Lecture 2 : Historical introduction to the world of elementary particles

- Discovery of the elctron by J.J.Thompson (1897)
- Blackbody spectrum and the introduction of the photon concept by Max Planck (1900)

  $E = h\nu$ h = Planck's constant = 6.626×10^{-34} Js
- Photoelectric effect A.Einstein (1905)

  $E < h\nu - w$
- Rutherford's scattering experiment (1911). Idea of atomic nucleus.
- Compton effect (1923) and Milikan's oil drop experiment (1916)
- Dirac's relativistic theory of electron (1926)
- Antiparticles, discovery of the of the positron in 1932 by C.D.Anderson
- Neutron (Chadwik (1932)
- Radioactive tritium beta decays and Pauli's hypothesis of neutrino (1930)

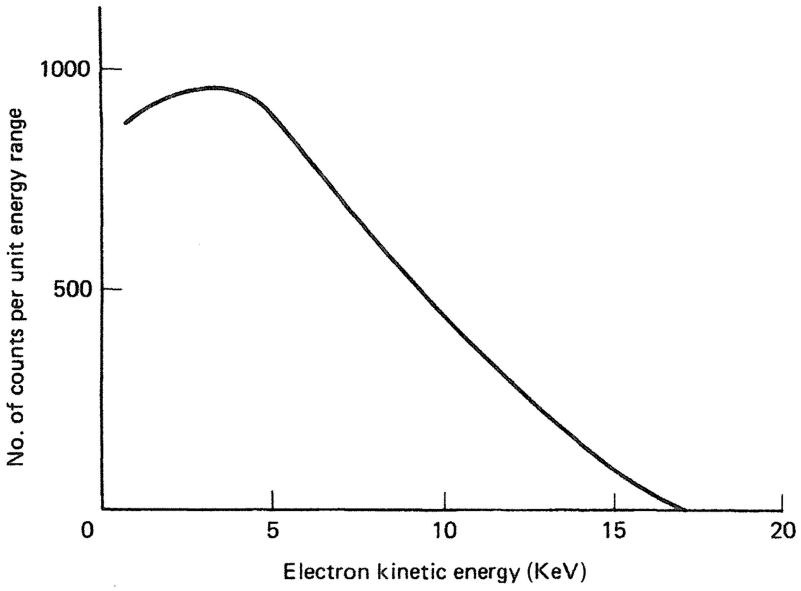


Fig. 1.5 The beta decay spectrum of tritium (${}^{3}_{1}H \rightarrow {}^{3}_{2}He$). (*Source*: Lewis, G. M. (1970) *Neutrinos*, Wykeham, London, p. 30.)

- Mesons (1930-1950) Yukawa'a discover of pi meson.

$$\pi^- \rightarrow \mu^- + \overline{\nu}$$

$$\pi^+ \rightarrow \mu^+ + \nu$$

- Muons and beginning of the lepton families

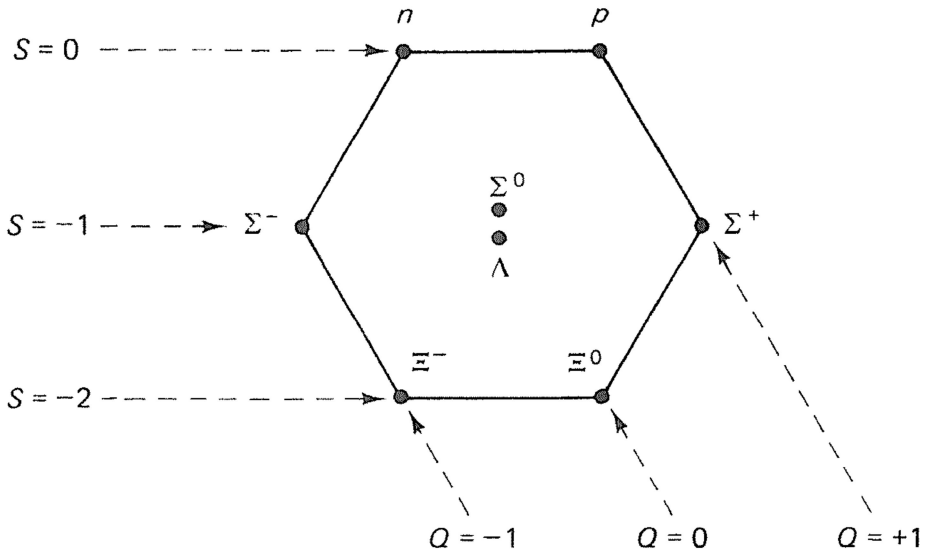
$$\mu^- \rightarrow e^- + \nu + \overline{\nu}$$

$$\mu^+ \rightarrow e^+ + \nu + \overline{\nu}$$

- Lepton number conservation :

$$\mu^- \not\rightarrow e^- + \gamma$$

- Strange particles
- M.Gell-Man'a classifications : Eightfold way and quark pictures



