AP 4010 Introduction to Nuclear Science
Fall 2004

Homework Assignment: Due September 21, 2004

1. Do any seven of the twelve problems at the end of Chapter 1 in Lilley's *Nuclear Physics*. [Remember: the answers are in Appendix G! …so show the essential steps of your solution.]

2. What are the wavelengths of 10, 100, and 1000 keV x-rays?

3. Separate the following nuclides into pairs of isotopes, isobars, isotones, or isomers: ${}^{3}_{1}\mathrm{H}$, ${}^{4}_{2}\mathrm{He}$, ${}^{3}_{2}\mathrm{He}$, ${}^{12}_{6}\mathrm{C}$, ${}^{12}_{7}\mathrm{N}$, ${}^{14}_{6}\mathrm{C}$, ${}^{99}_{43}\mathrm{Tc}$, ${}^{99}_{42}\mathrm{Mo}$, ${}^{99m}_{43}\mathrm{Tc}$, ${}^{100}_{44}\mathrm{Ru}$.

4. Estimate the "mean free path" corresponding to the cross section *per nucleon* of 1 b (10^{-28} m^2) in liquid hydrogen, air at STP (standard temperature 300 K and pressure, 1 atm), Al, Cu, and Pb.

   [Densities: LH = 0.07 g/cm cm^3; air = 0.0012 g/cm^3; Al = 2.7 g/cm^3; Cu = 8.96 g/cm^3; Pb = 11.34 g/cm^3.]

   [Atomic Weights: LH = 1.0079; air = 14.4; Al = 29.98; Cu = 63.55; Pb = 207.2.]

5. A beam of protons of 1 MeV energy containing 10^8 protons per second falls on a silver foil (0.05 mg cm^{-2}) thickness and is scattered at 45 deg. Use the Rutherford Scattering formula to estimate the number of protons per second that falls upon a detector 10 cm^{-2} in area located 1 m from the foil.