Chapter 1

Quantum Electrodynamics (QED) : Maxwell's equation , Dirac equation .

Feynman diagrams, Quantum mechanics, Relativity

Physical intuition → bottom-up approach → many gaps

Goal is the top-down approach

Cross section calculation

$$\frac{d\sigma}{d\Omega} = \frac{1}{64\pi^2 E_{cm}^2 \cdot |M|^2}$$

(CM scattering)

For the QED, The 'M' is not known.

The best we can do : Set M as a perturbation series of QED, and evaluate the first term.

The Feynman diagram → visualize the perturbation.

In QM perturbation theory, to first order, the amplitude is,

$$\langle \text{ final state } | \ H_1 \ | \text{ initial state } \rangle$$

For $(e^- + e^+ \to \mu^- + \mu^+)$,

M $\sim \langle u^+ u^- \ |H_1| \ \gamma \ \rangle^u \ \langle \gamma | H_1 | e^+ e^- \rangle_u$