Hwang et al., 2018d)▷

OGLE–2017–BLG–0373L Jovian planet with accidental ('caustic-chirality') degeneracy due to data gap (Skowron et al., 2018)▷

OGLE–2017–BLG–0482L super-Earth orbiting a low-mass host star (Han et al., 2018b)▷

OGLE–2017–BLG–1140L Spitzer and ground-based data demonstrate a Jovian planet orbiting an M dwarf in the foreground of the lensed Galactic-bar source star (Calchi Novati et al., 2018)▷

OGLE–2017–BLG–1434L eighth lensing planet with $q < 1 \times 10^{-4}$, with V/V_{max} test, confirms mass function turnover (Udalski et al., 2018)▷

OGLE–2017–BLG–1522L giant planet around a brown dwarf located in the Galactic Bulge (Jung et al., 2018b)▷

OGLE–2018–BLG–0596L low-mass-ratio planet around an M dwarf, and Spitzer parallax (Jung et al., 2019a)▷

OGLE–2018–BLG–0740L spectroscopic mass and host-star metallicity measurements (Han et al., 2019b)▷

OGLE–2018–BLG–1011L 2-planet system around a low-mass star (Han et al., 2019a)▷

Other identifiers

TCP J05074264+2447555L bright microlensing event with super-Earth planet towards Taurus; discovered from variable star monitoring with Slovak/Crimea stations (Nucita et al., 2018)▷

UKIRT–2017–BLG–001L infrared high-extinction event in the Galactic bulge; discovery (Shvartzvald et al., 2018)▷

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Appendix F. Imaging exoplanets

This (updated) appendix includes objects appearing in the online NASA Exoplanet Archive as of 31 December 2018, along with a small number of other candidates or retracted systems.

These notes list some key attributes of the system to underline its particular interest, give some indication of the attention the object has received (through the length of the bibliography), and provide a concise note on each paper to serve as a guide to the literature and a narrative of the progress in understanding the system. It makes no claim for completeness, and CDS–SIMBAD should be consulted for more details.

It includes only cross-identifications which are relevant in context, e.g., as used in the early discovery literature. CDS–SIMBAD or the NASA Exoplanet Archive should be consulted for other aliases. If a different alias was used in the NASA archive, this is explicitly noted.

The electronic version includes three classes of hyperlink: the object identifier (in bold) is linked to the host star page of the NASA Exoplanet Archive (it will be invalid if their syntax changes); each citation is linked to the bibliography; and the ▷ icon following the citation links to the relevant ADS page.

Ordering is by object name and, for Bayer–Flamsteed designations, by constellation; then by year/first author.

Notes on individual systems

Star names

Fomalhaut nearby (7.7 pc) star with cold dust disk; object predicted from disk morphology; observations over 1.73 yr show orbital motion; planetary nature continues to be debated as a consequence of the eccentric disk structure, and non-detection in the infrared; dust clumps in the debris disk (Wyatt & Dent, 2002)▷ sub-mm observations of an asymmetric disk (Holland et al., 2003)▷ debris disk observed with Spitzer (Stapelfeldt et al., 2004)▷ **2005:** planetary system proposed to explain the debris disk structure (Kalas et al., 2005)▷ predictions for a planet lying just inside the eccentric ring (Quillen, 2006)▷ planet detected with HST–ACS (Kalas et al., 2008)▷ interferometric detection of hot dust with VLTI–VINCI (Absil et al., 2009)▷ constraints on planet mass from disk morphology (Chiang et al., 2009)▷ long-range outward migration (Crida et al., 2009)▷ possible formation by gravitational instability (Dodson-Robinson et al., 2009)▷ spin–orbit alignment from optical long baseline interferometry(Le Bouquin et al., 2009)▷ Spitzer–IRAC limits on planetary companions (Marengo et al., 2009)▷ planet formation constraints from gravitational instability (Nero & Bjorkman, 2009)▷ collisional modeling in dusty debris disks (Stark & Kuchner, 2009)▷ **2010:** lunar phase of dust grains (Min et al., 2010)▷ imaging limits from VLTI–PIONIER (Absil et al., 2011)▷ possible formation by gravitational instability (Boss, 2011)▷ Herschel images indicating an extrasolar Kuiper belt at the height of its dynamical activity (Acke et al., 2012)▷ high-resolution ALMA observations (Boley et al., 2012)▷ Subaru–IRCS and archival HST–ACS characterisation (Currie et al., 2012a)▷ non-detection in the infrared (Janson et al., 2012)▷ age and binarity of host star (Mamajek, 2012)▷ constraints on collisional models of planetesimals debris disk from 7 mm emission (Ricci et al., 2012)▷ Keck–NIRC2 search for thermal emission from planetary companions (Currie et al., 2013b)▷ independent analysis of HST archival data (Galicher et al., 2013)▷ VLT–NACO coronagraphic observations (Kenworthy et al., 2013)▷ HST–STIS coronagraphic imaging (Kalas et al., 2013)▷ interferometric study with VLTI–VINCI (Lebreton et al., 2013)▷ hydrodynamical models can replicate sharp eccentric rings in debris disk without invoking planets (Lyra & Kuchner, 2013)▷ Fomalhaut C (Mamajek et al., 2013)▷ Keck null-interferometry (Mennesson et al., 2013)▷ asteroid belts (Su et al., 2013)▷ planet orbit and dynamical effects on outer dust belt (Beust et al., 2014)▷ models of impacts, captures, and collisional cascades to account for the bright dust cloud (Kenyon et al., 2014)▷ discovery of Fomalhaut C debris disk (Kennedy et al., 2014)▷ coronagraphic imaging analysis (Meshkat et al., 2014)▷ dynamical consequences of the planet's orbit (Tamayo, 2014)▷ **2015:** constraints on gas content (Cataldi et al., 2015)▷ dynamical history (Faramaz et al., 2015)▷ high-contrast Spitzer imaging (Janson et al., 2015)▷ collisional cascade models (Kenyon & Bromley, 2015)▷ interpretation as dust cloud produced by disk planetesimal collisions (Lawler et al., 2015) ▷ upper limits to the CO mass (Matrà et al., 2015)▷ explanation as a background neutron star (Neuhäuser et al., 2015)▷ gap clearing by planets (Nesvold & Kuchner, 2015b)▷ orbital fitting of imaged planetary companions with high eccentricities and unbound orbits (Beust et al., 2016)▷ detection limits for debris disks using VLT sparse aperture masking (Gauchet et al., 2016)▷ apocentre glow in eccentric debris disks (Pan et al., 2016)▷ inner debris disk structure from ALMA (Su et al., 2016)▷ ALMA 1.3 mm observations of the dust emission from the complete outer debris disk (MacGregor et al., 2017a)▷ ALMA CO J = 2–1 emission from the cometary belt (Matrà et al., 2017b)▷ foreground neutron star hypothesis constrained by Chandra X-ray limits (Poppenhaeger et al., 2017)▷ 1.3 mm ALMA observations of the debris disk (White et al., 2017)▷ gap clearing by planet's sweeping secular resonance (Zheng et al., 2017)▷ 'Cooper pair' modeling of the stellar triple system (Feng & Jones, 2018b)▷ dust belt structure modeled with the inclusion of nearby stellar companions (Kaib et al., 2018)▷

