Exercise Sheet 2 – Particle Physics – Summer 2016

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hand in: Mo 2.5. (in the lecture)

2.1 Two-body decay **(5 points)**

Consider the decay at rest of a particle with mass M in two particles with masses m_1 and m_2. What is the momentum of the final particles.

2.2 Angle between photons in $\pi^0 \to \gamma\gamma$ decay **(5 points)**

The neutral pion π^0 primarily (98.82%) decays into two photons. What is the minimum angle between two photons produced from decay of a pion with energy $E = 1$ GeV.

2.3 Partial width of $\pi^0 \to e^+e^-\gamma$ **(3 points)**

Calculate the partial width of the decay $\pi^0 \to e^+e^-\gamma$ given the branching fraction $B(\pi^0 \to e^+e^-\gamma) = 1.17\%$ and the π^0 life time $\tau = 0.085$ fs.

2.4 Neutrino interaction **(4 points)**

Calculate the interaction probability of a $E = 100$ GeV muon neutrino ν_μ with a 5 cm thick lead $^{207}_{82}$Pb block. The neutrino-nucleon cross section is $\sigma \approx 6.7 \frac{E}{GeV}$ fb.