

Astronomy 301 – Fall 2019

Homework 11

Due Date: Wednesday, November 20, 2019, 9:00 AM

You must turn in your homework answers electronically via Canvas. A .pdf or .docx file would be best, but if you can get a good image of your hand-written homework, a .jpg or .png file would okay also. Make sure your name and eid appear at the beginning of your homework.

We encourage you to work together on the homework but you are not allowed to copy from each other. You must write out the answers in your own words.

1. What is a Cepheid variable star and why does it vary? What is the range of their pulsation periods and luminosities? How do we find Cepheid variable stars in other galaxies? What is the Period-Luminosity Relation for Cepheid variables? Describe how Cepheid variable stars can be used to measure the distances to nearby galaxies.
2. If the Hubble constant is 70 km/sec/megaparsec, what is the redshift ($z = \Delta\lambda/\lambda$) of a galaxy that is 10^8 parsecs away?
3. A quasar has a redshift of 0.25 ($z = 0.25$). What is its radial velocity? What is its distance? (Use $H = 70$ km/sec/megaparsec.) Describe some observations that show that the use of QSO redshifts and Hubble's Law really does give the correct distances the quasars.
4. What is the most important evidence that there is a supermassive black hole at the center of every QSO and AGN? How do we measure the masses of the black holes? What is the range of masses for the black holes?
5. All elliptical galaxies and all spiral galaxies with nuclear bulges probably contain supermassive black holes at their centers. Most of the supermassive black holes closer than 100 megaparsecs are either quiescent or are low-luminosity active galactic nuclei, not quasars. Why not? Describe what probably happens if two galaxies with supermassive black holes in the centers collide and merge.