Astronomy 400B Lecture 4: The Milky Way

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Today's class will regard the Milky Way!

1 Solar Neighborhood

Stars in the local neighborhood provide a lot of our information about the Milky Way and, frankly, a lot of what we infer about any galaxy. Learning about the stars requires knowing something about their intrinsic luminosities and masses. This requirement results in the need to have robust distance estimates for a large number of stars.

1.1 Parallax

Trignometric parallax provides a direct distance estimate for very nearby stars. Trignometric parallax is the shift in the angular position on the sky of a star as viewed from different locations of the Earth's orbit around the Sun.

For an object at distance d, the parallax p is

$$\frac{1 \text{ AU}}{d} = \tan p \approx p \tag{1}$$

The pc is the distance where the parallax of a star would be $p = 1$ arcsec. The closest star is Proxima Centuari, with $p = 0.8$ arcsec and a $d = 1.3$ pc.

1.2 Distance Modulus

For nearby (Galactic) objects, we can relate the difference between the apparent and absolute magnitude of an object with its distance or parallax through the *distance modulus* equation

$$(m - M) = 5 \log \left(\frac{d}{10 \text{ pc}} \right) = 5 \log \left(\frac{0.1 \text{ arcsec}}{p} \right) \tag{2}$$