

three generations of matter
(fermions)

interactions / forces
(bosons)

I

II

III

mass
charge
spin

$\simeq 2.2 \text{ MeV}$
 $+2/3$
 $1/2$
u
up

$\simeq 1.3 \text{ GeV}$
 $+2/3$
 $1/2$
c
charm

$\simeq 173 \text{ GeV}$
 $+2/3$
 $1/2$
t
top

0
0
1
g
gluon

$\simeq 125 \text{ GeV}$
0
0
H
Higgs

QUARKS

$\simeq 4.7 \text{ MeV}$
 $-1/3$
 $1/2$
d
down

$\simeq 96 \text{ MeV}$
 $-1/3$
 $1/2$
s
strange

$\simeq 4.2 \text{ GeV}$
 $-1/3$
 $1/2$
b
bottom

0
0
1
 γ
photon

SCALAR BOSONS

$\simeq 0.511 \text{ MeV}$
 -1
 $1/2$
e
electron

$\simeq 106 \text{ MeV}$
 -1
 $1/2$
 μ
muon

$\simeq 1.777 \text{ GeV}$
 -1
 $1/2$
 τ
tau

$\simeq 80.4 \text{ GeV}$
 ± 1
1
W
W boson

GAUGE BOSONS
VECTOR BOSONS

LEPTONS

$< 1.0 \text{ eV}$
0
 $1/2$
 ν_e
electron neutrino

$< 0.17 \text{ eV}$
0
 $1/2$
 ν_μ
muon neutrino

$< 18.2 \text{ MeV}$
0
 $1/2$
 ν_τ
tau neutrino

$\simeq 91.2 \text{ GeV}$
0
1
Z
Z boson