Astronomy (Schroeder) Name: _____
fall, 2011

Exercise 10

Due Friday, November 11, 5:00 pm

For the first part of this assignment (questions 1 through 3) you will look for patterns in the distribution of various "deep sky" objects—star clusters and galaxies. You *could* do this by direct observation: hunting for deep sky objects with your own telescope as Messier and Herschel did. But that would take a long time, so instead, I suggest that you work from lists of deep sky objects that have been compiled by other observers. These days, the most convenient lists are in electronic format, built into various software packages such as the planetarium simulation software that you may have already used. If you have such a package installed on your computer, feel free to use it! The specific instructions below, however, assume that you will use the Your Sky web site at www.fourmilab.ch/yoursky.

Go to the Your Sky web site and tell it to make a sky map. In order to view as much of the sky as possible, set the latitude to zero; the longitude doesn't matter. The initial sky map will have lots of extraneous information on it, and will lack the information you need. So scroll down and uncheck the boxes for ecliptic and equator, moon and planets, constellation outlines and boundaries, star names, and Bayer/Flamsteed codes. (Leave constellation names turned on.) Then set the magnitude limit for stars to about 3.0, and the magnitude limit for deep sky objects to 7.0 (slightly below the naked-eye limit), and click the update button.

You should now see a sky map showing lots of funny symbols for deep sky objects. Some of these are nebulae and galaxies, but the most numerous ones are "open" star clusters, symbolized by hollow dotted circles. Look at how these clusters are arranged in the sky. Then change the time by 12 hours (to view the other half of the sky) and again look at the pattern. Please also make a printout of one of these maps (first change the "colour scheme" to "black on white background") and staple it to this assignment. On your printout, use a pencil to shade the approximate location of the Milky Way, which passes through the constellations Cassiopeia, Perseus, Auriga, Monoceros, Puppis, Carina, Crux, Norma, Sagittarius, Aquila, Sagitta, and Cygnus. Answer question 1.

Next, look at the distribution of "globular" star clusters, each symbolized by a dotted circle with a dot in the center. You'll want to increase the deep sky magnitude limit to about 8.0, to increase the number of globular clusters shown. Be sure to view both halves of the sky. Answer question 2.

Finally, increase the deep sky magnitude limit to 10.0, and look at the distribution of galaxies (symbolized by solid ovals for elliptical galaxies and solid dots with squiggles coming out of them for spiral galaxies). Answer question 3. Then go on to questions 4 and 5, which don't directly relate to the sky maps.

1. Describe how the open star clusters are distributed in the sky, in relation to the Milky Way. Can you explain why they are arranged in this way?

2. Describe how the globular star clusters are distributed in the sky, in relation to various constellations.

3. Describe how the galaxies are distributed in the sky, in relation to the Milky Way and various constellations. Can you explain why they are arranged in this way?

4. According to Henrietta Leavitt's measurements, Cepheid variable stars in the Large Magellanic Cloud with period 10 days have magnitude 13.5. Using large telescopes, it is possible to photograph similar stars in the Andromeda galaxy. From such photographs, we know that Cepheid variables in the Andromeda galaxy with a period of 10 days are 200 times fainter than in the LMC (this corresponds to magnitude 19.25, if you're curious). By what factor is the Andromeda galaxy farther away than the LMC? If the LMC is 150,000 light-years away, how far is the Andromeda galaxy?

5. Viewed with binoculars from a dark site on earth, the Andromeda galaxy has an angular diameter of about 3 degrees (six full moons!). Use this information and your answer to the previous question to determine the true diameter of the Andromeda galaxy, in light-years. (Hint: Set up a big circle problem in the space below. What is the circumference of the circle? How many Andromeda galaxies would fit around the circle?)