

E.12 The reaction $e^- e^+ \rightarrow \mu^- \mu^+$

Adding the muon to QED presents no problem. The muon has its own Dirac field, the coupling of the muon to the photon is identical to that of the electron, only the masses of muon and electron are different. In Feynman diagrams there are now muon and electron lines. Using the Feynman rules calculate the S- and T- matrix elements in lowest order in e for the reaction

$$e^-(p_1) + e^+(p_2) \rightarrow \mu^-(p_3) + \mu^+(p_4)$$

E. 13 Calculate the total cross section and the angular distribution in the c.m. system for the reaction

$$e^-(p_1) + e^+(p_2) \rightarrow \mu^-(p_3) + \mu^+(p_4).$$

$$\text{For } s \gg m_e^2, m_\mu^2$$

the electron and muon masses can be set to zero.