

Name \_\_\_\_\_

ID# \_\_\_\_\_

Section \_\_\_\_\_

### **Pre-lab: Structure and Motion of Spiral Galaxies**

Hand in this pre-lab at the beginning of the Stars and the H-R Diagram Lab.

Reading: *The Essential Cosmic Perspective*, Sections 15.1 and 16.2  
or *A Beginner's Guide to the Universe*, Sections 14.3 and 16.1.

The disk of the Milky Way is about 100,000 light years in diameter and 1,000 light years thick. What is the ratio of diameter to thickness of the Milky Way?

Name an everyday object that has the same diameter-to-thickness ratio as the Milky Way, and demonstrate that it does using estimates of the size/thickness (the object doesn't have to be perfectly circular).

The Sun actually moves relative to nearby stars and relative to the center of the Galaxy. The speed the Sun and other stars is one of the most important ways astronomer can about the structure of the Milky Way.

First, write the equation relating time, distance, and speed.

The Sun moves up and down in the disk of the Milky Way, covering a distance of about 2,000 light years ( $1.9 \times 10^{16}$  kilometers) in 65 million years ( $2.1 \times 10^{15}$  seconds). What is the Sun's average speed in this motion (in km/s)?

The time required for an object to complete one orbit is called the *period*, **P**. For an object in circular motion, what is the distance traveled in time **P** if the radius of the object's orbit is a distance **R**?

Using the relationships you wrote above, write a formula for the speed, **v**, of an object in a circular orbit, in terms of **P** and **R**.

The Sun is about 28,000 light years, or  $2.65 \times 10^{17}$  km, from the center of the Galaxy, and orbits in circle with a period of 230 million years, or  $7.25 \times 10^{15}$  seconds. What is the speed of the Sun's orbit in kilometers per second?

The Sun and other nearby stars orbit the center of the galaxy in a motion like a merry-go-round, bobbing up and down as they orbit around the center of the Galaxy. Based on the two velocities you calculated above, which is the dominant motion? So is this merry-go-round ride "smooth" or "bumpy?"