

# Standard Model of Elementary Particles

three generations of matter  
(fermions)

interactions / force carriers  
(bosons)

I

II

III

mass  
charge  
spin

$\approx 2.16 \text{ MeV}/c^2$

$\frac{2}{3}$

$\frac{1}{2}$

u

up

$\approx 1.273 \text{ GeV}/c^2$

$\frac{2}{3}$

$\frac{1}{2}$

c

charm

$\approx 172.57 \text{ GeV}/c^2$

$\frac{2}{3}$

$\frac{1}{2}$

t

top

0

0

1

g

gluon

$\approx 125.2 \text{ GeV}/c^2$

0

0

H

higgs

$\approx 4.7 \text{ MeV}/c^2$

$-\frac{1}{3}$

$\frac{1}{2}$

d

down

$\approx 93.5 \text{ MeV}/c^2$

$-\frac{1}{3}$

$\frac{1}{2}$

s

strange

$\approx 4.183 \text{ GeV}/c^2$

$-\frac{1}{3}$

$\frac{1}{2}$

b

bottom

0

0

1

$\gamma$

photon

$\approx 0.511 \text{ MeV}/c^2$

-1

$\frac{1}{2}$

e

electron

$\approx 105.66 \text{ MeV}/c^2$

-1

$\frac{1}{2}$

$\mu$

muon

$\approx 1.77693 \text{ GeV}/c^2$

-1

$\frac{1}{2}$

$\tau$

tau

$\approx 91.188 \text{ GeV}/c^2$

0

1

Z

Z boson

$< 0.8 \text{ eV}/c^2$

0

$\frac{1}{2}$

$\nu_e$

electron  
neutrino

$< 0.17 \text{ MeV}/c^2$

0

$\frac{1}{2}$

$\nu_\mu$

muon  
neutrino

$< 18.2 \text{ MeV}/c^2$

0

$\frac{1}{2}$

$\nu_\tau$

tau  
neutrino

$\approx 80.3692 \text{ GeV}/c^2$

$\pm 1$

1

W

W boson

QUARKS

LEPTONS

GAUGE BOSONS  
VECTOR BOSONS

SCALAR BOSONS