Readings and Homework for Weeks of Sept. 24 / Oct. 1 2018

Readings

Textbook, Chapters 6, S2, S3, S4

Problems (due Oct. 9 in class)

1. In the center of our Milky Way galaxy there is a compact object of mass $10^6 M_\odot$, where $M_\odot$ is the solar mass. This object does not emit any light. How could we know it is actually present?

2. If the object described in the previous problem is a black hole, then what is its maximal radius? Hint: In class I discussed the Newtonian argument for the existence of a black hole based on the escape velocity from the surface of the object not being allowed to be larger than the speed of light. For the sun, this gave a radius of about 10km.

3. An astronomer observes a bright star close to the center of the Milky Way and takes the spectrum of the light. The spectrum is similar to the spectrum of the sun, except that there are deep absorption lines at the frequency of a Level 1 hydrogen transition line. How would you interpret this result? Why is there this absorption line?

4/5. An astronomer observes a quasar (a quasar is a compact object which emits an amount of light comparable to that of all of the stars in a galaxy), takes its spectrum and observes that there are emission line peaks in the spectrum whose frequencies oscillate about the mean value by 1%. What could the source of these oscillations be? Give both a qualitative and a quantitative answer.

7. Textbook, Chapter 5, Problem 50 (Page 163).

8. Textbook, Chapter 5, Problem 52 (Page 164).


10. Textbook, Chapter 6, Problem 44 (Page 187). Here is the problem: Suppose you were looking at our own solar system from a distance of 10 light years. a) What angular resolution would you need to see the sun and Jupiter as distinct points of light? b) What angular resolution to see the Earth and the sun as distinct points of light? c) How does the angular resolution you obtain in parts a) and b) compare with the resolution of the Hubble Space Telescope? d) Comment on the challenge of making images of planets around other stars.

See also copies of book pages on my web page.