

## Home Work #1

- 1) Use equation 1.3 to estimate the radius of the sun using its luminosity and effective temperature ( $L_{\odot} = 3.86 \times 10^{33} \text{ erg s}^{-1}$ ,  $T_{\text{eff}} = 5780 \text{ K}$ ). What would the radius be if the luminosity was  $10L_{\odot}$ ?
- 2) The star Betelgeuse, a red supergiant, has  $T_{\text{eff}} = 3500 \text{ K}$  and an apparent radius of  $0.045''$ . Assuming its distance is  $140 \text{ pc}$ , show that the stellar radius  $R \approx 700R_{\odot}$ , and that its luminosity is  $L \approx 10L_{\odot}$ .
- 3) What mass of hydrogen must the sun convert to helium per second to supply the luminosity that we observe. If it could convert all of its hydrogen to helium and maintain its present luminosity how long could it last? In fact the sun can only convert about 10% of its hydrogen into helium, how long will this take?
- 4) Show that two stars of the same luminosity are in an unresolved binary system are about 0.75 magnitudes brighter than either star alone.
- 5) If you were outside our Galaxy at a distance of  $d \text{ Mpc}$ , what would the apparent magnitude of the sun be? Show that  $1''$  on the sky would correspond to  $5d \text{ pc}$ .