**Particle Physics Part I - Accelerators, QED and types of Particles**

**Particle Accelerators:**

Linear Single stage Linear Multiple Stage Cyclotrons/Synchrotrons

**Particle discoveries:** (i.e. atoms are not fundamental particles)

1877: Electron – JJ Thomson and “Cathode Rays” (they have charge)

1930: Bothe and Becke eject a neutron by bombarding beryllium with alphas

1932: Anderson detects Positron in cosmic ray collisions. (Anti particle predicted to exist by Dirac)

1936: Anderson detect the Muon in a cosmic ray collision

1955: anti protons created in an accelerator by colliding 6 GeV protons:

p + p → p + p + p + $\overbar{p}$ (How are the proton and anti proton created?)

**Quantum Mechanics vs. Field Theory:**

In Quantum Mechanics, Forces are mediated (transmitted) by field particles:

 Feynman - QED Yukawa - mesons

  

π+ - 139.6 MeV/c2

πo - 135.0 MeV/c2

π- - 139.6 MeV/c2

p + p --> p + p + πo

p + p --> p + n + π+

(conservation of charge)

Type Relative Strength Field Particle

Strong Nuclear 1 Gluons (mesons)

Electromagnetic 10-2 Photon (γ)

Weak Nuclear 10-6 W+, W- and Zo

Gravitational 10-38 Graviton?



**Particles and Anti Particles:**

Name Particle Antiparticle

Electron e- e+

Proton p $\overbar{p}$

Pion π+ π-

**What happens if particle meets anti particle:**

**How you know if they have an antiparticle:**

**What the +, o, and - mean:**

**Types of Particles**

|  |  |  |
| --- | --- | --- |
| Gauge Bosons | Leptons | Hadrons |
|  |  | Mesons | Baryons |
|  |  |