Exercise 3 – Particle Physics – Summer 2016

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hand in: Tue 17.5. (Post bin Prof. Niklaus Berger)

3.1 γ matrices   (3 points)

Show that $(\gamma^\mu)^\dagger = \gamma^0 \gamma^\mu \gamma^0$

3.2 Spinors   (5 points)

Writing the four-component spinor u_1 in terms of two two-component vectors,

$$\left(\begin{array}{c} u_A \\ u_B \end{array} \right),$$

show that in the non-relativistic limit the components of u_B are smaller than those of u_A by a factor $\frac{v}{c}$.

3.3 Draw a Feynman diagram   (3 points)

Draw the two lowest-order Feynman diagrams for the Compton scattering process $\gamma e^- \to \gamma e^-$.

3.4 electron-positron scattering   (5 points)

Draw the lowest-order t-channel and u-channel Feynman diagrams for $e^+ e^- \to \gamma\gamma$ and use the Feynman rules for QED to write down the corresponding matrix elements.