Homework # 3. Due: Thursday, 09/23/99

9. Coulomb correction to the allowed β-decay spectrum, Fermi function.
   a). Sketch the shape of the momentum spectrum N(p) for an allowed β-decay. Give a brief qualitative explanation of the shape.
   b). For a daughter nucleus of a given charge Z, estimate at which values of the β-particle's momentum is the spectrum significantly effected by the Coulomb interaction of the electron (or positron) with the nucleus. Give an expression for the boundary value of the β-particle's momentum "in letters" and "in numbers." Use the non-relativistic approximation.
   c). What is the range of applicability of the non-relativistic approximation?
   d). When is it necessary to take into account the influence of the atomic electrons?

10. Estimate the relative "strength" of the gravitational interaction with respect to the strong interaction in a nucleus. Use the approach outlined in Krane's Section 9.3. Start with figuring out the dimensions of the gravitational constant G_g. Convert this constant into dimensionless form by multiplying by appropriate powers of $\hbar$, c, and a mass scale m. Obtain the numerical value by assuming $m=m_p$.

11. Krane's problem 9.9

12. Krane's problem 9.17

13. Krane's problem 9.21 Hint: consider the reaction energetics as discussed e.g. in Section 9.1. Explain why the electron mass does not appear explicitly in Eq. (9.10).