

# Astrophysics

## Compulsory Home Exercises. Problem Set 5.

Return by Wednesday, April 20, 2022.

Please, write down **every step in your line of thinking** and state assumptions etc.  
A sole answer is not enough.

- In terms of the specific intensity  $I$ , which of the listed below is the correct expression for the amount of radiation flowing per unit time, per unit solid angle through a unit area at an angle to the normal?
  - $I \sin \theta$
  - $I \theta$
  - $I \cos \theta$
  - $I \cos \theta \sin \theta$
  - $I$
- Which 2 opacity sources do dominate in a stellar atmosphere ( $T_{\text{eff}}=8064 \text{ K}$ ,  $P_e=30 \text{ dyn/cm}^2$ ) at  $5000 \text{ \AA}$  and  $18000 \text{ \AA}$ ? Is the contribution of the second one is negligible enough to be not taken into account?
- Calculate the ratio of the absorption coefficients due to bound-free absorption above and below the Balmer edge (Balmer jump) for a hydrogen atmosphere with  $T_{\text{eff}}=9520 \text{ K}$ .
- Balmer hydrogen lines are not seen in the spectra of either O stars or K stars. Why not?
- An F star has a temperature  $T_{\text{eff}}=7000 \text{ K}$ . Microturbulence in the atmosphere has RMS velocity  $\xi_t=3 \text{ km/s}$ . Determine the FWHM of an optically thin line of iron with wavelength  $4000 \text{ \AA}$ .
- Determine the FWHM of an optically thin line which is broadened due to both the quadratic Stark effect with the FWHM of  $\Delta\lambda_{1/2}=3 \text{ \AA}$ , and other pressure effects with the FWHM of  $\Delta\lambda_{1/2}=0.5 \text{ \AA}$ .