Name: _____ PHYS 7501, FS 2017

Homework 4 **Due:** Start of class, October 5th

1. Suppose the 5.305MeV state of ^{44}Ti is populated by ^{40}Ca(α,γ).
   This 5^- state has been observed to primarily decay to the 2_1^+ state at 1.083MeV.
   a. Through what decay types El, Ml could this occur?

   b. For the lowest multipoles of each transition type, estimate $t_{½}$. Compare to the NNDC.

   c. Calculate the internal conversion coefficient α assuming a K-orbital electron ejection for these two cases

   d. Calculate $t_{½}$ for the hypothetical transition between the 5.305MeV 5^- state and the 5.250MeV 5^- state.

2. Suppose ^{40}Ca(α,γ) instead populates the 6.606MeV 2^+ excited state, it then decays by an $E2$ transition to the 2^+ excited state at 2.530MeV, which then decays to the 0^+ ground state. What would the angular distribution look like for the 2nd γ-ray when using the 1st γ-ray as the reference axis? Plot it.

3. Since $dE_f/dx \approx 10MeV$, a standard estimate for the barrier curvature is $\hbar\omega$=0.5MeV, and the spontaneous fission half-life for ^{235}U is $3.5 \times 10^{17} yrs$, what is the spontaneous fission half-life for ^{240}Pu? Compare to the experimental value of $1.2 \times 10^{11} yrs$.

4. In class, we found fission was the decay branch 25% of the time for a 42MeV α on ^{238}U. What would the fission decay branch be for a 42MeV neutron on ^{238}U? (Use $E_f(^{239}U) = 5.8MeV$)