

Astro 7B: Worksheet 6

(Spring 2021)

Strömgren radius (Adapted from C&O 12.3.1) Consider an O-type star situated in an HII region where the number density of hydrogen atoms is $n_H = 10^8 \text{ m}^{-3}$. Suppose the star produces ionization photons at a rate of

$$\frac{dN_I}{dt} = 10^{49} \text{ s}^{-1}$$

and that the rate of recombinations per volume in the surrounding hydrogen is

$$\frac{dn_R}{dt} = (3 \times 10^{-19} \text{ m}^3 \text{ s}^{-1}) n_H^2.$$

What is the radius of the Strömgren sphere produced by the star's ionizing photons?

1. Interstellar gas

- (a) Some galaxies in the universe are no longer forming stars. Would you expect to find an abundance of giant molecular clouds (GMCs) in such galaxies? Why or why not? To confirm your expectation, what part of the spectrum would you want to look in and why?
- (b) If you wanted to study how massive stars affect the surrounding gas in a star-forming region, which telescope would you use: the Hubble Space Telescope ("HST"; operating mostly in the optical/UV) or Chandra (an X-ray instrument)? Sketch the spectrum of the star forming region. What physical process is responsible for the spectral lines in your sketch? How does the spectrum you sketched compare to a spiral galaxy or elliptical galaxy?
- (c) Massive elliptical galaxies are surrounded by hot gas, of order 10^7 Kelvin. Would you expect the gas to be visible? If so, what physical process would produce photons?