Leptons and Strange Particles

Leptons

What are leptons?

- Leptons are fundamental particles and they DO NOT feel the strong nuclear force (unlike baryons).
- They interact via the weak interaction and the electromagnetic force if they are charged.
- Leptons, like quarks, come in 3 generations / flavours. (tau - third generation is not in the spec)

Lepton collisions produce hadrons

- The universe would be very dull if all its particles were leptons, because:
  - → Neutrinos interact very little.
  - → Taus and muons are very short-lived and decays back to electron.
  - → Electrons repel each other.
- HOWEVER, leptons and antileptons can interact to produce hadrons.
- For example, an electron-positron annihilation event produces a quark and a corresponding antiquark, producing a shower of hadrons in each direction.

Symbol	Relative Charge	L_e	L_μ
e^-	-1	+1	0
ν_e	0	+1	0
μ^-	-1	0	+1
ν_μ	0	0	+1

Generation 1 — Electron & electron neutrino

- Electrons (e^-) are stable leptons.
- Electrons, like other leptons, come with their own neutrino: ν_e.

Generation 2 — Muon & muon neutrino

- Muons (μ^-) are like heavy electrons but they are unstable, and decay eventually into ordinary electrons.

Neutrinos

- Neutrinos travel almost as fast as light, billions of them sweeping through the Earth from space every second with almost no interaction.
- Neutrinos have zero electric charge and almost zero mass. (they have some mass)
- 3 generations of neutrinos: ν_e, ν_μ, ν_τ

Strange Particles

- Strange particles are so called because they have a property called strangeness.
- Strange particles are created via the strong interaction.
- Strangeness is only conserved in the strong interaction.
- Strange particles decay through the weak interaction.
- Strangeness is NOT conserved through the weak interaction.

Quark	Strangeness
s	-1
$\bar{s}$	+1
u	0