Constellation identifiers

κ And super-Jupiter around late B-type star, from Subaru–HiCIAO SEEDS (Carson et al., 2013)▷ confirmed from common proper motion; $\Delta\theta$ = 1.1 arcsec; constraints on the companion mass, system age, and further multiplicity (Hinkley et al., 2013)▷ characterisation from high-contrast Keck and LBTI observations (Bonnefoy et al., 2014a)▷ age of host star from interferometry (Jones et al., 2016a)▷ H_2O abundance from infrared spectroscopy (Todorov et al., 2016)▷ SCExAO/CHARIS near-infrared imaging, spectroscopy, and modeling imply a young super-Jovian companion(Currie et al., 2018)▷

CT Cha common proper motion companion confirmed by VLT–NACO from T Tauri survey in the Chamaeleon star-forming region (Schmidt et al., 2008)▷ observations with VLT–NACO (Schmidt et al., 2009)▷

51 Eri young Jovian planet detected with Gemini–GPI (Macintosh et al., 2015)▷ astrometric confirmation and preliminary orbital parameters from GPI (De Rosa et al., 2015)▷ combined imaging, astrometry and radial velocity constraints (Montet et al., 2015a)▷ atmospheric convection, quenching, and derived composition (Moses et al., 2016)▷ photolytic hazes in the atmosphere (Zahnle et al., 2016)▷ fast orbit computation (Blunt et al., 2017)▷ 1–5 μm Gemini–GPI spectrophotometry favours cold-start core accretion with core mass $15-127\,M_\oplus$

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(Rajan et al., 2017)▷ spectral and atmospheric characterisation with VLT–SPHERE (Samland et al., 2017)▷

GQ Lup common proper motion companion confirmed by VLT–NACO from T Tauri survey in the Lupus star-forming region (Neuhäuser et al., 2005)▷ $\Delta\theta$ = 0.7 arcsec, Δm = 6 mag comoving confirmation from VLT–NACO (Guenther et al., 2005)▷ visible and near-infrared photometry (Marois et al., 2007)▷ high-contrast characterisation from Keck–OSIRIS integral field spectroscopy (McElwain et al., 2007)▷ near-infrared integral-field spectroscopy (Seifahrt et al., 2007)▷ astrometric and photometric monitoring (Neuhäuser et al., 2008)▷ mm dust emission (Dai et al., 2010)▷ Herschel–PACS spectroscopy suggesting crystalline H_2O-ice and silicates (McClure et al., 2012)▷ astrometric follow-up with VLT–NACO and HST (Ginski et al., 2014)▷ slow spin and orbital configuration (Schwarz et al., 2016)▷ limits on circumplanetary disk from ALMA CO observations (MacGregor et al., 2017b)▷ confirmation from Subaru–SEEDS (Uyama et al., 2017)▷ disk structure from ALMA and MagAO (Wu et al., 2017)▷

HN Peg T dwarf companion detected in a survey of nearby stars using Spitzer–IRAC (Luhman et al., 2007)▷

AB Pic companion of planet/brown dwarf mass from deep imaging of young (L dwarf) member of Tucana–Horologium with VLT–NACO (Chauvin et al., 2005b)▷ $\Delta\theta$ = 5.5 arcsec; near-infrared integral-field spectroscopy with VLT– SINFONI (Bonnefoy et al., 2010)▷

