PHYS 182 Fall 2019 Prof. R. Brandenberger

Readings and Homework for Week of Nov. 18 2019

Readings

Textbook, Chapters 19, 20, 22, 23

Problems (due Nov. 27 in class)

1. Suppose we observe no pulses of radiiation from a neutron star. Is it possible that a civilization in some other star system would see this neutron star as a pulsar? Explain.

2. Why is the joint detection of the merging neutron star binary GW170817 in gravitational wave and optical channels a very important event for modern astronomy?

3. Is the radius of the event horizon of the black hole resulting from the merger of a black hole binary system larger or smaller than the sum of the event horizon radii of the two original black holes? Explain.

4. Did the very first high-mass stars in the history of the universe produce energy through the CNO cycle? Explain.

5. A typical white dwarf has a mass of about that of the sun, and the radius of the Earth (about 6400km). Calculate the density. How does it compare with the density of familiar objects?

6. Use the parallax formula to calculate the distance to each of the following stars (in light years): a) Alpha Centauri, $p = 0.74^{\text{“}}$; b) Procyon: $p = 0.286^{\text{“}}$.

7. The spectral lines of two stars in a particular eclipsing binary system shift back and forth with a period of 6 months. The lines of both stars shift by the same amount, and the Doppler shift indicates that each star has an orbital

speed of $80,000$m/s. What are the masses of the two stars (assume circular orbits about their center of mass).

8. Sirius A has a luminosity of $26L_0$, where L_0 is the absolute luminosity of the sun, and a surface temperature of about $9400K$. What is the radius?

9. In what ways are brown dwarfs similar to Jupiter-like planets? In what ways are they like stars?

10. Small black holes have a higher mass density than that of larger black holes (assume here that the mass is distributed uniformly within the horizon). How large does the black hole have to be in order for the density to equal that of regular water?