

Relativistic Quantum Field Theory, Fall 2006

Homework Assignment # 10

(Due Wednesday, November 15, after the lecture.)

Lectures and Reading Assignments:

Readings are from “*An Introduction to QFT*” by Peskin and Schroeder.

- Lec 19, 11/06 (Mon): Spin Sums and Trace Technology. Crossing Symmetry and Mandelstam Variables **Sec. 5.1 - 5.4**
- There will be **NO LECTURE** on Wed, 11/08.
- Lec 20, 11/13 (Mon): The electron vertex function **Sec. 6.2, 6.3**

Problems:

Numbered problems are from Peskin and Schroeder, Ch. 5.

1. **Compton Scattering:**

A photon of energy E collides with a stationary electron of mass m_e . Consider the elastic scattering process, $\gamma + e^- \rightarrow \gamma + e^-$ (“Compton scattering”). Compute the differential cross section as a function of θ , the angle between the initial and final directions of the photon, in two limits:

- “Classical limit”, $E \ll m_e$; and
- “Relativistic limit”, $E \gg m_e$.

NOTE 1: You can either work out the general answer and then take the two limits, or take the limits at some intermediate step (e.g. the invariant matrix element computation).

NOTE 2: This calculation is considered in section 5.5 of P&S; feel free to consult the book when working on this problem.

2. Problem 5.2
3. Problem 5.5