

8.701

Introduction to Nuclear
and Particle Physics

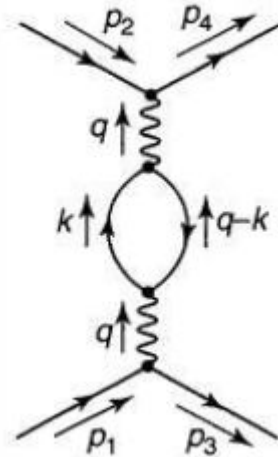
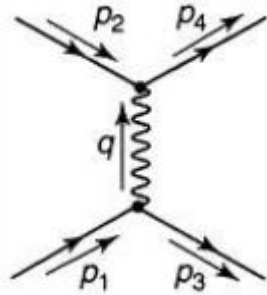
Markus Klute - MIT

4. QED

4.9 Renormalization and
higher-order QED diagrams



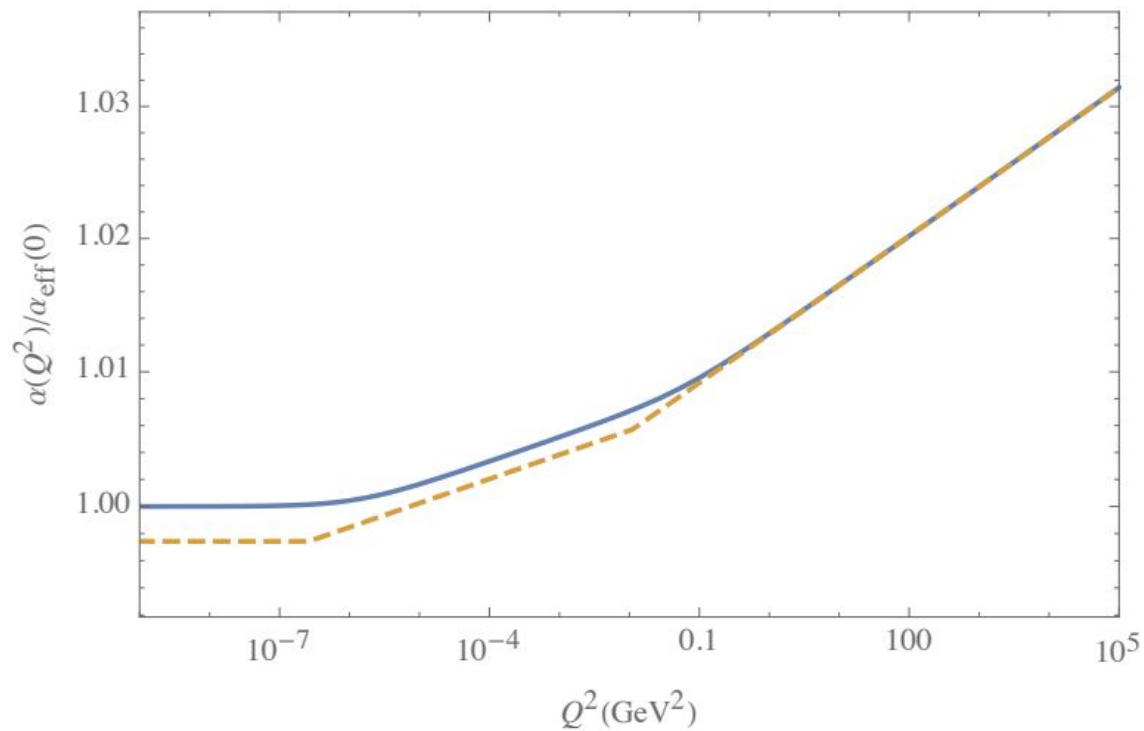
Vacuum Polarization and Renormalization



$$\alpha(|q^2|) = \frac{\alpha(0)}{1 - \left(\frac{\alpha(0)}{3\pi}\right) \ln\left(\frac{|q^2|}{m^2}\right)}$$

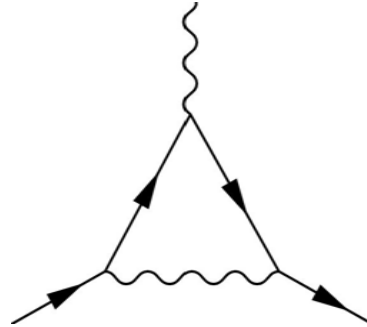
$$\alpha(M_W^2) \simeq \frac{1}{128}$$

Running of α_{QED}



Anomalous Magnetic Moment

Famous higher-order process for electrons (or muons)



$$\boldsymbol{\mu} = g \frac{e}{2m} \mathbf{S}$$

Schwinger showed (1948) that this modifies the electron g -factor from 2 to $2 + \pi/\alpha$. It is known with an uncertainty in g_e of about 10^{-12} .

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