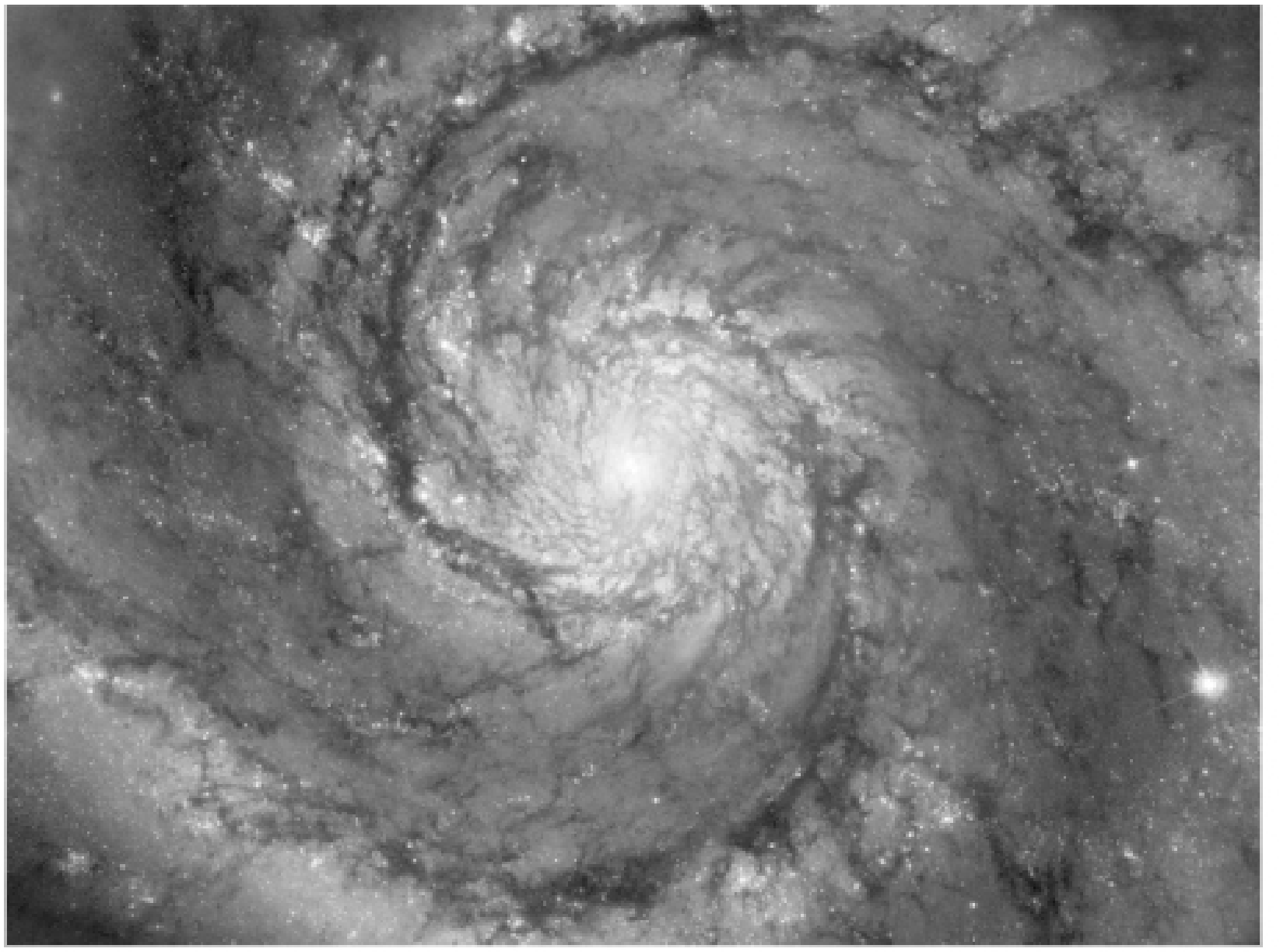
Astronomy 101

Introduction to Astronomy



Winter 2010

Part 2: Labs 8-11

(Excluding Galaxy Classification Images for Lab 9)

Credits:
Cover image of M51 from NASA's Hubble Heritage Project - **Labs:** Gravity: Oliver Fraser, Julianne Dalcanton - Atoms: Apocryphal, Julianne Dalcanton - Thermal Radiation: Julianne Dalcanton - Atoms & Light: Apocryphal, Julianne Dalcanton - Spectral Classification of Stars: Stacey Palen, Richard Plotkin, Julianne Dalcanton Colors: Julianne Dalcanton - Color-Magnitude Diagrams: Marcel Agueros, Nate McCrady, Ana Larson, Julianne Dalcanton - Measuring Distance: Todd Grinsteiner, Julianne Dalcanton - Galaxy Classification: Andrew West, Julianne Dalcanton - Dark Matter: Greg Stinson, Julianne Dalcanton - Hubble Law: Luis Mendoza, Toby Smith, Ana Larson, Julianne Dalcanton

Determining the distances to stars and galaxies is one of the most vexing problems in astronomy. There are four basic methods that are used to determine distances: radar, parallax, standard rods or candles, and the Hubble Law. Each of these methods is most useful at certain distances. Radar methods are only useful within the Solar System, while the Hubble Law is useful only on the most distant scales ($> 40\,\mathrm{Mpc}$). In this exercise, we investigate the use of parallax and standard rods to determine distances.

Parallax

Although we may be able to derive many of a star's properties through the spectrum of the light it emits, in most cases we cannot immediately figure out its luminosity or its distance. Instead, for nearby stars we rely on a method with which you are actually already familiar: parallax.

You can see the parallax effect by holding your thumb out at arm's length. As you alternate opening and closing each eye, you should be able so see the position of your thumb jump back and forth relative to objects in the background. This is because the centers of your eyes are a few centimeters apart, so that each eye has a slightly different point of view.

In this lab, you will experiment with using parallaxes to determine distances. You will also use the standard rod method to measure distances to objects that are too far away to have measurable parallaxes.

Procedure

For this lab you will need a meterstick and a partner. It may also be helpful to use some masking tape to mark out intervals of one meter on the floor before beginning this exercise.

1. Take the meter stick and hold it in front of you, horizontally to the floor. Orient the meter stick so that one end touches your nose, and the other end points forward away from your body, like Pinocchio.

2. When your partner is done mocking you, he or she should hold a pencil halfway down the meter stick at the 50 cm mark.

3. Alternately open and close each eye, noting how the pencil moves against specific background objects. You will need to remember how large the parallax shift is, so that later you can compare it to the angular shift with the pencil in a different position.