

Winter, 2009. Homework Set 2. Due Wed, Feb. 11.

Problem numbers refer to your textbook.

1. Consider the process $e^+e^- \rightarrow \mu^+\mu^-$ in the extreme high energy limit, where the mass of the muon can be neglected. Explain why certain helicity combinations of μ^+ and μ^- have vanishing scattering amplitude in this limit (this will be outlined in class). Choose one combination of helicity states for the final μ^+ and μ^- . for which the amplitude is non-vanishing, and compute the cross section for unpolarized electrons to scatter into that combination of states.
2. Work out the details of the Compton scattering cross section, completing the calculation done in class. Calculate first the matrix element squared.
3. Calculate the differential cross section for Compton scattering in the lab frame (again, just filling out the details of the derivation performed in class).
4. Study the differential cross section for Compton scattering in the high energy limit, in the center of mass frame. In other words, assume that the electron mass can be neglected everywhere. Is the cross section singular? For what photon scattering angles? Can you offer an interpretation?