The baryon octet

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- Discovery of antiproton

$$p + p \rightarrow p + p + p + \overline{p}$$

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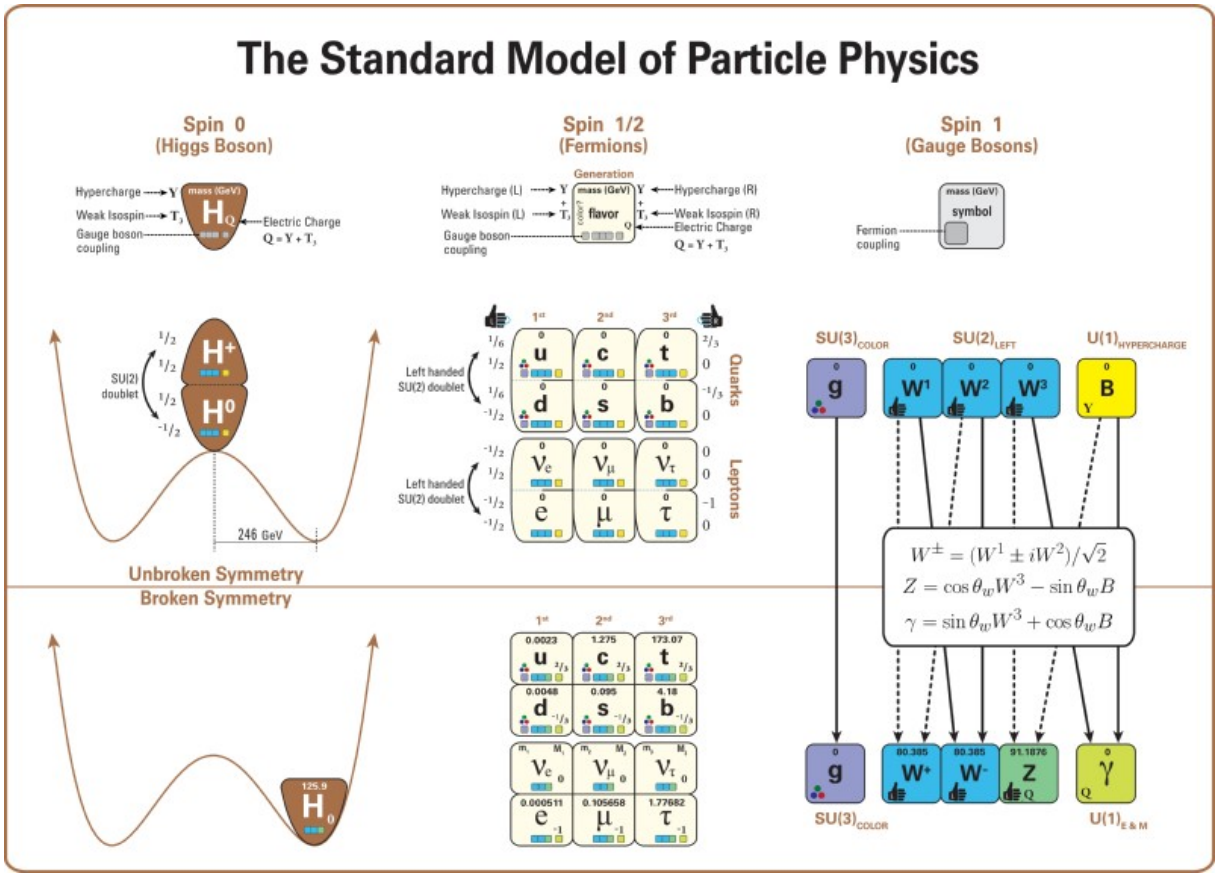
- Quark colors
- All naturally occuring particles ara color singlets
- Vector bosons : W^+ , W^- , Z , γ

- Standard Model (SM) of elementary particles based on quantum gauge field theories and local gauge interactions.



Standard Model of particle physics, a complete diagram
(by Latham Boyle - wikipage)

Homework

Solve the following problems at the end of the Chapter I of the textbook by D.Griffiths “Introduction to Elementary PArticles J.Wiley)

Solve Problem 1.1

Solve Problem 1.2

Solve Problem 1.3

Solve Problem 1.4

Solve Problem 1.5