Physics 56400 Assignment #4 – Due October 29th

1. A proton beam hits a target to produce a secondary beam that contains neutral kaons with a momentum p. What distance must this beam travel before the K_S^0component is less than a fraction f? Calculate this distance for $p = 120\ GeV$ and for $f = 10^{-4}$ and for $f = 10^{-6}$.

2. Suppose the cross section for a K^0 interacting with a piece of regenerator material (assume it to be a pure element) is σ and the cross section for a $\overline{K^0}$ interacting with the same type of material is $\overline{\sigma}$. As a beam of neutral kaons propagates through this material it will be attenuated, so that the fraction emerging from the material will be given by $e^{-\Gamma x}$ or $e^{-\overline{\Gamma} x}$ for K^0 and $\overline{K^0}$, respectively. What are the expressions for Γ and $\overline{\Gamma}$ in terms of the cross sections σ and $\overline{\sigma}$?

3. If an initially pure beam of K_L^0 passes through a piece of the material referred to in question 2 with a thickness x in the path of the beam, what fraction of the beam that emerges will be in the K_S^0 state?

4. What is the probability of observing a K_S^0 decay as a function of distance z from the end of the regenerator material?