

PHY 5667 : Quantum Field Theory A, Fall 2003

October 30<sup>th</sup>, 2003

Assignment # 5

(due Thursday November 13<sup>th</sup>, 2003)

1. Which of the diagrams in Eq. (4.58) contribute to the invariant matrix element  $\mathcal{M}(p_1, p_2 \rightarrow p_3, p_4)$  at  $\mathcal{O}(\lambda^2)$ ? Write the explicit expression of  $\mathcal{M}(p_1, p_2 \rightarrow p_3, p_4)$  at  $\mathcal{O}(\lambda^2)$  in momentum space.
2. Problem 4.2 of Peskin and Schroeder's book.
3. Consider the two fermion scattering:

$$\text{fermion}(p) + \text{fermion}(k) \rightarrow \text{fermion}(p') + \text{fermion}(k')$$

in the context of the Yukawa theory. We have derived the lowest order or *tree level* invariant matrix element  $\mathcal{M}$  for this scattering process in class. Using that result, complete our discussion by calculating the differential cross section  $\left(\frac{d\sigma}{d\Omega}\right)_{CM}$  and the total cross section  $\sigma$ .

4. Problem 5.2 of Peskin and Schroeder's book.