ASTR702

HW #1

1) $p = 0.379''$

$d = \frac{1}{p} = 7.64\,pc \doteq 8.15 \times 10^{18}\,cm$

b) $m - M = 5 \log d - 5$

$= -2.89$

2) $m = -1.53$

$m - M = 5 \log d - 5$

$M = -5 \log d + 5 + m$

$= -5 \log (7.64) + 5 - 1.53 = 1.36$

5) $\frac{L_s}{L_\odot} = 10^{0.4 (M_\odot - M_s)}$

$M_\odot = 4.75$ (looked up)

$\Rightarrow \frac{L_s}{L_\odot} = 10^{0.4 (4.75 - 1.36)} = 22.70$

c) A $\sim 10^4$ K

d) $L = 4\pi R^2 \sigma T^4$

$\frac{R_s}{R_\odot} = \left(\frac{L_s}{L_\odot}\right)^{1/2} \left(\frac{T_\odot}{T_s}\right)^2$

$T_\odot = 5800$ K

$\frac{R_s}{R_\odot} = (22.70)^{1/2} \left(\frac{5800}{10^4}\right) = 1.60$

3) $T = 25{,}000\,K \qquad m = 8.44$

a) If at same distance, $\frac{L_1}{L_2} = \frac{F_1}{F_2}$

$$\frac{F_P}{F_A} = 10^{0.4(-1.53-8.44)} = 1.03\times10^{-4} = \frac{L_P}{L_A}$$

$$\frac{L_P}{L_\odot} = \frac{L_P}{L_A}\,\frac{L_A}{L_\odot} = 1.03\times10^{-4}\cdot 22.70 = 2.33\times10^{-3}$$

b) $$\frac{R_P}{R_\odot} = \left(\frac{L_P}{L_\odot}\right)^{1/2}\left(\frac{T_\odot}{T_P}\right)^2$$

$$= \left(2.33\times10^{-3}\right)^{1/2}\left(\frac{5800}{25{,}000}\right)^2$$

$$= 7.60\times10^{-3}$$

4) $m_v \hat{=} 28$

a) If brightest stars have $m_v = -1$

$$\frac{F_{28}}{F} = 10^{0.4(m - m_{28})}$$

$$= 10^{0.4(-1-28)}$$

$$= 2.51 \times 10^{-12}$$

b) $m - M = 5 \log d - 5$

$$d = \frac{150 \times 10^6 \text{ km}}{3.08 \times 10^{13} \text{ km/pc}} = 4.87 \times 10^{-6} \text{ pc}$$

$$M = -27 - 5 \log (4.87 \times 10^{-6}) + 5$$

$$= 4.56$$

5) $A = 14\ m^2 = 1.4 \times 10^4\ cm^2$

$L = A\sigma T^4$

Assume $T = 310\ K$

$L = (1.4 \times 10^4\ cm^2)(5.67 \times 10^{-5}\ erg\ cm^{-2}\ s^{-1}\ K^{-4})(310K)^4$

$= 7.33 \times 10^9\ erg/s$

b) $\lambda_{max} = \frac{0.2898\ cm}{T} = \frac{0.2898}{310} = 0.000935\ cm$

$= 9.35\ mm$

MIR