F20 PHYSICS 137B: HW 8

Due October 30 at 11:59 pm

October 20, 2020

1 Griffiths problems

Do the following problems from Griffiths: 11.14, 11.16ab

2 Other problems

2.1

A hydrogen atom in the ground state is placed in a uniform electric field in the z-direction:

$$\mathbf{E} = E_0 e^{-t/\tau} \hat{z}, \tag{2.1}$$

which is turned on at $t = 0$. What is the probability that the atom is excited to the $2P$ state at $t \gg \tau$?

2.2

Suppose that a hydrogen atom, initially in the ground state, is placed in an oscillating electric field $E = E_0 \cos \omega t$ in the z-direction, with $\hbar\omega \gg 13.6$ eV. Calculate the rate of transitions to the continuum. Assume that the electrons are ejected in the z-direction and that the rate of emission into other directions is equivalent to this.

2.3

Suppose "white" light with a constant energy density $u(\omega) = u_0$ is shined on a hydrogen atom in its ground state. What is the total rate of transitions that the atom will make to higher $n = 2$ states due to the light?