AP 4010 Introduction to Nuclear Science
Fall 2004

Homework Assignment 5: Due October 26, 2004

NOTE: There will be no class on Tuesday, November 2 because of Election Day. Our next class will be November 9.

1. Do any **three** problems of 2.5 through 2.10 at the end of Chapter 2 in Lilley's *Nuclear Physics*.

2. Consider a nucleus as a *uniform* dense sphere of radius $R = 1.4\ A^{1/3}$ fm. Assume also that the charge, Z, is also *uniformly* distributed. Using *classical* mechanics, answer the following three questions:

   Calculate the angular velocity, ω, of the sphere required to produce an angular momentum equal to $l\hbar$ (where l is a small integer)?

   What is the rotational kinetic energy associated with the rotation?

   Show that the current circulating the axis of rotation is $\omega eZ/2\pi$ (where $e = 1.6 \times 10^{-19}$ C).

   Finally, compute "typical" values for ω, $I\omega^2/2$, and $\omega Z/2\pi$ for $Z = 32$, $A = 64$, $R = 5.6$ fm, and $l = 1$.

   Hints: The moment of inertia of a sphere is $I = 2\ MR^2/5$ (where M is the mass of the sphere.) Momentum and energy are $I\omega$ and $I\omega^2/2$, respectively.

3. Use the SEMF to estimate the (a) the energy required to remove one neutron from each of ^{7}Li, ^{91}Zr, and ^{236}U; (b) the energy required to remove one proton from each of ^{20}Ne, ^{55}Mn, and ^{197}Au.