

I The great Orion Nebula, viewed here by the Hubble Space Telescope, is lit by the four hot stars in the Trapezium at its center, the group dominated by Theta-1 Orionis C.



II The brown dwarf Gliese 229B glimmers red next to its vastly brighter M1 dwarf companion. At a temperature of only about 1000 degrees kelvin, its infrared spectrum contains absorption bands of methane, which are never found in stars.



III Above is a peaceful sunset that might, when the Sun is brightening on its first ascent of the giant branch, look something like the scene below.





IV The carbon star IRC+10216 is surrounded by a dust shell of its own making. The circles indicate the position of the star and the inner edge of the dust shell.

V Different molecules appear in different locations in the ejected shell around the carbon star IRC+10216, each dependent on different conditions and the degree of illumination by starlight. Each map is 6000 AU across. From inside out we see hydrogen cyanide (HCN), cyanogen (CN), cyanoacetylene (HC<sub>3</sub>N), and unstable cyanoethynyl (C<sub>3</sub>N).



Molecules in IRC+10216





VI (*above*) The Helix Nebula's closeness together with the Hubble Space Telescope allows us to see the details of the extraordinary knots of matter in the central hole that blend to form the inner ring.

VII This Hubble Space Telescope view of the Eskimo Nebula, NGC 2392, a planetary nebula in Gemini, reveals spectacular complexity. The central star, from which came the expanding gaseous cloud, has a temperature of 70,000 degrees kelvin, and is still heating.



VIII NGC 7027 is a complex, dusty nebula that has one of the highest central star temperatures known, so high that very little of the star's light is radiated in the optical. The nebula is rich in carbon, implying that its progenitor was an AGB carbon star. The concentric shells represent earlier episodes of mass loss.

IX The Egg Nebula in Cygnus, observed by the Hubble Space Telescope, consists of dozens of expanding dusty shells. Light from a warm star hidden in a thick disk illuminates the surroundings through the disk's poles. Eventually, the star's wind will compress its surroundings to a shell that will be ionized as the star heats to a temperature beyond 25,000 K.





X The Tarantula Nebula, the closest example of a "giant diffuse nebula," lies within a companion galaxy, the Large Magellanic Cloud. It is powered principally by R136 (*in the box, enlarged, at the upper right*), a huge cluster of luminous stars packed into a tiny volume.



XI The young Double cluster in Perseus, within the great Perseus OB1 association, itself contains O stars as well as red supergiants.



XII A spectacular Hubble Space Telescope view of Eta Carinae shows a pair of bubbles, a bipolar flow presumably blown along the massive star's rotation axis during its enormous outburst over a century ago. Black lanes of dust thread through the illuminated gas.



XIII The Hubble Space Telescope shows the luminous blue variable AG Carinae (the star hidden behind the dark disk) to be surrounded by a knotty irregular nebula.



XIV The Hubble Space Telescope's near-infrared camera was needed to punch through the thick dust of our Galaxy's disk to see the so-called "Pistol Star," a "luminous blue variable" like Eta Carinae. Located close to the center of the Galaxy, its surrounding ejecta stretch over 4 light-years.



XV An image of Betelgeuse (upper left in Orion) taken with the Hubble Space Telescope shows the star's disk and a bubble of hot gas on its surface.



XVI Supernova 1987A, the aftermath of the evolution of a blue supergiant, exploded in the Large Magellanic Cloud. The supernova is the bright "star" toward the lower right. The bright, diffuse object toward upper left is the Tarantula Nebula.

XVII A computer simulation shows a quarter view of the turbulent core of a supernova only 120 kilometers across, a few-hundredths of a second after the collapse. The wavy white line is the wall of outwardly pushing neutrinos. A neutron star is being created within.



XVIII (*left*) The "Southern Crab" is a planetary nebula with a symbiotic star at its center, and is the result of mass loss stirred by a hot white dwarf.

XIX (*below*) The pulsar in the Crab Nebula, here radiating X-rays, turns on and off 30 times per second. The flash lasts for only a few-thousandths of a second.





XX The Hubble Space Telescope reveals a tiny non-pulsing neutron star (*arrow*) radiating by virtue of its 1.2 million degrees kelvin temperature.



XXI Earth and Sun are partners, born at nearly the same time, 4.5 billion years ago.



XXII FU Orionis, a massively brightened T Tauri star, is surrounded by a large dusty cloud.



XXIII Associated with the Orion Nebula are numerous disks surrounding young stars, most lit by the bright Trapezium stars that power the nebula. One dark disk to the left is seen in relief against the bright gas.

XXIV The biggest of the terrestrial planets, Earth, is contrasted with the Moon. The other terrestrials, Mercury, Venus and Mars, are similarly structured, and consist largely of iron and rock. The apparent proximity of the Moon to the Earth is the result of foreshortening.





XXV Jupiter, king of the planets, incorporates light stuff, and is made mostly of hydrogen and helium. Its outer large satellites are largely water ice.



XXVI A dusty disk, 800 AU wide, surrounds the class A main sequence star Beta Pictoris. Evidence that the disk may contain planets includes the chemical composition of the dust, the warping of the disk, and an interior hole where planets may have been accumulated from the dust. (The "hole" seen here is produced by an occulting device that hides the bright star.)



XXVII The "Ring-Tail galaxy" in Corvus consists of two colliding galaxies, NGC 4038 and NGC 4039, that send out long tidal streamers (*left*). A close-up of the interior taken by the Hubble Space Telescope (*right*) reveals hosts of new stars forming within the maelstrom of the collision.



XXVIII This whole-sky map shows the brightness of the cosmic background radiation, which shines at a frigid three degrees above absolute zero, as observed by the *COBE* (= Cosmic Background Explorer) satellite. Tiny fluctuations of only a millionth of a degree reflect variations in density from which galaxies and their clusters ultimately arose.



XXIX The Hubble Deep Field, a 100-hour exposure with the Hubble Space Telescope, reveals galaxies of all kinds terribly far away, to billions of light-years, allowing us to look billions of years back into the past.



XXX The Calabash Nebula, named after its odd gourd-like shape, surrounds a long-period M9 Mira that lies at the dense neck of the object where the two bubbles meet. The star is optically hidden from view by a thick disk of dust; gas streams out through the poles producing shock waves as it batters the surrounding medium.



XXXI An infrared view of R Coronae Borealis shows a huge cloud of glowing dust several minutes of arc and over a light-year across that surrounds the star proper. The cloud is the dusty remains of many episodes of the mass loss that have produced the random drops in visual brightness.



XXXII Home, our solid Earth, made mostly of the debris of supernovae.



XXXIII The grandeur of a living rose places the Sun among the true wonders of the Universe.