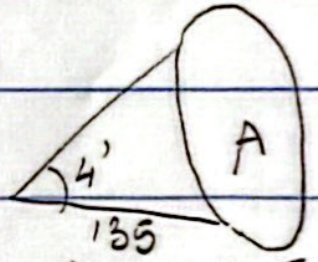
HW 13, 14

13. a) $B = 5.41$ mag, $V = 4.6$ mag $\Rightarrow (B-V)_{obs} = 0.81$ mag $\leftarrow (B-V)_{intr} = 0.1$ mag

$R_V = 3.1 \Rightarrow A_V = R_V \cdot \underbrace{E(B-V)}_{= 0.81 - 0.1 = 0.71} = 3.1 \cdot 0.71 \approx 2.2$ $\uparrow A_5 \text{II}$

b) $A_K = 2.0$ over O region $\Omega = 4'$; $d \sim 135$ pc



$R_V = 3.1 \Rightarrow \frac{N(H)}{A_V} \sim 1.9 \cdot 10^{21}$

$\frac{A_K}{A_{Ic}} = 0.212 \Rightarrow A_{Ic} = \frac{A_K}{0.212}$; $\frac{A_V}{A_{Ic}} = 1.805 \Rightarrow A_V = A_{Ic} \cdot 1.805 = \frac{2.0}{0.212} \cdot 1.805$

$\Rightarrow A_V \approx 17.03$ mag

$\Omega = \frac{A}{d^2} = \pi\left(\frac{4.60}{206265}\right)^2 \Rightarrow A = 135^2 \cdot (3.1 \cdot 10^{18})^2 \cdot \pi\left(\frac{4.60}{206265}\right)^2 \approx 7.45 \cdot 10^{35}\ cm^2$

13b (cont). $\tilde{N}(H) = Av \cdot 1.9 \cdot 10^{21} \Rightarrow N_{total} = \int \tilde{N}(H)\, dA$

$= \tilde{N}(H) \cdot A$

$\Rightarrow M = N_{total} \cdot m_H = 17.03 \cdot 1.9 \cdot 10^{21} \cdot 7.45 \cdot 10^{35} \cdot 1.67 \cdot 10^{-24}$

$\approx 4.03 \cdot 10^{34} g \approx 20.2 M_\odot$

14. $\frac{I(4364)}{I(5008)} = 0.0035 = F_\lambda$; $A(4363) - A(5008) = 0.39$ mag $= A_\lambda$

$\frac{I(5008)}{I(4363)} \sim 7.18 \exp\left(\frac{32038}{T}\right)$; $n_{e^-} < 10^3$ cm^{-3}

$\Rightarrow A_\lambda = -2.5 \log_{10}\left(\frac{F_\lambda}{F_{\lambda,0}}\right) \Rightarrow \log_{10}\left(\frac{F_\lambda}{F_{\lambda,0}}\right) = -0.156 \Rightarrow \frac{F_\lambda}{F_{\lambda,0}} = 10^{-0.156}$

$\Rightarrow \frac{1}{F_{\lambda,0}} = \frac{10^{-0.156}}{0.0035} \approx 199.5 \approx \frac{I(5008)}{I(4363)} \sim 7.18 \exp\left(\frac{32038}{T}\right)$

$\Rightarrow T = \left[\ln\left(\frac{199.5}{7.18}\right) \cdot 32038^{-1}\right]^{-1} \approx 9637 K \sim 9600 K$