

# 8.701

Introduction to Nuclear  
and Particle Physics

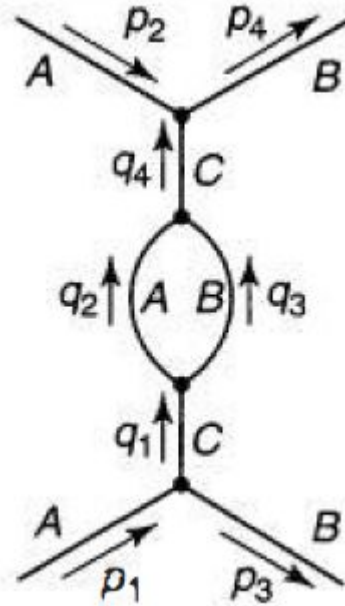
Markus Klute - MIT

3. Feynman Calculus

3.5 Divergency



# Two loop diagram



$$\mathcal{M} = i \left( \frac{g}{2\pi} \right)^4 \frac{1}{[(p_1 - p_3)^2 - m_C^2 c^2]^2} \int \frac{1}{[(p_1 - p_3 - q)^2 - m_A^2 c^2](q^2 - m_B^2 c^2)} d^4 q$$

# Divergency and Cutoff

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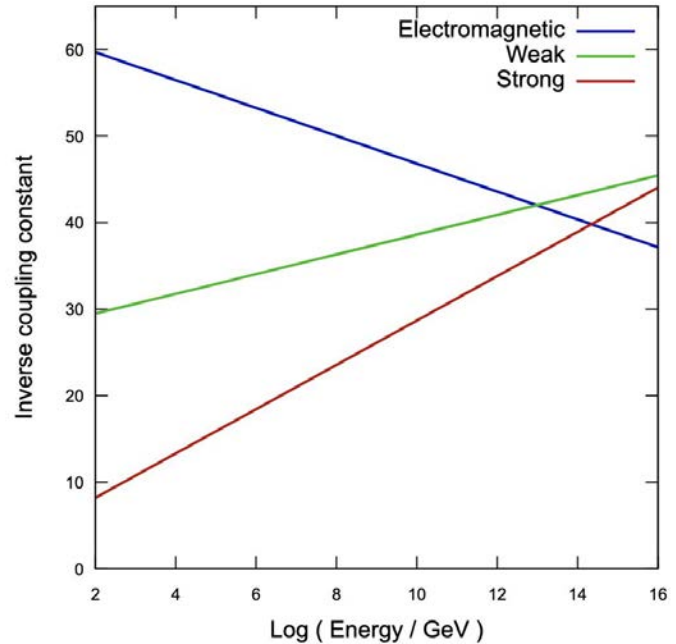
$$\int^{\infty} \frac{1}{q^4} q^3 dq = \ln q |^{\infty} = \infty$$

$$\frac{-M^2 c^2}{(q^2 - M^2 c^2)}$$

# Running couplings “constants” and “invariant” masses

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$$m_{\text{physical}} = m + \delta m; \quad g_{\text{physical}} = g + \delta g$$



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