Please turn in your homework now!

In this class we will cover The Milky Way:

- Overview
- Galactic rotation
- Spiral structure
- The Galactic center
Overview

We live in the Milky Way, aka “Galaxy”
The Standard Galactic Model

The thickness of the disk is about 1 kpc

The globular cluster distribution determines the distance to the Galactic center.
“There are lumps out there”
(H. Newberg)

Example: The Sagittarius Dwarf Elliptical Galaxy

http://www.astro.wesleyan.edu/~kvj/
Galactic Rotation

The disk rotates about the Galactic center.

*More properly:* Material in the disk orbits about the Galactic Center. (We will assume these orbits are circular.)

The details of this “differential rotation” is studied actively. It is used to infer the mass distribution in the Galaxy.

One thing we can count on: The revolution period cannot decrease as we move out from the Galactic center.

Let’s see how the Galactic “rotation curve” is determined...
Measuring the Galactic Rotation Curve

Kutner Figure 16.4

Kutner Figure 16.6

Angle between $R_0$ and the line of sight ($d$) is $\ell$.

“Galactic Longitude”

Angle between $R$ and the line of sight is $\theta$
Radial velocity from Doppler Shift:
\[ v_r = v(R) \sin \theta - v_0 \sin \ell \]

Apply some trigonometry:
\[ \frac{\sin \theta}{R_0} = \frac{\sin \ell}{R} \]

Arrive at the following:
\[ v_r = \left[ v(r) \frac{R_0}{R} - v_0 \right] \sin \ell \]
Result: The Galactic Rotation Curve

See Kutner Fig. 16.9

"Keplerian" curve (mass concentrated at center)

Note: Suppressed Zero
Spiral Structure

Look for “lumpiness” in the radial velocity distributions

H-I (21cm)

CO

Spiral Arms !?

Kutner
Fig 16.14
The Galactic Center

Wide-Field VLA Radio Image of the Galactic Center
(\( \lambda = 90 \) cm)

- Sgr D HII
- Sgr D SNR
- Sgr B2
- Sgr B1
- Arc
- Threads
- The Cane
- Background Galaxy
- Threads
- Sgr A
- SNR 0.9+0.1
- SNR 0.3+0.0
- SNR 359.0–0.9
- SNR 359.1–0.5
- Sgr C
- The Pelican
- Snake
- Mouse
- Sgr E
- Coherent structure?

Radio (6cm)

X-Ray

(See Kutner Fig. 16.16)
The Black Hole at the Center of our Galaxy

Measure the accelerations of stars near the Galactic Center to infer the enclosed mass.