β Pic 2-planet system (second planet identified in 2019); planet b is in a ∼ 20-yr orbit at 8–15 au; only a selection of the papers published before the first planet confirmation in 2009 are included here: discovery of the circumstellar disk (Smith & Terrile, 1984)▷ comet-like bodies in the protoplanetary disk (Beust et al., 1994)▷ planet on inclined orbit can explain the warped debris disk (Mouillet et al., 1997)▷ rings in the planetesimal disk (Kalas et al., 2000)▷ inner disk rings (Wahhaj et al., 2003)▷ early extrasolar planetary system revealed by planetesimal belts (Okamoto et al., 2004)▷ evidence for comet-like bodies (Roberge et al., 2006)▷ evidence for planets (Freistetter et al., 2007)▷ **2009:** planet detected from imaging of the dusty disk using VLT–NACO (Lagrange et al., 2009a)▷ dust distribution (Ahmic et al., 2009)▷ fine structure from VLT–NACO (Boccaletti et al., 2009)▷ orbital constraints from Keck AO (Fitzgerald et al., 2009)▷ planetary transit explanation for the photometric variations observed in November 1981 (Lecavelier des Etangs & Vidal-Madjar, 2009)▷ deep imaging and orbit constraints (Lagrange et al., 2009b)▷ deep near-infrared interferometric search for low-mass companions (Absil et al., 2010)▷ **2010:** detectability assessment with GPI (Kataria & Simon, 2010)▷ confirmation from high-contrast high-spatial resolution near-infrared images with VLT–NACO (Lagrange et al., 2010)▷ 4 μm imaging from VLT–NACO apodising phase plate (Quanz et al., 2010)▷ **2011:** high angular resolution detection at 2.2 μm with VLT–NACO (Bonnefoy et al., 2011)▷ gas-braking (Brandeker, 2011)▷ 5 μm imaging and evidence for a misalignment between the planet and the warped inner disk (Currie et al., 2011b)▷ misalignment and the warped inner disk (Dawson et al., 2011)▷ rovibrational CO detection (Troutman et al., 2011)▷ 1.3-mm imaging with the Submillimeter Array (Wilner et al., 2011)▷ **2012:** orbit characterisation (Chauvin et al., 2012)▷ hot circumstellar material imaged with VLT–PIONIER (Defrère et al., 2012)▷ planet constraints from HARPS (Lagrange et al., 2012b)▷ planet position with respect to the debris disk (Lagrange et al., 2012a)▷ mineralogy and structure of the inner debris disk (Li et al., 2012)▷ VLT imaging of the gas disk (Nilsson et al., 2012)▷ background galaxy (Regibo et al., 2012)▷ **2013:** companion searches to 2 au with VLT–NACO (Absil et al., 2013)▷ independent imaging confirmation with Gemini–NICI (Boccaletti et al., 2013)▷ near-infrared energy distribution (Bonnefoy et al., 2013)▷ VLT–Gemini atmospheric study (Currie et al., 2013a)▷ unusual gas composition in the disk (Xie et al., 2013)▷ **2014:** physical and orbital properties (Bonnefoy et al., 2014b)▷ disk asymmetry attributed to giant impacts (Jackson et al., 2014)▷ shape, internal structure and gravity (Kong et al., 2014)▷ two families of exocomets (Kiefer et al., 2014)▷ deep imaging of the innermost disk (Milli et al., 2014)▷ Magellan AO observations (Males et al., 2014)▷ orbit from Gemini–NICI (Nielsen et al., 2014)▷ rotational broadening of 25 km s^{-1} indicates rapid planetary spin rate (Snellen et al., 2014)▷ **2015:** atmospheric model from SPHERE observations (Baudino et al., 2015)▷ H-band spectrum (Chilcote et al., 2015)▷ inner disk in polarised light (Millar-Blanchaer et al., 2015)▷ Magellan AO observations (Morzinski et al., 2015)▷ model of colliding planetesimals (Nesvold & Kuchner, 2015a)▷ gap clearing by planets (Nesvold & Kuchner, 2015b)▷ **2016:** dust model based on imaging with HST–STIS, HST–WFC3, Spitzer–MIPS, Herschel–PACS, and ALMA (Ballering et al., 2016)▷ detection limits for debris disks using sparse aperture masking at the VLT (Gauchet et al., 2016)▷ self-consistent gas disk model (Kral et al., 2016)▷ planetary orbit (Lecavelier des Etangs & Vidal-Madjar, 2016)▷ orbit and (Hill sphere) transit prospects (Wang et al., 2016)▷ exocomet circumstellar Fe I absorption (Welsh & Montgomery, 2016)▷ **2017:** 1–2.4 μm spectrum with GPI (Chilcote et al., 2017)▷ detection of [C I] emission with ALMA (Higuchi et al., 2017)▷ exocomet flux and CO/CO_2 ice abundance from ALMA CO observations (Matrà et al., 2017a)▷ 31 δ Scuti pulsation frequencies (28 new) from Antarctic ATSEP observations (Mékarnia et al., 2017)▷ bRing observatory dedicated to monitoring the Hill sphere transit (Stuik et al., 2017)▷ physical properties of the neutral Fe I gas from 1700 HARPS spectra from 2003–15 (Vidal-Madjar et al., 2017)▷ HI Ly-α detected in gas disk from HST–COS (Wilson et al., 2017)▷ **2018:** resolved C I disk emission from ALMA (Cataldi et al., 2018)▷ VLT–SINFONI integral-field spectroscopy yields molecular (CO, H_2O) system maps (Hoeijmakers et al., 2018b)▷ accelerating coma absorption during transits from HARPS (Kennedy, 2018)▷ constraints on other giant planets from 2000 HARPS spectra over 13 yr, and NaCo images 2003–2016 (Lagrange et al., 2018)▷ transit constraints from BRITE (Lous et al., 2018)▷ exo-ring environment revealed by HST–STIS imaging (Schneider et al., 2018)▷ host star astrometric motion from Hipparcos–Gaia yields $11 M_p = \pm 2 M_J$ (Snellen & Brown, 2018)▷ **2019:** evidence for planet c from 10-yr HARPS data, with $9 M_J$, a = 2.7 au, e = 0.24 (Lagrange et al., 2019)▷ transiting exocomets detected in broadband light by TESS (Zieba et al., 2019)▷ pulsation characteristics of the host star (Zwintz et al., 2019)▷

GU Psc wide planetary-mass companion to a young M3 star, discovered from GMOS spectroscopy with Gemini–S; confirmed from CFT–WIRCam near-infrared imaging (Naud et al., 2014)▷ search for photometric variability with CFHT–WIRCam (Naud et al., 2017)▷

DH Tau discovered from near-infrared coronagraphic observations of the classical T Tauri star with Subaru–CIAO (Itoh et al., 2005)▷ $\Delta\theta$ = 2.3 arcsec; mid-infrared observations of the transition disk (Gräfe et al., 2011)▷ VLT–SINFONI spectroscopy (Patience et al., 2012)▷ astrometric follow-up with VLT–NACO and HST (Ginski et al., 2014)▷ planetary accretion rates (Zhou et al., 2014c)▷ limit on circumplanetary disk mask from IRAM–NOEMA (Wolff et al., 2017)▷

FU Tau pair of young brown dwarfs in the Taurus star-forming region discovered from Spitzer–IRAC (Luhman et al., 2009)▷ $\Delta\theta$ = 5.7 arcsec; molecular outflow (Monin et al., 2013)▷

Main catalogues

GJ 504 cold Jovian planet around Sun-like star from Subaru–HiCIAO imaging (Kuzuhara et al., 2013)▷ direct imaging detection of CH_4 with Subaru–HiCIAO (Janson et al., 2013)▷ spectral energy distribution models from LBTI–LEECH observations (Skemer et al., 2016)▷ estimated lightning flash densities (Hodosán et al., 2016a)▷ chemical composition and age of 2.5 Gyr (D'Orazi et al., 2017)▷ combining interferometric, radial velocity, and high contrast imaging data (Bonnefoy et al., 2018)▷

