Homework 7, due 11-3

In class we introduced the Fermi gas model of nuclei. Consider a Fermi gas of protons and neutrons. The total energy depends on the number of protons, Z, and the number of neutrons, N. We will assume that N and Z are not very different. Write the total energy in the form

$$E = a_V A + a_A \frac{(Z - A/2)^2}{A} + \dots,$$

where $\dots$ are terms of higher order in $(Z - A/2)$. Express the volume energy a_V and the asymmetry energy a_A in units of the (average) Fermi energy

$$\epsilon_F = \frac{\hbar^2 k_F^2}{2m_N},$$

where k_F is the average Fermi momentum of the protons and neutrons.