

Problem Set 2

(assigned September 22nd, due October 11th)

These are book questions Chapter 5: qu. 2 and Chapter 6: qu. 2.

- 1 Consider a mix of the cold and warm neutral medium along a particular line of sight. Their emission and absorption are blended and you cannot differentiate between the two. If the mix is 50:50, what is the inferred temperature that you measure? What if the cold gas only amounts to 1% of the total column density? Explain why it is challenging to measure the temperature of the WNM.

- 2a Using the expression for the optical depth in equation 6.21, show that the bremsstrahlung flux of an HII region is proportional to the number of ionizing photons of the central object. Assume uniform density for simplicity and that the emission is measured at high enough frequencies for the emission to be optically thin.

- 2b You observe an HII region at a distance of 1 kpc with a known temperature of 10^4 K. From its radio SED, you find that it turns over at 10 GHz with a flux of 10 Jy. Using the result from above, determine the number of ionizing photons from the central source. Referring to Table 6.1, what stellar type does this correspond to?

- 2c From the turnover frequency calculate the emission measure, and thence the radius of the region. What angular size does this correspond to and what telescope could resolve it at the observing frequency?