Readings and Homework for Weeks of Nov. 12 and 19 2018

Readings

Textbook, Chapters 21, 22 & 23.

Final Problem Set (due Nov. 26 in class)

1. In class I only very briefly discussed white dwarf supernovae (Type IA Supernovae). Give a more detailed description. Why are these objects particularly important for astronomy?

2. Which stars do you think contain a higher fraction of heavy elements: stars in globular clusters in the galactic halo, or stars in the spiral arms. Why?

3. You have the chance of glancing at the sky through a powerful telescope and see a nebula. How can you tell if the nebula is a planetary nebula or a remnant of a supernova explosion?

4. 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?

5. The Hubble redshift-distance diagram is interpreted as evidence for the expansion of space. Why can’t it be interpreted as evidence for a large explosion having taken place a long time ago in a static universe, sending all galaxies in motion away from us?

6. 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?

7. 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?

8. What is the mass of a gas cloud in which the pressure balances gravity for a gas temperature of $10^6 K$ and a number density of 0.01 particles per cubic centimeter? Use your answer to explain why hot gas must cool down before it can collect into star-forming clouds.

9. Consider a hydrogen emission line that has a rest wavelength of 656.3nm. You observe a spectrum of a galaxy and find that this line has a wavelength of 664.7nm. What is the redshift of this galaxy? How fast does it appear to be moving away from us?

10. The most distant galaxies observed to date have a redshift of about 10. How does the wavelength of the light from these galaxies compare with that of our galaxy? What kind of telescopes should we use to see these old galaxies?