Problem Set 5
Due Fri, Sept 29[♣]

Background: Chapters 4 & 5 (Finite Depth Box), & "When Ψ Is Not An Eigenfunction of $\hat{A}$" (below)
Problems: P4.13, P4.16, P4.17, P4.18, P4.19, P4.21, P4.23, P4.24, P4.25 (*Mathematica* problem, all parts), P5.2, P5.3, P5.4, Extra Problem (below)

When Ψ Is Not An Eigenfunction of $\hat{A}$

Suppose you are given a system's wave function (Ψ) *and* you are asked to predict things about measurements of an observable *a* (corresponding to $\hat{A}$), *and* Ψ is not an eigenfunction of $\hat{A}$. What do you do?

First, remember that Ψ (assuming it is well-behaved) can be rewritten as a linear combination of the eigenfunctions of $\hat{A}$. If there are a set of functions, ϕ_i, that satisfy:

$$\hat{A}\,\phi_i = a_i\,\phi_i$$

then we can write:

$$\Psi \;=\; \sum^{all\ i} c_i\,\phi_i$$

Next, remember that all questions about measurements can be solved using this linear combination. For example,

- The expectation value $\langle a \rangle$ will be a weighted average of the a_i
- A single measurement will yield one of the a_i but we don't know which one
- The probability of measuring any particular a_i is proportional to $|c_i|^2$

Extra Problem

a. Draw the molecules referred to in problems P5.2, P5.3, P5.4

b. What quantity would you vary in the finite depth 1-D box (Ch. 5) to gradually convert it into an infinite depth box (Ch. 4)?

c. Show varying the quantity in part B causes the wave functions and energies for the particle in a finite depth box (Ch. 5) to approach the corresponding quantities for the particle in an infinite depth box (Ch. 4)

[♣] Deadline will be relaxed, *if* tell me about your Th-F schedule, *and* you arrange to meet with me during a free hour on either Th or F to work on your problem set.