Physics 5110 Homework 5 (due Feb 15)

February 10, 2012

1. Williams, problem 4.2.

2. Various experimentally determined energy levels of \(^{40}\text{Ar}\), \(^{40}\text{Ca}\), and \(^{40}\text{K}\) are shown in Williams, Fig 5.8. Explain the dotted line below the lowest \(^{40}\text{K}\) level from which \(\beta^+\) decay originates. Use the semi-empirical mass formula to calculate the masses of the three nuclides and compare your results with the experimental values for the energy levels shown there. (Be sure to convert to atomic masses, including the electrons.)

3. Construct an energy level diagram for beta stability like Williams Fig 5.7, but do it for the A = 40 isobars, going from \(^{40}\text{Sc}\) to \(^{40}\text{P}\). Use atomic masses in MeV/c^2. The National Nuclear Data Center (NNDC) interactive chart of nuclides should help. (There is a link from the course web resources page.)

4. Williams, problem 5.6. Except do this starting with A = 242, Z = 94 and ending with \(^{206}\text{Pb}\). Present your results in the form of Williams Table 5.2. Again, the NNDC tool can help.

5. Extra credit. Williams, problem 4.3. Note that in some printings there is an error. It should have \(R_0^2\).