

three generations of matter
(fermions)

interactions / forces
(bosons)

mass
charge
spin

I

II

III

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

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

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

0
0
1
g
gluon

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

QUARKS

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

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

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

0
0
1
 γ
photon

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

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

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

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

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

$< 0.17 \text{ eV}$
0
 $1/2$
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$< 18.2 \text{ MeV}$
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 $1/2$
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$\approx 91.2 \text{ GeV}$
0
1
Z
Z boson

three generations of matter (fermions)

interactions / forces (bosons)

I

II

III

mass
charge
spin

$\approx 2.2 \text{ MeV}$
 $+\frac{2}{3}$
 $\frac{1}{2}$
u
up

$\approx 1.3 \text{ GeV}$
 $+\frac{2}{3}$
 $\frac{1}{2}$
c
charm

$\approx 173 \text{ GeV}$
 $+\frac{2}{3}$
 $\frac{1}{2}$
t
top

0
0
1
g
gluon

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

QUARKS

$\approx 4.7 \text{ MeV}$
 $-\frac{1}{3}$
 $\frac{1}{2}$
d
down

$\approx 96 \text{ MeV}$
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s
strange

$\approx 4.2 \text{ GeV}$
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bottom

0
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1
 γ
photon

SCALAR BOSONS

$\approx 0.511 \text{ MeV}$
-1
 $\frac{1}{2}$
e
electron

$\approx 106 \text{ MeV}$
-1
 $\frac{1}{2}$
 μ
muon

$\approx 1.777 \text{ GeV}$
-1
 $\frac{1}{2}$
 τ
tau

$\approx 80.4 \text{ GeV}$
 ± 1
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VECTOR BOSONS

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