

Electron c_σ^\dagger
Spin 1/2
Charge -1

Hole c_σ
Spin 1/2
Charge 1

quasi-bound state

Paramagnon Φ
Spin 1
Charge 0

fractionalization

Spinon-1 Ψ_σ^\dagger
Spin 1/2
Charge 0

Spinon-2 $\tilde{\Psi}_\sigma^\dagger$
Spin 1/2
Charge 0

Hole c_σ
Spin 1/2
Charge 1

fractionalization

Spinon
Spin 1/2
Charge 0

Holon
Spin 0
Charge 1

(b) Electron fractionalization

(a) Paramagnon fractionalization