

ASTR 220 Homework #9

Spring 2005

Due Thursday, May 12, 2005, at the beginning of lecture.

Please neatly write or type your homework.

Be aware of potential plagiarism: make sure to put the answer into your own words. Feel free to discuss the questions with your classmates, but write up the answers yourself - do not copy.

Make sure to show your work for any calculations - answers that appear like magic will receive no credit.

1. Active Galactic Nuclei.
 - (a) Sketch a diagram of an AGN, clearly labeling its major parts: the supermassive black hole, accretion disk, molecular torus, and jets. **Please give yourself some room for your diagram – don't cram it into a corner.**
 - (b) Indicate on your diagram where you would have to be to view the AGN as a **quasar AND** as a **radio galaxy**. (You can't see both from the same position, so you'll have two positions.)
2. Ch. 15, Review Questions, #21.
3. Ch. 15, Problems, #33.
4. By measuring the redshift of a galaxy's absorption lines, we find that the galaxy has a velocity of $1.5 \times 10^3 km/s$. According to the Hubble law, how far away is it? Assume that the Hubble constant is $71 km/s/Mpc$.
5. The Distance Chain.
 - (a) Which method for finding distance in the distance chain is the most accurate? Explain how it works.
 - (b) If this method is the most accurate, why don't we just use it to find the distance to all the objects we are interested in knowing the distance to?
6. The luminosity of a white dwarf supernova is approximately 10^{10} times the Sun's luminosity, or $3.8 \times 10^{36} W$. We observe a white dwarf supernova in a distant galaxy that has an apparent brightness of $2 \times 10^{-13} W/m^2$. What is the distance of the galaxy? Give your answer in both **meters** and **light-years**. ($1lyr = 9.46 \times 10^{15} m$.)
7. Dark Matter in the Milky Way.
 - (a) What is the approximate **radius** of the disk of the Milky Way galaxy? State the source of your information.
 - (b) Calculate the mass of the Milky Way galaxy enclosed by a radius of 50,000 lyr ($4.7 \times 10^{20} m$). Use Figure 16.1c to find the approximate orbital velocity of stars at that distance.
 - (c) Calculate the mass of the Milky Way galaxy enclosed by a radius of 80,000 lyr ($7.6 \times 10^{20} m$).
 - (d) Given your answer to part a, would you expect your answers in parts b and c to be **approximately equal**? Why aren't they?
8. Discuss the two major possible types of dark matter that astronomers think might exist. Which type is believed to make up most of the dark matter in the universe?
9. Ch. 17, Review Questions, #10.
10. The Big Bang is often described as an "explosion", which makes people think that matter was blown outward into a huge, empty universe. Explain why this description is incorrect.