

Phys 402: Applications of Quantum Mechanics

Homework 10 (Total 2 problems; due 930am, Thursday, April 7, 2016)

[To receive full credits, please show all necessary steps that lead to your answers.]

- 1) John wants to optically pump an electron from 1s to one of the 2p orbital in a hydrogen atom so that at the end at certain moment the electron occupies the 2p orbital with nearly 100% (or more than 90%) probability. The maximum electric field in the lasers available in John's lab is around 1000V/m. Estimate what range of the laser frequencies John needs to work with to achieve the above goal.
- 2) Consider a hydrogen atom at 2p state. Estimate the life time of the atom due to the spontaneous emission. (Pre-read Section 9.2.3 and 9.3.1 before starting. This is a simple example where you can apply what you have learned so far. You might need a little bit information from Chapter 5, section 5.4.5 on the black-body spectrum to understand the spontaneous emission.)