HD 95086 4–5 Jupiter-mass planet discovered from direct imaging with VLT–NACO (Rameau et al., 2013b)▷ confirmation from Gemini–NICI H-band observations (Meshkat et al., 2013)▷ confirmation by direct imaging with VLT–NACO (Rameau et al., 2013a)▷ detection and characterisation with Gemini–GPI (Galicher et al., 2014)▷ debris distribution and constraints on multi-planet architectures (Su et al., 2015)▷ 1.5–2.2 μm spectral characterisation from GPI (De Rosa et al., 2016)▷ disk geometry from astrometric monitoring with GPI 2013–16 (Rameau et al., 2016)▷ broad disk with sharp boundaries from ALMA 1.3 mm observations (Su et al., 2017b)▷ system characterisation from combined HARPS/VLT–SPHERE (Chauvin et al., 2018)▷ sub-mm ALMA observations show background galaxy projected on the debris disk (Zapata et al., 2018)▷

HD 100546 giant planet at 50 au around Herbig Ae/Be star discovered from direct imaging with VLT–NACO (Quanz et al., 2015)▷ earlier observations of disk structure and evidence for planets: evidence for star-grazing comets or planetesimals from IUE (Grady et al., 1997)▷ resolved circumstellar disk in the thermal infrared (Liu et al., 2003)▷ disk imaged at 3.4 mm (Wilner et al., 2003)▷ inner disk cavity with evidence for young planetary system (Grady et al., 2005)▷ resolving disk rotation, and evidence for a giant planet (Acke & van den Ancker, 2006)▷ inner disk structure (Benisty et al., 2010)▷ polarimetric differential imaging of the disk between 10–140 au with VLT–NACO

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(Quanz et al., 2011)▷ structure of the planet-forming region (Tatulli et al., 2011)▷ warm gas at 50 au (Goto et al., 2012)▷ young protoplanet candidate embedded in the disk (Quanz et al., 2013)▷ multi-epoch scattered light observations (Avenhaus et al., 2014)▷ near-infrared spectroscopy and further evidence for an orbiting companion (Britain et al., 2014)▷ candidate detection with Gemini–NICI and additional (planet-induced) disk structure at small separations (Currie et al., 2014d)▷ asymmetric disk near the gap (Panić et al., 2014)▷ resolved imaging with ALMA (Pineda et al., 2014)▷ two companions suggested from ALMA (Walsh et al., 2014)▷ high-contrast imaging/integral field spectroscopy/polarimetry with Gemini–GPI, with evidence for multiple accreting planets (Currie et al., 2015)▷ evidence for sequential planet formation (Pinilla et al., 2015)▷ hydrodynamic simulations of circumplanetary disk (Perez et al., 2015)▷ 3.8–4.8 μm observations with VLT–NACO (Quanz et al., 2015)▷ morphology and evidence for very young planets (Quanz, 2015)▷ polarised light and infrared observations with VLT–SPHERE show high brightness contrasts and arm-like structures (Garufi et al., 2016)▷ shocks and spiral disk structures (Lyra et al., 2016)▷ scattered light mapping of the protoplanetary disk (Stolker et al., 2016)▷ confirmation of protoplanet candidate and second emission source at 13–14 au from Gemini–GPI (Currie et al., 2017)▷ complex spiral structure from Gemini–GPI and MagAO (Follette et al., 2017)▷ luminosity interpreted through models of planetary accretion shock (Marleau et al., 2017)▷ bar-like structure across the disk gap in Hα polarised light with VLT–SPHERE/ZIMPOL (Mendigutía et al., 2017)▷ disk emission in Hα from Gemini–GPI and MagAO (Rameau et al., 2017)▷ ALMA CO emission tracing warp or radial flow within 100 au (Walsh et al., 2017)▷ ALMA 'shock tracer' SO observations suggest molecular disk wind (Booth et al., 2018)▷ gap size constraints from mid-infrared observations with MIDI (Jamialahmadi et al., 2018)▷ high-contrast disk study with VLT–SPHERE (Sissa et al., 2018)▷

HD 106906 planetary-mass companion orbiting a tight stellar binary at 7 arcsec (650–700 au); discovered with the Magellan Adaptive Optics (MagAO) + Clio2 system (Bailey et al., 2014)▷ asymmetric disk distribution from HST–ACS (Kalas et al., 2015)▷ narrow edge-on disk revealed by VLT–SPHERE (Lagrange et al., 2016)▷ disk structure from MagAO (Wu et al., 2016)▷ 1.1–2.5 μm spectroscopy with VLT–SINFONI yields mass of 11.9M_J (hot start) or 14.0M_J (cold start) (Daemgen et al., 2017a)▷ disk morphology from Lidov–Kozai perturbations (Nesvold et al., 2017)▷ wide orbit originating from inward migration and binary scattering (Rodet et al., 2017)▷ near-coplanar stellar flyby (De Rosa & Kalas, 2019)▷ orbital dynamics in a complex evolving architecture (Rodet et al., 2019)▷

HD 131399A not in NASA archive; young 4M_J planet in triple-star system, orbiting star A at 50–100 au; claimed discovery with VLT–SPHERE (Wagner et al., 2016)▷ low-mass stellar companion in a 10-d orbit (Lagrange et al., 2017)▷ dynamical stability (Funk et al., 2017)▷ formation of wide-orbit gas giants from inner-disk scattering and orbit circularisation (Higuchi & Ida, 2017)▷ evidence from Gemini–GPI, VLT–SPHERE, and Keck–NIRC2 that the suggested planet is a background star (Nielsen et al., 2017)▷ stellar parameters (Przybilla et al., 2017)▷ stability analysis and prospects for planet ejection (Veras et al., 2017)▷

HD 203030 young substellar companion near the L/T transition discovered with Hale 5-m PHARO camera (Metchev & Hillenbrand, 2006)▷ astrometric follow-up with VLT–NACO and HST (Ginski et al., 2014)▷ low-gravity spectral features and revised age of HD 203030B (Miles-Páez et al., 2017)▷

HD 206893B not in NASA archive; discovery inside a debris disk by VLT–SPHERE (Milli et al., 2017)▷ follow-up observations with VLT–SPHERE and others (Delorme et al., 2017)▷

