Charged Lepton Flavour Violation: An Introduction

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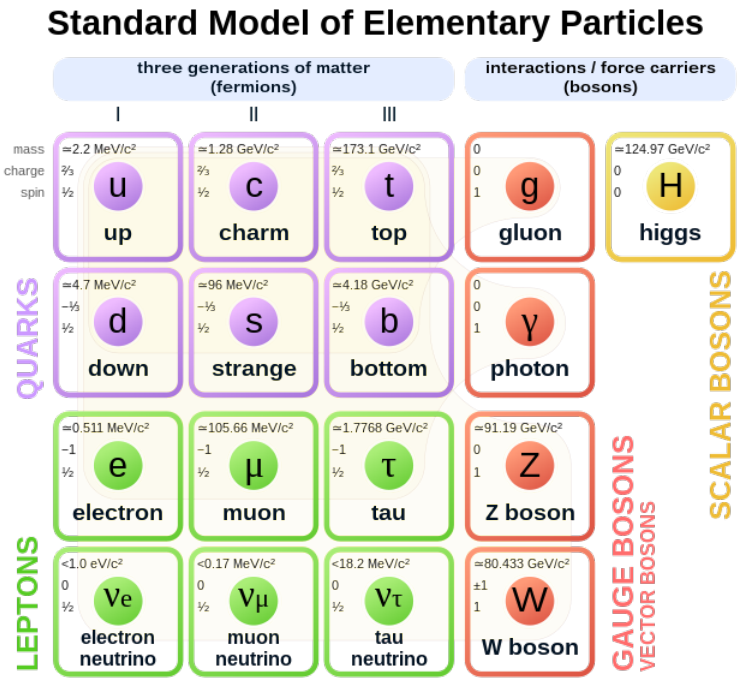
Standard Model conserved quantities

There are a few quantities that are strictly conserved in SM processes:

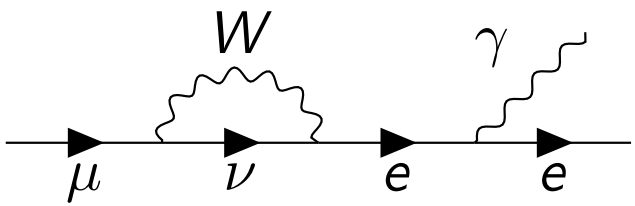
- Electric & colour charge
- Baryon number B
- Lepton number L

If neutrinos were massless, individual lepton flavour numbers L_e, L_μ, and L_τ would be conserved. With massive neutrinos, only L is conserved.
(Provided neutrinos are Dirac fermions and not Majorana fermions)



Charged Lepton Flavour Violation (CLFV)

- Example processes would be $\mu \to e\gamma$, $\mu \to e\,e\,e$, and $\tau \to \mu, e + X$
- We already see lepton flavour being violated in neutrino oscillation
- Best estimates of $\mu \to e\gamma$ rates by the same mechanism are $< 10^{-54}$, which are not realistically measurable
- Thus observing these processes implies new physics is at play!



Best probes for it currently, with their rates

Current best

MEG detector?

Best theories for explaining it

Conclusion