

PHY140Y

Spring Term – Tutorial 18 Discussion

28 February 1999

1. A hydrogen atom in its ground state absorbs a 12.75 eV photon and is placed in an excited state. The excited atom can then de-excite.
 - (a) What are the possible energy states it can go to?
 - (b) What are the energies of all possible photons released in the atom going from this excited state to the ground state?
2. A Rydberg atom is a hydrogen atom with an electron in a very excited state ($n \sim 200$).
 - (a) What is the radius of a Rydberg atom with $n = 250$?
 - (b) What is its *binding energy*?
 - (c) Suppose a Rydberg atom in the $n = 273$ state drops to the $n = 272$ state. What is the frequency of the emitted photon? Why are radio-astronomers interested in these sorts of atoms?
3. Let's look at de Broglie waves:
 - (a) What is the minimum electron speed that would make an electron microscope superior to an optical microscope that uses 450 nm light?
 - (b) How slow must an electron travel so that its de Broglie wavelength equals 1 mm?
 - (c) The Earth moves at 30 km/s. What is its de Broglie wavelength?