HIP 65426 $\Delta\theta$ = 0.8 arcsec; discovered from the VLT–SPHERE SHINE programme (Chauvin et al., 2017)▷ spectral and orbit characterisation (Cheetham et al., 2019)▷ formation by core accretion and luminosity evolution (Marleau et al., 2019)▷

HIP 78530 $\Delta\theta$ = 4.5 arcsec; discovered from imaging of the Upper Sco association with Gemini–N–NIRI (Lafrenière et al., 2011)▷ Gemini 0.9–2.45 μm spectroscopy (Lachapelle et al., 2015)▷

HIP 79462 not in NASA archive; discovery with Subaru–SEEDS (Uyama et al., 2017)▷

HIP 79098(AB) co-moving 16 – 25M_J companion to a young binary system; discovery (Janson et al., 2019)

HR 2562 substellar companion to a nearby debris disk system, discovered from imaging with Gemini–GPI (Konopacky et al., 2016b)▷ VLT–SPHERE astrometric confirmation and orbital analysis of the brown dwarf companion (Maire et al., 2018) spectro-photometric characterisation with VLT–SPHERE (Mesa et al., 2018)

HR 8799 4-planet system; high-contrast imaging with Keck–NIRC2 and Gemini–NIRI revealed objects b,c,d (Marois et al., 2008) ▷ **2009:** possible formation by gravitational instability (Dodson-Robinson et al., 2009)▷ H-band image from 2002 observations with Subaru–AO confirming counter-clockwise orbit (Fukagawa et al., 2009)▷ prospects for future planetary scattering (Goździewski & Migaszewski, 2009)▷ HST–NICMOS detection of planet b in 1998 (Lafrenière et al., 2009) ▷ pre-discovery 2007 image with Keck–AO (Metchev et al., 2009)▷ formation by gravitational instability (Nero & Bjorkman, 2009)▷ system architecture (Reidemeister et al., 2009)▷ nature of the debris disk (Su et al., 2009)▷ **2010:** near-infrared spectroscopy (Bowler et al., 2010)▷ search for wide companions with Gemini and HST–NICMOS (Close & Males, 2010)▷ resonances, stability and masses (Fabrycky & Murray-Clay, 2010)▷ thermal infrared MMT–AO observations (Hinz et al., 2010)▷ metallicity of the massive protoplanets if formed by gravitational instability (Helled & Bodenheimer, 2010)▷ spatially-resolved spectroscopy (Janson et al., 2010)▷ planetesimal belts (Moro-Martín et al., 2010a)▷ additional inner object (planet e) evident from Keck imaging (Marois et al., 2010)▷ possible brown dwarf nature of companions (Moro-Martín et al., 2010b)▷ dynamical simulations (Marshall et al., 2010)▷ age determination from asteroseismology (Moya et al., 2010a)▷ λ Boo nature of host star (Moya et al., 2010b)▷ image of a fourth planet from Keck (Marois et al., 2010)▷ **2011:** astrometry with VLT–NACO (Bergfors et al., 2011)▷ atmospheric clouds and chemistry in planet b (Barman et al., 2011a)▷ possible formation by gravitational instability (Boss, 2011)▷ Subaru–VLT–MMT study (Currie et al., 2011a)▷ M-band imaging (Galicher et al., 2011)▷ constraints on companions inside 10 au (Hinkley et al., 2011)▷ spatially-resolved sub-mm imaging of the debris disk (Hughes et al., 2011)▷ model atmospheres (Madhusudhan et al., 2011a)▷ spatially-resolved sub-mm imaging of the debris disk (Patience et al., 2011)▷ orbital motion from 1998 HST data, and constraints on inclination, eccentricity, stability (Soummer et al., 2011)▷ determination of host star inclination from asteroseismology (Wright et al., 2011a)▷ **2012:** CHARA array host star angular diameter favours planetary masses (Baines et al., 2012)▷ direct detection and orbital analysis from archival 2005 Keck–NIRC2 data (Currie et al., 2012b)▷ masses, radii and cloud properties (Marley et al., 2012)▷ shape of debris disk inner edge from chaotic zone (Mustill & Wyatt, 2012)▷ LBT adaptive optics imaging (Skemer et al., 2012)▷ constraints on orbit inclination and age (Sudol & Haghighipour, 2012)▷ **2013:** LBT observations and detection of planet e in H-band (Esposito et al., 2013)▷ detection of CO and H_2O absorption (Konopacky et al., 2013)▷ effects of a planetesimal debris disk on system stability (Moore & Quillen, 2013)▷ near-infrared spectroscopy (Oppenheimer et al., 2013)▷ **2014:** deep thermal infrared imaging and constraints on a fifth planet (Currie et al., 2014b)▷ possible double Laplace mean motion resonances, 1e:2d:4c:8b (Goździewski & Migaszewski, 2014)▷ Gemini–GPI spectroscopy of planets c and d (Ingraham et al., 2014)▷ atmospheric analysis (Lee et al., 2014b)▷ constraints on the initial entropy (Marleau & Cumming, 2014)▷ resolved imaging of the debris disk with Herschel (Matthews et al., 2014)▷ LBT and Magellan adaptive optics imaging at 3–5 μm (Skemer et al., 2014)▷ **2015:** detection of H_2O, CH_4, and CO with Keck–OSIRIS (Barman et al., 2015)▷ constraints on architecture (Maire et al., 2015)▷ astrometry and orbital motion (Pueyo et al., 2015)▷ **2016:** high-cadence high-contrast imaging from VLT–SPHERE first-light (Apai et al., 2016)▷ physical and chemical properties from VLT–SPHERE first-light (Bonnefoy et al., 2016)▷ disk modeling from ALMA at 1.34 mm (Booth et al., 2016)▷ models of the inner debris disk (Contro et al., 2016)▷ long-term system stability (Götberg et al., 2016)▷ detection limits for debris disks using sparse aperture masking at the VLT (Gauchet et al., 2016)▷ limits on the debris disk from HST–STIS (Gerard et al., 2016)▷ astrometric constraints from Keck–NIRC2 (Konopacky et al., 2016a)▷ dynamical stability (Morrison & Kratter, 2016)▷ atmospheric convection, quenching, and derived composition (Moses et al., 2016)▷ spectrophotometry and astrometry from VLT–SPHERE first-light (Zurlo et al., 2016)▷ **2017:** image processing using VIP with LBTI–LMIRCam and the vortex coronagraph (Gomez Gonzalez et al., 2017)▷ atmospheric retrieval for the planets (Lavie et al., 2017b)▷ mas astrometry with VLT–SPHERE (Wertz et al., 2017)▷ spectroscopic modeling (Lavie et al., 2017b)▷ planetary migration as the origin of the 2:1 mean motion resonance (Ramos et al., 2017)▷ **2018:** updated architectural and dynamical model (Goździewski & Migaszewski, 2018)▷ KLIP forward modeling based on Gemini–GPI

