

## Structure of matter: Series 5

Due on November 23<sup>rd</sup> 2017 after the lecture

Please indicate your name and the name of your seminar group leader on the solution sheets!

1. Estimate the difference between the emission wavelength of the transition  $n=2 \rightarrow n=1$  in an ordinary hydrogen atom and a deuterium atom. (4 Points)
  2. Stellar spectra exhibit a multitude of spectral lines, and by far not all of them are related to hydrogen. Some of them belong to the spectra of ionized Helium and Lithium. However, the spectra of H;  $\text{He}^+$  and  $\text{Li}^{2+}$  exhibit strong similarities.
    - a. Sketch and calculate the energy levels of  $\text{He}^+$  and  $\text{Li}^{2+}$  up to the Hydrogen level  $n = 3$  and compare the energy levels with the corresponding energy levels of the Hydrogen atom.
    - b. Which spectral lines of  $\text{He}^+$  and  $\text{Li}^{2+}$  would coincide with the Lyman series of Hydrogen if the Rydberg constants of Hydrogen,  $\text{He}^+$  and  $\text{Li}^{2+}$  would be the same?
    - c. Let us assume that the reduced electron mass is the same for Hydrogen and  $\text{He}^+$ . Would we find some orbits with coinciding radii for the Hydrogen atom and the He-ion, respectively?
- (6 + 2 + 1 points)