Week 6 (due May 14)

Reading: sections 69, 70, 71.

1. Consider spinor field interacting with a fixed classical gauge field $A_\mu(x)$ in the standard way:

$$L = \bar{\psi}(i\slashed{\partial} - m)\psi + e\bar{\psi}\gamma^\mu\psi A_\mu(x).$$

(a) Suppose $e \ll 1$ so we can treat the interaction as a small perturbation. Write down the Feynman rule (in momentum space) for computing scattering amplitudes.

(b) Let $A_\mu(x)$ be the Coulomb potential, i.e.

$$A_\mu(x) = g_{\mu 0}\frac{Q}{r}, \quad r^2 = \sum_i x^i x^i.$$

Compute the differential cross-section for electrons scattering off this potential.

2. Show that the structure constants f^{abc} are completely antisymmetric provided the generators are normalized as in eq. (69.8).

3. Problem 69.2 in Srednicky.

4. Problem 70.2(abcd) in Srednicky.