Problem Set #7

Due Monday, May 4 by 5pm to Dickinson 104

Unless otherwise indicated, all problems come from "The Cosmic Perspective," 8e

1. Problem 20.42 *Hubble's Galaxy Types (Note: Make sure your classifications include **brief** justifications – a sentence or two is sufficient.)*
2. Classifying galaxies is an interesting challenge. It is traditionally done by eye and attempts to classify via computer algorithm have been surprisingly unsuccessful. It is still done mostly by eye by experienced observers. This is very time consuming, particularly in an era where a single deep image may have tens or hundreds of thousands of galaxies. **GalaxyZoo** is a "citizen science" project that allows members of the public to classify galaxies. It's designed to be fun and educational for the users, and the classifications are used in real science; there are many published journal articles that use the results from GalaxyZoo. Take a look at **www.galaxyzoo.org**. Click on the button to take you to "JWST Cosmos." Start classifying galaxies. If you like, you can make an account if you want to keep track of which galaxies you've classified (classifying galaxies is a great way to productively procrastinate when you have other work you should be doing). Make sure to **classify *at least* 20 galaxies** before answering the following questions:
    a. Given what you know about galaxy types and classification, what do you think GalaxyZoo means when it asks a user whether a galaxy is "smooth" or shows "features or a disk"? Which type of galaxy (or galaxies) fits into each category? Explain.
    b. Based on what we talked about in class, what differences do you notice about idealized galaxies (i.e. sketches I drew and pictures I showed) compared to "real" galaxies (pictures in GalaxyZoo)? What do you think might account for those differences? Cite at least two specific differences.
3. Problem 20.44 *Cepheids as Standard Candles*
4. Consider a Cepheid variable star observed in the galaxy M100 with period of 29 days and a brightness of 10^{-18} W/m^2. How far away would you conclude this star to be? Verify that this distance consistent with the widely-accepted distance to M100 (Google it!).
5. As we discussed in the first half of the course, trigonometric parallax is a way to measure distance to stars in our Galaxy. Because of the incredibly small angles that even nearby stars move over, we cannot use parallax to measure distances to stars outside our Galaxy (or, even, to the large majority of stars *inside* our Galaxy). While we cannot measure the distances to distant galaxies directly using parallax, the measurement of their distances depends critically on the parallax method. Explain how.