Physics 499

Homework Assignment 1
Finding Roots

Due Wednesday April 17th

Problem : Λ hypernuclei
Reference: Am. J. Phys. 58, 1016 (Oct 1990).

The energies of the bound states of a three dimensional square well of radius R are solutions of the equation:

for $\ell = 0$

$$tan\Big(\sqrt{\frac{2m(V_0 - |E|)}{\hbar^2}}\ R\Big) = -\sqrt{\frac{V_0 - |E|}{|E|}} \tag{1}$$

Consider the following data for Λ bound states in the nucleus:

Nucleus	^{13}C	^{16}O	^{28}Si	^{40}Ca	^{51}V	^{89}Y
Mass Number (A):	13	16	28	40	51	89
ℓ=0 binding energy (in MeV):	10.5	12.1	17.1	18.5	18.0	23.0

Useful information: Nuclear radii are roughly given by: R = 1.1 $A^{1/3}$ in fm; $m_\Lambda c^2$ = 1115 MeV ; $\hbar c$ = 197.33 MeV-fm

Using your favorite computer programming method for finding roots of an equation, find values of the mean field potential V_0 (in MeV) for each of these nuclei. Are they approximately equal? Discuss the significance of this. What is the average mean field potential that the lambda particle experiences in the nuclear medium?

You should turn in (e-mail) two files: your computer code that will run in either gcc or ROOT, and a file discussing your results. The prefered format for the discussion file is latex. Be sure your name is somewhere in each file you e-mail to me.