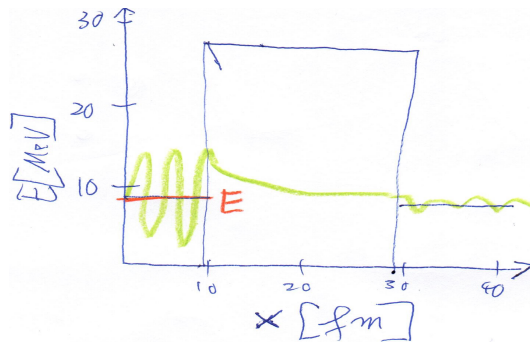


Phys106, II-Semester 2018/19, Assignment 10

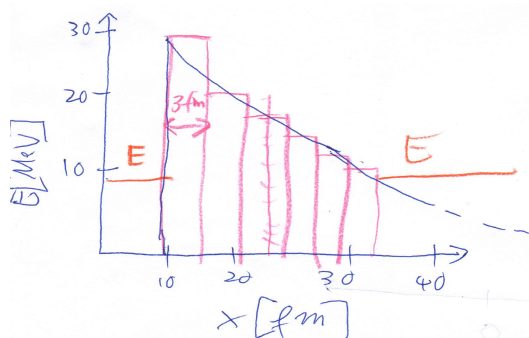
Instructor: Sebastian Wüster

1. A polonium-212 nucleus emits an α -particle of energy 8.78 MeV by tunnelling through a barrier which is 26.4 MeV high and 18 femtometer wide.

- (i) What is the probability of tunnelling assuming a single rectangular barrier, such as in Fig shown below?

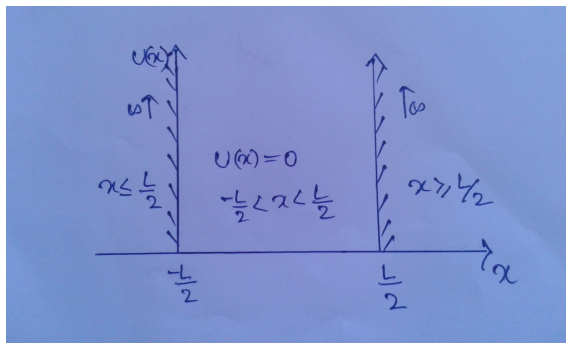


- (ii) What is the probability of tunnelling assuming a series of rectangular barriers of heights 26 MeV, 20 MeV, 16 MeV, 13 MeV, 11 MeV, 9 MeV and widths 3 fm as shown in Fig. below? *This give a more accurate approximation of the realistic drop-off of the Coulomb potential outside the nucleus.*



Please turn over....

2. Consider an infinite wall box potential such as in the lecture, but shifted to the range $-\frac{L}{2} < x < \frac{L}{2}$, see Fig. below. Re-do the derivation from the lecture to find eigen-states and eigenvalues. Discuss your answer.



3. **(advanced)** Show Eq. (113) for the tunnelling probability through a barrier. For this, follow the steps discussed in the lecture of matching wave function and derivatives continuously between the regions I, II, III. Use the Ansatz (pieces) of wave-function given in section 3.3.2). *Please refer to Beiser, Appendix Chapter 5*