Exercises spring 2016 PHY981

Spring 2015

Exercise 1, deadline January 22

Masses and binding energies. The data on binding energies can be found in the file bedata.dat at the github address of the course, see https://github.com/NuclearStructure/PHY981/tree/master/doc/pub/spdata/programs

- Write a small program which reads in the proton and neutron numbers and the binding energies

and make a plot of all neutron separation energies for the chain of oxygen (O), calcium (Ca), nickel (Ni), tin (Sn) and lead (Pb) isotopes, that is you need to plot

$$S_n = BE(N,Z) - BE(N-1,Z).$$

Comment your results.

- In the same figures, you should also include the liquid drop model results of Eq. (2.17) of Alex Brown's text, namely

$$BE(N,Z) = \alpha_1 A - \alpha_2 A^{2/3} - \alpha_3 \frac{Z^2}{A^{1/3}} - \alpha_4 \frac{(N-Z)^2}{A},$$

with $\alpha_1 = 15.49$ MeV, $\alpha_2 = 17.23$ MeV, $\alpha_3 = 0.697$ MeV and $\alpha_4 = 22.6$ MeV. Again, comment your results.

- Make also a plot of the binding energies as function of A using the data in the file on bindingenergies and the above liquid drop model. Make a figure similar to figure 2.5 of Alex Brown where you set the various parameters $\alpha_i = 0$. Comment your results.

- Use the liquid drop model to find the neutron drip lines for Z values up to 120.

Analyze then the fluorine isotopes and find, where available the corresponding experimental data, and compare the liquid drop model predicition with experiment. Comment your results.

A program example in C++ and the input data file *bedata.dat* can be found found at the github repository for the course, see https://github.com/NuclearStructure/PHY981/tree/master/doc/pub/spdata/programs

Deadline for this exercise is **January 22, 5pm**. You can hand in electronically by just sending me your github link, or just the file. I digest most formats, from scans to ipython notebooks. The choice is yours.