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data (Greenbaum et al., 2018)⊳ Keck–OSIRIS molecular mapping yields strong detection of H_2O and CO, but no CH_4 (Petit dit de la Roche et al., 2018)⊳ fifth planet's effect on outer dust belt consistent with ALMA observations (Read et al., 2018)⊳ dynamical constraints from Gemini–GPI (Wang et al., 2018b)⊳ detection of H_2O from planet c with Keck–NIRSPEC (Wang et al., 2018a)⊳

2M J0122–24 young dusty L dwarf companion at the deuterium-burning limit discovered with Keck–NIRC2 (Bowler et al., 2013)⊳ long-slit spectroscopy from VLT–SPHERE (Hinkley et al., 2015)⊳

2M J0219–39 brown dwarf/planet-mass companion to a Tucana–Horologium M dwarf (Artigau et al., 2015)⊳

2M J0441+23 companion to young brown dwarf in Taurus star-forming region ($\Delta\theta$ = 0.1 arcsec) imaged with HST–WFPC2 and Gemini AO (Todorov et al., 2010b)⊳

2M J1207–39 young nearby brown dwarf companion in TW Hya association discovered from VLT–NACO imaging, 3 epochs over 1 year (Chauvin et al., 2004)⊳ further VLT–NACO observations over 1 year (Chauvin et al., 2005a)⊳ moving cluster distance (Mamajek, 2005)⊳ emission-line variability (Scholz et al., 2005)⊳ HST–NICMOS imaging (Song et al., 2006)⊳ trigonometric parallax and luminosity determination (Biller & Close, 2007)⊳ trigonometric parallax (Gizis et al., 2007)⊳ temperature, mass, and evidence for edge-on disk (Mohanty et al., 2007)⊳ underluminosity as a protoplanet collision afterglow (Mamajek & Meyer, 2007)⊳ disk characterisation (Riaz & Gizis, 2007)⊳ emission-line variability over hours to years (Stelzer et al., 2007)⊳ high-resolution near-infrared spectrum (Patience et al., 2010)⊳ cool, cloudy, CH_4 atmosphere from modeling (Barman et al., 2011b)⊳ evidence against edge-on disk, and thick-cloud explanation for its underluminosity (Skemer et al., 2011)⊳ Herschel–SPIRE observations (Riaz et al., 2012)⊳ LBT and Magellan adaptive optics imaging at 3–5 μm (Skemer et al., 2014)⊳ rotational modulation from HST–WFC3 with a period 10.7 h (Zhou et al., 2016c)⊳ angular rotation of the azimuthal asymmetry observed with HST–STIS attributed to precession (Debes et al., 2017)⊳ ALMA detection of compact disk (Ricci et al., 2017b)⊳

2M J2140+16 discovered from 3-yr of astrometry, spectroscopy, and Keck AO of low-mass field binaries (Konopacky et al., 2010)⊳

2M J2236+47 red planetary-mass companion to the AB Dor moving group candidate (Bowler et al., 2017b)⊳

Other

CFBDSIR J1458 common proper motion companion discovered from Keck–NIRC2 AO imaging, $\Delta\theta$ = 0.1 arcsec (Liu et al., 2011)⊳

CHXR 73 discovered from imaging of the Chamaeleon I star-forming region using HST–ACS, $\Delta\theta$ = 1.3 arcsec (Luhman et al., 2006)⊳

GSC 0621–00 discovered from Hale 5-m AO imaging survey for wide companions to solar-type stars in Upper Scorpius (Ireland et al., 2011)⊳ circumplanetary accretion disk from Keck–OSIRIS (Bowler et al., 2011)⊳ planetary accretion rates (Zhou et al., 2014c)⊳ Gemini 0.9–2.45 μm spectroscopy (Lachapelle et al., 2015)⊳ no evidence for dynamical scattering from orbital motion (Pearce et al., 2019)⊳

LkCa 15 2-planet system; $\Delta\theta$ = 0.07, 0.10, 0.88 arcsec; located inside a known gap in the protoplanetary disk of a solar analogue, revealed by non-redundant aperture masking interferometry at three epochs with LBT–LMIRCam (Sallum et al., 2015)⊳ preceding and subsequent observations: structure of the protoplanetary disk (Piétu et al., 2007)⊳ search for sub-stellar disk structure (Bonavita et al., 2010)⊳ disk gap and indications of planet formation (Thalmann et al., 2010)⊳ disk structure (Andrews et al., 2011)⊳ sulphur-bearing molecules in the protoplanetary disk (Dutrey et al., 2011)⊳ nature of the transition disk (Isella et al., 2012)⊳ direct-imaging evidence of a likely (proto)planet inside a known gap in the protoplanetary disk from Keck–NIRC2 (Kraus & Ireland, 2012)⊳ disk searches (Isella et al., 2014)⊳ disk structure from Gemini–NIRI (Thalmann et al., 2014)⊳ multiple companions on Keplerian orbits and accretion onto protoplanet b from LBT–LMIRCam (Sallum et al., 2015)⊳ optical imaging polarimetry with VLT–SPHERE–ZIMPOL (Thalmann et al., 2015)⊳ asymmetric disk structures in scattered light with VLT–SPHERE–IRDIS (Thalmann et al., 2016)⊳ luminosity interpreted through models of planetary accretion shock (Marleau et al., 2017)⊳ X-ray heating inferred from Chandra observations (Skinner & Güdel, 2017)⊳ spectro-astrometry with WHT–ISIS reveals extended Hα emission but no accreting planet (Mendigutía et al., 2018)⊳

