

Quantum Design Project

1. Make a plot of the energies of the lowest three states of a square well of width a as a function of well depth. (When the well depth is infinite, the energies will be in the ratio 1:4:9.)
2. Find the well depth for which the energy differences E_{12} and E_{23} are the same. (I think this can be done.)

3. From your plot, I expect you will find that there is no way to make $E_{23} = 2E_{12}$ by varying the well depth. There are good reasons to think that it might be possible to make $E_{23} = 2E_{12}$ by using a double finite square well (both wells with the same depth and width.) Find values for well depth and separation that make this happen (or explain why it is not possible.)

Logistics:

Work in teams of 3. Set up your own team.

You can use AI, but claims in your “final report” must be supported. You’ll almost certainly need to do some computer work, either to solve transcendental equations or to numerically integrate the Schrodinger equation.

Due date: Tuesday, November 18. You should get started right away. I think you can do parts 1 and 2 in an afternoon of work. (The single well is “easily” solved by solving a transcendental equation, see Griffiths pp 70-72.)

This assignment will count as a double homework.