

Standard Model of Elementary Particles

three generations of matter
(fermions)

interactions / force carriers
(bosons)

I

II

III

mass

charge

spin

$\approx 2.2 \text{ MeV}/c^2$

$\frac{2}{3}$

$\frac{1}{2}$

u

up

$\approx 1.28 \text{ GeV}/c^2$

$\frac{2}{3}$

$\frac{1}{2}$

c

charm

$\approx 173.1 \text{ GeV}/c^2$

$\frac{2}{3}$

$\frac{1}{2}$

t

top

0

0

1

g

gluon

$\approx 124.97 \text{ GeV}/c^2$

0

0

H

higgs

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

$-\frac{1}{3}$

$\frac{1}{2}$

d

down

$\approx 96 \text{ MeV}/c^2$

$-\frac{1}{3}$

$\frac{1}{2}$

s

strange

$\approx 4.18 \text{ GeV}/c^2$

$-\frac{1}{3}$

$\frac{1}{2}$

b

bottom

0

0

1

γ

photon

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

-1

$\frac{1}{2}$

e

electron

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

-1

$\frac{1}{2}$

μ

muon

$\approx 1.7768 \text{ GeV}/c^2$

-1

$\frac{1}{2}$

τ

tau

$\approx 91.19 \text{ GeV}/c^2$

0

1

Z

Z boson

$< 1.0 \text{ eV}/c^2$

0

$\frac{1}{2}$

ν_e

electron
neutrino

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

0

$\frac{1}{2}$

ν_μ

muon
neutrino

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

0

$\frac{1}{2}$

ν_τ

tau
neutrino

$\approx 80.360 \text{ GeV}/c^2$

± 1

1

W

W boson

QUARKS

LEPTONS

GAUGE BOSONS
VECTOR BOSONS

SCALAR BOSONS