















# Standard Model of Elementary Particles

three generations of matter (fermions)						interactions / force carriers (bosons)		
I			II			III		
mass	$\approx 2.2 \text{ MeV}/c^2$	$\approx 1.28 \text{ GeV}/c^2$	$\approx 173.1 \text{ GeV}/c^2$	0	$\approx 125.09 \text{ GeV}/c^2$			
charge	$\frac{2}{3}$	$\frac{2}{3}$	$\frac{2}{3}$	0	0			
spin	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	1	0			
QUARKS	 up	 charm	 top	 gluon	 higgs			
	$\approx 4.7 \text{ MeV}/c^2$	$\approx 96 \text{ MeV}/c^2$	$\approx 4.18 \text{ GeV}/c^2$	0	0			
	$-\frac{1}{3}$	$-\frac{1}{3}$	$-\frac{1}{3}$	0	1			
	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	 photon				
LEPTONS	$\approx 0.511 \text{ MeV}/c^2$	$\approx 105.66 \text{ MeV}/c^2$	$\approx 1.7768 \text{ GeV}/c^2$	0	$\approx 91.19 \text{ GeV}/c^2$			
	$-1$	$-1$	$-1$	0	0			
	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	1	1			
	 electron	 muon	 tau	 Z boson				
	$\approx 0.511 \text{ MeV}/c^2$	$\approx 105.66 \text{ MeV}/c^2$	$\approx 1.7768 \text{ GeV}/c^2$	0	$\approx 80.39 \text{ GeV}/c^2$			
	$-1$	$-1$	$-1$	0	$\pm 1$			
	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	1	1			
	 electron neutrino	 muon neutrino	 tau neutrino	 W boson				