

## PROPERTIES OF ELEMENTARY PARTICLES (D5)

| <i>Particle Name</i>     | <i>Symbol</i>  | <i>Antiparticle</i>                     | <i>Invariant Mass <math>m_0</math> [MeV/c<sup>2</sup>] (Uncertainty)</i> | <i>Electric Charge <math>Q</math> [e]</i> | <i>Type and Sub-type / Generation</i> | <i>Spin <math>S</math></i> | <i>Mean Life <math>\tau</math> [per eV]</i>          |
|--------------------------|----------------|---|--|---|---------------------------------------|----------------------------|--|
| <b>Up Quark</b>          | u              | Antiup ( $\bar{u}$ )                    | $2.16^{+0.49}_{-0.26}$   | $+\frac{2}{3}$                            | Quark: Up-type, Gen. I                | $\frac{1}{2}$              | -  |
| <b>Down Quark</b>        | d              | Antidown ( $\bar{d}$ )                  | $4.67^{+0.48}_{-0.17}$   | $-\frac{1}{3}$                            | Quark: Down-type, Gen. I              | $\frac{1}{2}$              | -  |
| <b>Charm Quark</b>       | c              | Anticharm ( $\bar{c}$ )                 | $1\,270.0 \pm 20$  | $+\frac{2}{3}$                            | Quark: Up-type, Gen. II               | $\frac{1}{2}$              | -  |
| <b>Strange Quark</b>     | s              | Antistrange ( $\bar{s}$ )               | $93.4^{+8.6}_{-3.4}$   | $-\frac{1}{3}$                            | Quark: Down-type, Gen. II             | $\frac{1}{2}$              | -  |
| <b>Top Quark</b>         | t              | Antitop ( $\bar{t}$ )                   | $172\,690.0 \pm 300$   | $+\frac{2}{3}$                            | Quark: Up-type, Gen. III              | $\frac{1}{2}$              | -  |
| <b>Bottom Quark</b>      | b              | Antibottom ( $\bar{b}$ )                | $4\,180^{+30}_{-20}$   | $-\frac{1}{3}$                            | Quark: Down-type, Gen. III            | $\frac{1}{2}$              | -  |
| <b>Electron</b>          | e              | Positron ( $e^+$ )                      | $0.511\,998\,950\,00 \pm 0.000\,000\,000\,15$                            | -1  | Lepton: Charged, Gen. I               | $\frac{1}{2}$              | $> 6.6 \times 10^{28}$ a                             |
| <b>Electron Neutrino</b> | $\nu_e$        | Electron Antineutrino ( $\bar{\nu}_e$ ) | $< 0.000\,001\,1$  | $< 4 \times 10^{-35}$                     | Lepton: Neutral, Gen. I               | $\frac{1}{2}$              | $> 300$ s  |
| <b>Muon</b>              | $\mu$          | Antimuon ( $\mu^+$ )                    | $105.658\,375\,5 \pm 0.000\,002\,3$                                      | -1  | Lepton: Charged, Gen. II              | $\frac{1}{2}$              | $(2.196\,981\,1 \pm 0.000\,002\,2) \times 10^{-6}$ s |
| <b>Muon Neutrino</b>     | $\nu_\mu$      | Muon Antineutrino ( $\bar{\nu}_\mu$ )   | $< 0.19$   | $< 4 \times 10^{-35}$                     | Lepton: Neutral, Gen. II              | $\frac{1}{2}$              | $> 300$ s  |
| <b>Tau (Tauon)</b>       | $\tau$         | Antitau ( $\tau^+$ )                    | $1\,776.86 \pm 0.12$   | -1  | Lepton: Charged, Gen. III             | $\frac{1}{2}$              | $(290.3 \pm 0.5) \times 10^{-15}$ s                  |
| <b>Tau Neutrino</b>      | $\nu_\tau$     | Tau Antineutrino ( $\bar{\nu}_\tau$ )   | $< 18.2$   | $< 4 \times 10^{-35}$                     | Lepton: Neutral, Gen. III             | $\frac{1}{2}$              | $> 300$ s  |
| <b>Photon</b>            | $\gamma$       | -                                       | $< 1 \times 10^{-24}$  | $< 1 \times 10^{-46}$                     | Boson: Gauge                          | 1                          | -  |
| <b>Gluon</b>             | g              | -                                       | 0<br>(Theoretical)   | 0   | Boson: Gauge                          | 1                          | -  |
| <b>W<sup>+</sup></b>     | W <sup>+</sup> | -                                       | $80\,377.0 \pm 12$   | 1   | Boson: Gauge                          | 1                          | -  |

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|----------------------|---------------|---------------------|--|---|---------------------------------------|----------------------------|---|
| <b><i>W</i></b>      | $W^-$         | -                   | 80 377.0 $\pm$ 12  | -1  | Boson: Gauge                          | 1                          | -   |
| <b><i>Z</i></b>      | $Z$           | -                   | 91 187.6 $\pm$ 2.1   | 0   | Boson: Gauge                          | 1                          | -   |
| <b><i>Higgs</i></b>  | $H^0$         | -                   | 125 250.0 $\pm$ 170  | 0   | Boson: Scalar                         | 0                          | $1.6 \times 10^{-22}$ s                     |

**Units:**

- MeV/c<sup>2</sup>: Megaelectronvolts/speed of light<sup>2</sup> (Mass)
- e: Elementary Charge
- a: Year
- s: Second

**Sources:**

- Particle Name <sup>[1] [2]</sup>
- Symbol <sup>[1] [2]</sup>
- Invariant Mass,  $m_0$  <sup>[1] [2]</sup>
- Electric Charge,  $Q$  <sup>[1] [2]</sup>
- Type and Sub-type/Generation <sup>[1] [2]</sup>
- Spin,  $S$  <sup>[1] [2]</sup>
- Mean Life,  $\tau$  <sup>[1] [2] [3]</sup>