

Homework 4, due 9-22

In class we solved the Schrödinger equation for the s-wave bound state of the deuteron under the assumption that the bound state is shallow. Repeat the calculation without using this approximation. Use the potential

$$V(r) = \begin{cases} -V_0 & r < a \\ 0 & r > a \end{cases}$$

with $a = 1.4$ fm. Fix V_0 from the measured binding energy $B = -2.2$ MeV. Determine the rms radius $\sqrt{\langle r^2 \rangle}$ of the deuteron.

Hint: Remember that

$$\int d^3r f(r) = 4\pi \int r^2 dr f(r).$$