Oph 11 discovered from imaging of Ophiuchus star-forming clouds with Keck AO and Gemini–N–NIRI (Close et al., 2007)⊳

PDS 70 2-planet system in a transition disk; discovery of planet b from VLT–SPHERE (Keppler et al., 2018)⊳ constraints on gas accretion rate (Aoyama & Ikoma, 2019)⊳ planet–disk interaction and resonance shaping (Bae et al., 2019)⊳ evidence for circumplanetary disk (Christiaens et al., 2019)⊳ discovery of planet c (Haffert et al., 2019)⊳ highly structured disk from ALMA (Keppler et al., 2019)⊳ sculpting of the transition disk (Muley et al., 2019)⊳ magnetospheric accretion and Hα emission (Thanathibodee et al., 2019)⊳

Ross 458 ≡ DT Vir; discovered from spectroscopy with Magellan–FIRE (Burgasser et al., 2010)⊳ further observations (Burningham et al., 2011)⊳ effect of stellar wind on magnetosphere (Vidotto et al., 2014)⊳

ROXs 12 discovery from Keck–NIRC2 (Kraus et al., 2014)⊳ imaging search for close-in massive bodies responsible for outward scattering (Bryan et al., 2016a)⊳ morphology and spin–orbit misalignment from Gemini–North–NIFS and Keck–OSIRIS (Bowler et al., 2017a)⊳

ROXs 42B companion near the deuterium-burning limit in a young binary star system discovered from various imaging and spectroscopy (Currie et al., 2014c)⊳ independent observations with Keck–NIRC2 (Kraus et al., 2014)⊳ spectroscopic confirmation (Bowler et al., 2014)⊳ atmospheric modeling (Currie et al., 2014a)⊳ high contrast imaging search for close-in massive bodies responsible for outward scattering (Bryan et al., 2016a)⊳ mid-infrared characterisation from Keck–NIRC2 3–5 μm photometry (Daemgen et al., 2017b)⊳ confirmation from Subaru–SEEDS (Uyama et al., 2017)⊳

1RXS J1609–21 member of the Upper Scorpius association, $\Delta\theta$ = 2.2 arcsec; discovered from imaging and spectroscopy with Gemini–N–NIRI near-infrared AO (Lafrenière et al., 2008)⊳ confirmation from astrometry with Gemini–ALTAIR (Lafrenière et al., 2010)⊳ estimate of planet mass of $14 \pm 2 M_J$ (Pecaut et al., 2012)⊳ astrometric follow-up with VLT–NACO and HST (Ginski et al., 2014)⊳ possible radio detection with GMRT (Sirothia et al., 2014)⊳ Gemini 0.9–2.45 μm spectroscopy (Lachapelle et al., 2015)⊳

SR 12AB discovered from near-infrared imaging and spectroscopy of a binary T Tauri star in the ρ Oph star-forming region with IRSF–SIRIUS, $\Delta\theta$ = 8.7 arcsec (Kuzuhara et al., 2011)⊳ spectroscopic confirmation (Bowler et al., 2014)⊳

USco CTIO 108 member of the Upper Sco association, $\Delta\theta$ = 4.6 arcsec; discovered from optical and near-infrared photometry and spectroscopy of a brown dwarf with WHT–ACAM (Béjar et al., 2008)⊳ astrometric follow-up with VLT–NACO and HST (Ginski et al., 2014)⊳

VHS J1256–12 brown dwarf triple system; discovered from imaging of a nearby M dwarf with ESA–VISTA–VIRCAM (Gauza et al., 2015)⊳ thermal infrared imaging: clouds and equilibrium C chemistry (Rich et al., 2016)⊳ Magellan adaptive optics imaging (Stone et al., 2016)⊳

WD 0806–661B ≡ GJ 3483; brown dwarf common proper motion companion to white dwarf primary, at $\Delta\theta$ = 130 arcsec; candidate for one of the coldest known brown dwarfs; discovered from multi-epoch Spitzer–IRAC imaging (Luhman et al., 2011)⊳ age, mass and formation mechanism (Rodriguez et al., 2011)⊳ confirmation from Spitzer–IRAC, VLT–HAWK–I, and Magellan–FourStar (Luhman et al., 2012)⊳

WISEP J1217+16 wide companion to nearby brown dwarf discovered from imaging with Keck–NIRC2 (Liu et al., 2012)⊳ resolved spectroscopy, age, and kinematics (Leggett et al., 2014)⊳

Interstellar vagabonds

1I/2017 U1 (Oumuamua) discovery of a red and extremely elongated interstellar asteroid from Pan–STARRS on 2017 October 18 (Meech et al., 2017)⊳ colours, 5:3:1 aspect ratio, and 8.1-h rotation period (Bannister et al., 2017)⊳ pole, pericentre, and nodes (de la Fuente Marcos & de la Fuente Marcos, 2017)⊳ elongated shape attributed to Eikonal abrasion (Domokos et al., 2017)⊳ origin in a nearby young stellar association (Gaidos et al., 2017b)⊳ observations from NOT and WIYN, and predicted population within Neptune's orbit (Jewitt et al., 2017)⊳ rotation period and shape from light curve, with no evidence for coma or tail (Knight et al., 2017)⊳ kinematics and Galactic velocity (Mamajek, 2017)⊳ implications for planetary system formation (Trilling et al., 2017)⊳ distinguishing vagabonds from products of solar system scattering (Wright, 2017)⊳ imaging and spectroscopy, and radar search for meteor activity (Ye et al., 2017)⊳ possibility as macroscopic dark matter (Cyncynates et al., 2017)⊳ tumbling motion indicating violent past (Drahus et al., 2017)⊳ Palomar optical spectrum (Masiero, 2017)⊳ **2018:** Galactic orbit and age estimate of 0.20–0.45 Gyr (Almeida-Fernandes & Rocha-Pinto, 2018)⊳ Galactic orbit, and possible past close encounters (Bailer-Jones et al.,

