Source: KBhPHYS201QuantumWorldBookNotesIndex

1 | Meet the Leptons

- There are three families of subatomic particles
    - Flavor 1: the electron and it's nuetrino
    - Flavor 2: the Muon and it's nuetrino
    - Flavor 3: the the tau lepton and it's nuetrino
- Leptons carry one-half unit of spin and are either neutral or have 1 negative charge
- For every lepton there's an anti-lepton with an opposite unit of charge and the same mass
- Leptons have no known size and in all theories describing them are point particles

1.1 | Particles

- **Leptons** are fundemental spin one half particles that experience no strong interactions and contain no quarks
- **Baryons** are strong interacting particles that *do* contain quarks and have spin one half, but also 3/2 and 5/2 in some cases and are relatively heavy
- **Mesons** are composite strongly interacting particles also made of quarks that have spin either 0 or 1.
- **Quarks** are the fundamentally strongly interacting particles that are constituents of Baryons and have baryonic charge giving them a charge of 0 if two of them are united and 1 if 3 of them are
- **Force carriers** are particles whose creation, annihilation, and exchange create forces. It is these particles that we believe have no substructure

1.2 | Electrons

- Electrons are Leptons
- Has an opposite which is the positron
- Effectively launched particle physics as we know it
- Is beta radiation
- Equations to bridge relativity and quantum mechanics in order to describe the electron predicted 1/2 spin and also anti-matter
    - Some particles are their own anti-particles

1.2.1 | Radioactivity

- They realized that helium nucleus's shouldn't be able to escape the nucleus of a particle and that it would have to escape through quantum tunneling
- Gamma radiation is produced by a change in quantum state of the protons
- Neutrino was suggested as a way to solve some of beta decay's issues
    - So was neutron
- There are 3 types of neutrinos known
- We detected Nuetrinos through weak interactions with things around them

1.3 | Muons

- Cosmic radiation kept giving rise to the theory that there were charged particles around 200x more massive than an electron

- Muons appeared exactly like electrons but more massive
    - For some reason however it doesn't decay into an electron and like a gamma ray so we can assume it is somehow fundamentally different
        - This brings us back to it being a different *flavor*
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