ASTR469
HW #6

1 a) $\lambda \hat{=} 80°W$ $t = 15.5$

$LST = 3.45^h = 3^h 27^m$

b) $+1^h$

c) $\sin(a) = \sin(\delta)\sin(\varphi) + \cos(\delta)\cos(HA)\cos(\varphi)$

$\varphi \hat{=} +38.5°$ $\delta \hat{=} +63°$

$\Rightarrow a \hat{=} 65°$

d) $\sim 60°$

e) $1\ GHz \hat{=} 30\ cm$ $2 GHz \sim 15\ cm$

$$\frac{1}{\lambda} = R\left(\frac{1}{n^2} - \frac{1}{(n+1)^2}\right)$$

$R = 1.1 \times 10^7\ m^{-1}$

Solves to $n = 187 - 148$

2a) W3Main: Peak: 0.8K, FWHM: ~20km/s

Velocity: ~-40 km/s

W3OH: Peak: 0.15K, FWHM: ~30km/s

Velocity: ~ -45 km/s

b) The continuum level is key here.

W3Main has T_c ~ 80K.

W3OH has T_c ~ 12K.

HI_1 and HI_2 have T_c ~ 0K

For the two W3 positions, HI foreground to W3 is seen in absorption. If T_c is higher, absorption is stronger. For two HI positions, no background continuum, so no absorption.

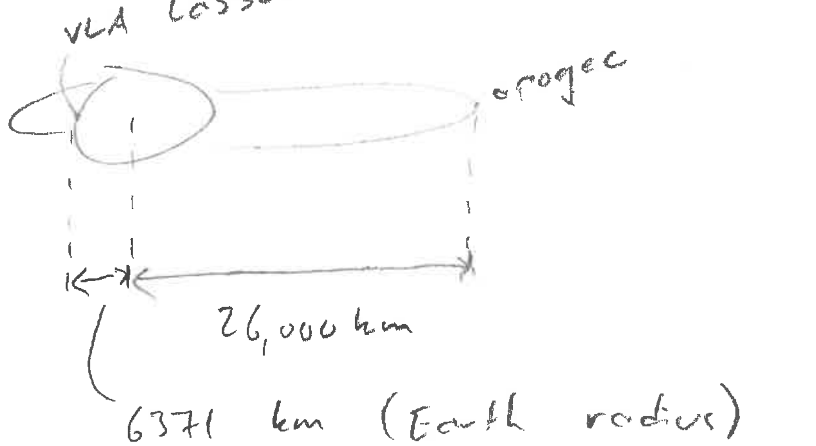
3) $\lambda_{max} = \frac{0.002898 m}{T}$

$5 GHz \hat{=} 0.06 m$

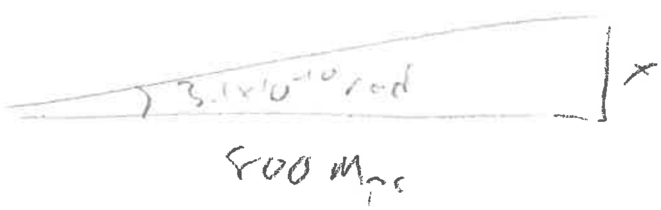
$\Rightarrow T \hat{=} \frac{0.003}{0.06} = 0.05 K$

Since the universe is at least ~3K, nothing peaks in the radio.

4) $\nu = 30\,GHz$ $\lambda = 0.01\,m$



$$\theta = 1.22\,\frac{\lambda}{D} \approx \frac{0.01}{(26000 + 6400) \times 10^3} = 3.1 \times 10^{-10}\ rad$$



$$\Rightarrow 3.1 \times 10^{-10} = \frac{x}{500\,Mpc}$$

$$\Rightarrow x = 7.5 \times 10^{-7}\ Mpc = 0.75\,pc$$