

Homework 7

Due in class Oct. 7

From Shankar: Exercises 7.3.4, 7.3.6, 7.4.1, 7.4.2, 7.4.5, and 7.5.2.

7. A charged particle experiences the oscillator potential

$$V = \frac{1}{2}m\omega^2 X^2.$$

The whole system is then placed in a uniform electric field so that there is an additional potential

$$W = -q\mathcal{E}X$$

where q is the charge and \mathcal{E} the magnitude of the electric field.

- (a) Plot the total potential for this system with $\mathcal{E} \neq 0$.
- (b) Calculate the eigenstates and energies for this system.
- (c) This is a reasonable model of an electron bound to an atom placed in an electric field. A useful parameter for an atomic state is its polarizability. Calculate the induced dipole moment for the present system for a given state $|n\rangle$.