

# Standard Model of Elementary Particles

three generations of matter  
(fermions)

interactions / force carriers  
(bosons)

I

II

III

mass  
charge  
spin

QUARKS

LEPTONS

$\approx 2.2 \text{ MeV}/c^2$   
 $\frac{2}{3}$   
 $\frac{1}{2}$   
**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  
 $\gamma$   
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

$\approx 1.7768 \text{ GeV}/c^2$   
-1  
 $\frac{1}{2}$   
 $\tau$   
tau

$\approx 91.19 \text{ GeV}/c^2$   
0  
1  
**Z**  
Z boson

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

$\approx 80.39 \text{ GeV}/c^2$   
 $\pm 1$   
1  
**W**  
W boson

GAUGE BOSONS  
VECTOR BOSONS

SCALAR BOSONS