

**Lab #13: Mapping the Galaxy**

- Describe each of the 4 types of objects discussed in the lab.
  1. Open Clusters: These are relatively young groups of ~hundreds of newly born blue stars. The stars are often very hot and massive, live their lives quickly, and don't tend to stick together in any organized way. Open clusters are born from giant clouds of gas and dust usually in the disk of the galaxy, only lasting ~hundreds of millions of years before breaking apart and spreading stars throughout the galactic neighborhood.
  2. Globular Clusters: These are very old, spherical distributions ~thousands of redder, older stars that are usually found far away from the disk of the galaxy, especially in the galactic bulge and halo. Globular clusters are very stable and kinematically hot, with dense cores and diffuse edges. Some globular clusters are nearly as old as the universe itself.
  3. Gaseous Nebulae: These are very different; they aren't a type of star collection (although sometimes they do contain stars). Nebulae are simply clouds of gas and sometimes dust in the interstellar medium, coming in a variety of forms and constituting a variety of chemicals. All clouds have Hydrogen, and many have Helium, ions, or even molecules like CO or CN. They may be very dark, cold, and dense, or they may be very bright, hot, and ionized. Some examples are planetary nebulae, giant molecular clouds, and HI/HII regions.
  4. Galaxies: Like clusters, galaxies are giant collections of stars; however, galaxies are much, much bigger than the previous 3 objects. In fact, most galaxies contain open clusters, globular clusters, gaseous nebulae, or some combination of all three. Spiral galaxies have all three objects, but are known for their star formation. Elliptical galaxies are like giant globular clusters, containing little gas or star formation. Irregular galaxies have lots of gaseous nebulae and open clusters, but very little shape.
- When you look up into the sky and see a band of stars, what does that tell you about the structure of the Galaxy you live in?

The band of stars suggests that we live somewhere in the disk of a spiral galaxy, given that the band is flat, and the disk is concentrated on one side of the celestial sphere. We can also make out a tiny central bulge of the disk, which itself has lots of dust and gas, suggesting spiral arms and star formation.

- Describe the difference (in terms of the 4 objects discussed in lab) in what you would see if you were a) standing in the center of our Galaxy, and b) standing at the edge of our Galaxy.
  - a) If we were at the galactic center, we would see a spherical distribution of globular clusters and galaxies surrounding us in all directions, with no preferred direction. The open clusters and gaseous nebulae would be concentrated in a band of stars and gas (the Milky Way's disk) that would completely surround us in a ring on the celestial sphere.
  - b) If we were standing at the edge of the galaxy, the distribution of galaxies would not change. We would still see a spherical distribution of globular clusters and a disk of gaseous nebulae and open clusters, but only on one side of the sky (toward the galaxy).

*Note: Most of the information I used to write this summary came from the lab manual, but some of the facts about gaseous nebulae came from information I found on Wikipedia.*