

Physics 556/714 Problem Set #10

due *beginning of class* Thursday Dec 4

- 1) Griffiths problem 10.6: "In the text I said that electron energies in neutron decay..."
Also calculate how your answer changes if the neutrino has a non-zero mass.
- 2) Griffiths problem 10.11: "Show that if $mc^2 \ll E$..."
- 3) Consider the decay of the heavy τ lepton.
 - a) What is the partial decay width for $\tau^- \rightarrow \mu^- \bar{\nu}_\mu \nu_\tau$? Assume $m_\mu = 0$.
(You should be able to quote this result without any calculation at all.)
 - b) What is the value of the above decay width in MeV?
 - c) What is the corresponding lifetime of the τ in seconds?
(How do you deal with the fact that the τ does not decay to this final state 100% of the time?)
 - d) How does this value compare with the experimentally measured value? Was our assumption about the muon mass valid?
- 4) Griffiths problem 10.1: "(a) Calculate $\langle M^2 \rangle$ for $\nu_\mu + e^- \rightarrow \mu^- + \nu_e$..."
Take part a) of this problem as given. Do only parts b) and c).

714 students please also do the following:

- 5) Griffiths problem 10.20: "Calculate the decay rate for $Z^0 \rightarrow f + \bar{f}$ "
Use the Coulomb gauge.
(Not sure about some of the Feynman rules? Check Griffiths appendix D)