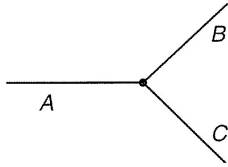**Lecture 11 : The Feynman Calculus - 2**
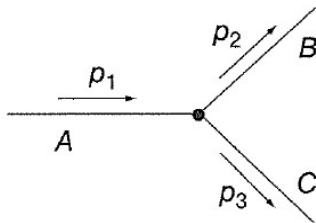
Feynman rules for a toy theory **(D.Griffiths textbook p.211)**
A universe consisting of three particles A, B and C. The only primitive diagram

vertex factor is –ig, where g is the coupling constant.

Homework : Study pages 211-221 to derive the Feynman rules for the above toy model of the field theory.

Lowest order diagram for the decay A → B + C

Decay rate is
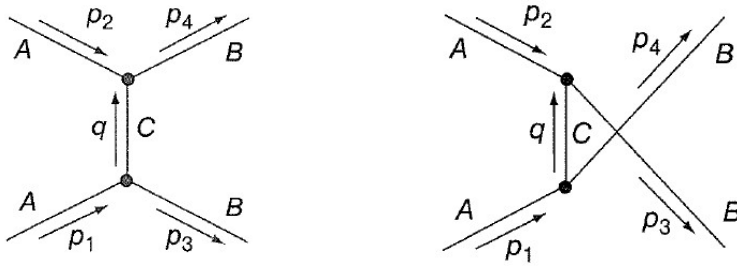
$$\Gamma = \frac{g^2 |\mathbf{p}|}{8\pi \hbar m_A^2 c}$$

Where magnitude of the either one of outgoing particle's momentum

$$|\mathbf{p}| = \frac{c}{2m_A}\sqrt{m_A^4 + m_B^4 + m_C^4 - 2m_A^2 m_B^2 - 2m_A^2 m_C^2 - 2m_B^2 m_C^2}$$

Therefore the lifetime of the A becomes

$$\tau = \frac{1}{\Gamma} = \frac{8\pi \hbar m_A^2 c}{g^2 |\mathbf{p}|}$$
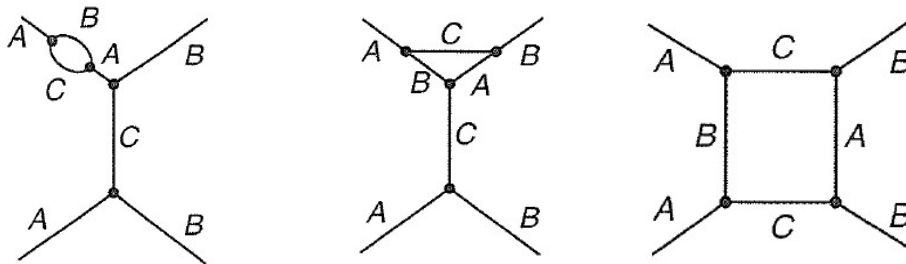
A + A → B + B Scattering

Lowest order diagrams contributing to the scattering

Differential cross section for the scattering in CM frame becomes

$$\frac{d\sigma}{d\Omega} = \frac{1}{2}\left(\frac{\hbar c g^2}{16\pi\, E\, \mathbf{p}^2\, \sin^2\theta}\right)^2$$

- Higher order corrections : sample diagrams

- Solve the following problems at the end of the Chapter VI of the textbook "Intr. to Elementary Particle Physics" by D.Griffiths.

Solve Problem 6.1

Solve Problem 6.2

Solve Problem 6.3

Solve Problem 6.4

Solve Problem 6.7

Solve Problem 6.9