

## Selected Particles

(All masses in MeV/c<sup>2</sup>)

Baryons ( $m \lesssim 1500$ )				Mesons ( $m < 900$ )				Leptons (all)		
<u>Name</u>	<u>Mass</u>	<u>Spin</u>	<u>S</u>	<u>Name</u>	<u>Mass</u>	<u>Spin</u>	<u>S</u>	<u>Name</u>	<u>Mass</u>	<u>Spin</u>
p <sup>+</sup>	938	1/2	0	π <sup>+</sup>	139	0	0	e <sup>-</sup>	0.511	1/2
n <sup>0</sup>	940	1/2	0	π <sup>0</sup>	135	0	0	ν <sub>e</sub>	0	1/2
Λ <sup>0</sup>	1116	1/2	-1	π <sup>-</sup>	139	0	0	μ <sup>-</sup>	105.7	1/2
Σ <sup>+</sup>	1189	1/2	-1	K <sup>+</sup>	494	0	+1	ν <sub>μ</sub>	0	1/2
Σ <sup>0</sup>	1193	1/2	-1	K <sup>0</sup>	498	0	+1	τ <sup>-</sup>	1777	1/2
Σ <sup>-</sup>	1197	1/2	-1	$\bar{K}^0$	498	0	-1	ν <sub>τ</sub>	0	1/2
Δ <sup>++</sup>	1231	3/2	0	K <sup>-</sup>	494	0	-1			
Δ <sup>+</sup>	1232	3/2	0	η	547	0	0			
Δ <sup>0</sup>	1234	3/2	0	ρ <sup>+</sup>	770	1	0			
Δ <sup>-</sup>	1235	3/2	0	ρ <sup>0</sup>	770	1	0			
Ξ <sup>0</sup>	1315	1/2	-2	ρ <sup>-</sup>	770	1	0			
Ξ <sup>-</sup>	1321	1/2	-2	ω	782	1	0			
Σ* <sup>+</sup>	1383	3/2	-1	K* <sup>+</sup>	896	1	+1			
Σ* <sup>0</sup>	1384	3/2	-1	K* <sup>0</sup>	892	1	+1			
Σ* <sup>-</sup>	1387	3/2	-1	$\bar{K}^{*0}$	892	1	-1			
Λ* <sup>0</sup>	1406	1/2	-1	K* <sup>-</sup>	896	1	-1			
N* <sup>+</sup>	1440?	1/2	0							
N* <sup>0</sup>	1440?	1/2	0							
Ξ* <sup>0</sup>	1532	3/2	-2							
Ξ* <sup>-</sup>	1535	3/2	-2							

  

Other Particles (all)		
<u>Name</u>	<u>Mass</u>	<u>Spin</u>
photon	0	1
W <sup>±</sup>	80,425	1
Z	91,188	1
gluon	0	1
Higgs	115,000+	0
graviton	0	2

### Categories of Interactions

Decision process:

- If charge conservation violated → Impossible
- Else if baryon number violated → Impossible
- Else if odd # fermions (both sides) → Impossible
- Else if decay AND too little energy → Impossible
- Else if strangeness violated → Weak
- Else if all particles are strong → Strong
- Else if neutrinos → Weak
- Else → E & M

# Standard Model Particles

(All masses in  $\text{MeV}/c^2$ )

All fermions have an anti-particle whose charge is reversed, but its spin, mass, and number of colors are the same.

The other particles are all their own anti-particles, except for the  $W^\pm$ , which are anti-particles of each other.

Name	Symbol	Charge	Colors	Spin	Mass	
Electron	$e^-$	-1	1	$\frac{1}{2}$	0.511	leptons
Electron neutrino	$\nu_e$	0	1	$\frac{1}{2}$	0?	
Muon	$\mu^-$	-1	1	$\frac{1}{2}$	105.7	
Muon neutrino	$\nu_\mu$	0	1	$\frac{1}{2}$	0?	
Tau	$\tau^-$	-1	1	$\frac{1}{2}$	1777	
Tau neutrino	$\nu_\tau$	0	1	$\frac{1}{2}$	0?	
Up quark	u	+2/3	3	$\frac{1}{2}$	3	quarks
Down quark	d	-1/3	3	$\frac{1}{2}$	5	
Charm quark	c	+2/3	3	$\frac{1}{2}$	1,300	
Strange quark	s	-1/3	3	$\frac{1}{2}$	120	
Top quark	t	+2/3	3	$\frac{1}{2}$	174,000	
Bottom quark	b	-1/3	3	$\frac{1}{2}$	4,300	
Photon	$\gamma$	0	1	1	0	force carriers
Gluon	g	0	8	1	0	
W-bosons	$W^\pm$	$\pm 1$	1	1	80,400	
Z-boson	$Z^0$	0	1	1	91,200	
Higgs	$H^0$	0	1	0	>114,000	
Graviton	?	0	1	2	0	} Not in the standard model

Standard model particles