Exam Radiative processes

17/01/2014 Afternoon

1   Short questions

- Show that if stimulated emission is neglected, so that there are only two Einstein coefficients left in the transfer equation. An appropriate relation between the Einstein coefficients will be consistent with the Thermal equilibrium between the atom and the radiation field of a Wienn spectrum, but not a Planck spectrum.

- A radio-astronomer states that $I_\nu = \alpha D S_\nu$ for some cloud with diameter D. Which assumptions were made?

- If we look at the solar disk centre, we that Hα lines are in absorption but Lyα lines in emission. Explain how this is possible. Assume LTE.

2   Question 2

A spherical cloud with some radius, a temperature of 8000 K and an ion-density was given. Assumptions: optically thin and consists entirely out of hydrogen.

- Calculate the luminosity using the volume emissivity (gaunt-factor=1) in solar luminosities.

- At what wavelength would you see this?

- What is the luminosity if it were optically thick?

3   Question 3

We used Larmor's formula for several radiative processes. Can you synthesise them and give which assumptions were made?

4 Question 4

A spectrum of two similar stars is given. What can you tell about the stars? (Emission, absorption, which lines,...) Use the last page of the course as a guideline. (The spectrum was something like the figure shown but with some extra emission lines in the lower wavelength range. Lines like Hα, Hβ, [OIII], [SNII] were given.