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2018)▷ spin, oscillation, nutation, and inferred aspect ratio (Belton et al., 2018)▷ excess acceleration arising from solar radiation pressure (Bialy & Loeb, 2018)▷ APO time-resolved colour photometry (Bolin et al., 2018)▷ as a tidal disruption fragment from a binary star system (Ćuk, 2018)▷ (de la Fuente Marcos et al., 2018) number density and origin of comparable objects (Do et al., 2018)▷ tumbling motion and implications for its origin (Drahus et al., 2018)▷ dynamical history (Dybczyński & Królikowska, 2018)▷ GBT Breakthrough Listen observations (Enriquez et al., 2018)▷ as a messenger from the Local Association (Feng & Jones, 2018a)▷ spectroscopy and thermal modeling (Fitzsimmons et al., 2018)▷ tumbling rotational state (Fraser et al., 2018)▷ variability and aspect ratio considered as a debris contact binary (Gaidos, 2018)▷ review of photometric observations (Hainaut et al., 2018)▷ rotational dynamics irregular-shape asteroids moving through the interstellar gas (Hoang et al., 2018)▷ ejection of rocky and icy material from binary star systems (Jackson et al., 2018)▷ (Kwiecinski et al., 2018a) origin as Jacobi ellipsoid of a self-gravitating incompressible liquid (Katz, 2018)▷ minimal effects of tidal torques during its interstellar passage (Kwiecinski et al., 2018b)▷ six peculiar features (Loeb, 2018)▷ density (1.5-2.8 $Mg\,m^{-3}$) and aspect ratio (6 ± 1:1) from light curve amplitudes (McNeill et al., 2018)▷ non-gravitational acceleration implies comet-like outgassing (Micheli et al., 2018)▷ origin from highly anisotropic planetesimal disk of a young nearby star (Moro-Martín, 2018)▷ search for OH 18 cm radio emission with the Green Bank Telescope(Park et al., 2018)▷ Galactic origin and representative object density (Portegies Zwart et al., 2018)▷ production in tidal disruption events of refractory planetoids by white dwarfs (Rafikov, 2018a)▷ spin evolution challenges cometary origin (Rafikov, 2018b)▷ origin as a fragment of comet-like planetesimal from a planet-forming disk (Raymond et al., 2018a)▷ planetary dynamics and planetesimal formation (Raymond et al., 2018b)▷ expected arrival rates, impact parameters, velocities, and detection prospects of similar objects (Seligman & Laughlin, 2018)▷ metal pollution of low-mass Population III stars through accretion of similar objects (Tanikawa et al., 2018)▷ serendipitous MWA search for narrowband radio signals (Tingay et al., 2018)▷ Spitzer non-detection and implied composition (Trilling et al., 2018)▷ assessing the origin of interstellar small bodies (Zuluaga et al., 2018)▷ backtracing interstellar objects (Zhang, 2018)▷ exo-Oort cloud object ejected through post-main sequence mass loss and stellar encounters (Moro-Martín, 2019)▷

2019: as a fractal dust aggregate (Flekkøy et al., 2019)▷ close encounters with the Sun (Forbes & Loeb, 2019)▷ the fate of planetesimal disks (Hands et al., 2019)▷ Allen Telescope Array limits on non-natural radio transmissions at 1–10 GHz (Harp et al., 2019)▷ Project Lyra: sending a rendezvous spacecraft (Hein et al., 2019)▷ insights from SOHO–STEREO non-detections (Hui & Knight, 2019)▷ evidence against non-gravitational accelerations (Katz, 2019)▷ light curve evidence for torque and disk-like shape (Mashchenko, 2019)▷ as an ejected Oort cloud object (Moro-Martín, 2019)▷ as an icy fractal aggregate (Moro-Martín, 2019)▷ orbital history (Bannister et al., 2019)▷ planetary system origins (Rice & Laughlin, 2019)▷ anomalous acceleration (Seligman et al., 2019)▷ extreme geometry (Siraj & Loeb, 2019)▷ collisional elongation as origin of its elongated shape (Sugiura et al., 2019)▷ dust bombardment as an explanation of elongated shape (Vavilov & Medvedev, 2019)▷ scout ET probes (Gertz, 2019)▷ dynamics of interstellar asteroids (Hallatt & Wiegert, 2019)▷ Project Lyra: catching Oumuamua: mission opportunities after 2024 (Hibberd et al., 2019a)▷ as debris of dwarf interstellar comet that disintegrated before perihelion (Sekanina, 2019d)▷ survival of Oort cloud comets near the Sun (Sekanina, 2019c)▷ outgassing as the trigger of non-gravitational acceleration (Sekanina, 2019e)▷

2I/2019 (Borisov) discovery by amateur astronomer Gennady Borisov (Bacci et al., 2019)▷ difficulty of predicting stellar occultations (Bamberger & Wells, 2019)▷ physical characterisation with GTC–OSIRIS (de León et al., 2019)▷ detection of CN gas (Fitzsimmons et al., 2019)▷ predicted numbers of interstellar comets (Gibbs, 2019)▷ inbound light curve (Gladman et al., 2019)▷ initial characterisation (Jewitt & Luu, 2019)▷ velocity of ejected dust (Kochergin et al., 2019)▷ infrared photometry (Lee et al., 2019)▷ C_2-depleted interstellar comet (Opitom et al., 2019)▷ dust microphysics (Zubko et al., 2019)▷ search for its origin (Bailer-Jones et al., 2019)▷ characterisation of the nucleus, morphology and activity (Bolin et al., 2019)▷ evolving coma (Bolin, 2019)▷ origin as Kruger 60 (Dybczyński et al., 2019)▷ as a stardust comet (Eubanks, 2019)▷ dynamics of interstellar asteroids (Hallatt & Wiegert, 2019)▷ sending a spacecraft (Hibberd et al., 2019b)▷ C chain depletion (Kareta et al., 2019)▷ detection of diatomic carbon (Lin et al., 2019)▷ detection of a H_2O-tracer (McKay et al., 2019)▷ similarity with Oumuamua (Sekanina, 2019a)▷ HST imaging (Sekanina, 2019b)▷ sublimation of H_2O-ice (Sekanina, 2019f)▷ searching for H_2O-ice in the coma (Yang et al., 2019)▷ prediscovery activity beyond 5 au (Ye et al., 2019)▷

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