

Fermions

Leptons (spin 1/2)

Electron
(Charge -1)

e^-

Electron
Neutrino
(Charge 0)

ν_e

Tau
(Charge -1)

T

Tau
Neutrino
(Charge 0)

ν_e

Muon
(Charge -1)

μ

Muon
Neutrino
(Charge 0)

ν_μ

Quarks (spin 1/2)

Bottom
Quark
(Charge -1/3)

b

Up Quark
(Charge 2/3)

u

Down
Quark
(Charge -1/3)

d

Top Quark
(Charge 2/3)

t

Strange
Quark
(Charge -1/3)

s

Charm
Quark
(Charge 2/3)

c

Baryons (spin 1/2, 2/3)

Proton
(Charge +1)

P^+

Anti
Proton
(Charge -1)

\bar{P}^-

Neutron
(Charge 0)

N^0

Lambda
(Charge 0)

Λ^0

Omega
(Charge -1)

Ω^-

Measons (spin 0,1)

Pion
(Charge +1)

π^+

Kaon
(Charge -1)

K^-

Rho
(Charge +1)

ρ^+

B-zero
(Charge 0)

B^0

Eta-c
(Charge 0)

η_c

- ❖ Any member of a group of subatomic particles having odd half-integral angular momentum (spin 1/2, 3/2).
- ❖ Fermions obey the Pauli exclusion principle, which forbids more than one particle of this type from occupying a single quantum state.
- ❖ Fermions include nuclei of odd mass number.

Bosons (spin 1)

Photon
(Charge 0)

γ

W^- Boson
(Charge -1)

W^-

W^+ Boson
(Charge 1)

W^+

Z^0 Boson
(Charge 0)

Z^0

Gluon?
(Charge 0)

g

- ❖ Subatomic particle with integral spin (i.e., angular momentum in quantum-mechanical units of 0, 1, etc.)
- ❖ Bosons (force carriers) differ significantly from fermions in that there is no limit to the number that can occupy the same quantum state.