

Problem sheet (2)

1. Draw all relevant Feynman diagrams for

$$e^+(k)e^-(p) \rightarrow e^+(k')e^-(p')$$

scattering and hence write down the invariant amplitude for the process.

[2]

2. Show that

$$\sum_s (p, s) \bar{u}(p, s) = \not{p} + m .$$

where

$$u(p, s) = \sqrt{E+m} \begin{pmatrix} \chi^s \\ \frac{\vec{\sigma} \cdot \vec{p}}{E+m} \chi^s \end{pmatrix} \quad \text{and} \quad \chi^\uparrow = \begin{pmatrix} 1 \\ 0 \end{pmatrix}, \quad \chi^\downarrow = \begin{pmatrix} 0 \\ 1 \end{pmatrix}$$

[4]

3. Show that

$$\text{Tr}((\not{k}' - m)\gamma^\mu(\not{k} - m)\gamma^\nu) = 4(k'^\mu k^\nu - (k' \cdot k)g^{\mu\nu} + k^\mu k'^\nu) + 4m^2 g^{\mu\nu}$$

[HINT: The γ -matrices obey $\{\gamma^\mu, \gamma^\nu\} = 2g^{\mu\nu}$ and traces are cyclic]

[4]