Naked Eye Observation of the Night Sky

January 26, 2011

Goals: To gain a common language for finding things in the night sky. To use this language to measure the motion of objects in the night sky.

Classroom Activities

Stars and Distance using Rulers and Protractors

We wish to describe how things in the night sky move. To do this we must have some method to measure distance. The first thing to settle is the unit we will measure distance by. Rulers aren't of much use since you cannot get to the stars to use it. Instead it is useful imagine the stars are points of light on a hemisphere (in the planetarium you hardly need any imagination for this). The question then becomes how do you measure distance on a sphere?

It is instructive to consider a simpler task first: Measuring the distance between two points on a circle while you are standing at the center of the circle. This can be done using angles.

There are a number of stars sprinkled around the lab.

1. On your piece of paper sketch (roughly is fine) the shape of the room showing where you and your lab partners are sitting as well as the location of the stars on the walls.

2. Use the CD to draw a circle around where you and your partners are sitting.

3. Draw a ray that starts at your lab bench and goes through a star and crosses the circle (but only once). Repeat until all of the stars have been connected in this way.

4. Using your protractor have each member of your group measure the angular separation 3 pairs of stars and record this in the space below.

diagram of room diagram of room

Stars and Distance using Fists and Fingers

While this is a valid way to measure the distance between stars it is completely impractical when it comes to stars in a dark night sky. A better way is to use your hands and fingers. A fist at arms length away is 10^o across and an index finger pointing at arms length away is 2^o across. Repeat the measurements you made above for the separation between stars but this time but this time do it directly using your fists and fingers. Record your results below.

The Horizon Coordinate System

Specify the location of a star in the sky you need some where to measure from. Also you need to account for the fact that the star is **up**in the sky. The Horizon Coordinate System allows one to do both of these things. The point that everything is measured from is the horizon due north of where you stand. Lacking windows on the northern side of the room the horizon is not obvious. As a rough approximation to the horizon use the point on the wall you see when you look straight at it while standing as the horizon. The coordinate that specifies where around the room the object of interest is is called the Azimuth and it is measured at the horizon. Zero azimuth is due north, 90^o azimuth is due east, 180^o azimuth is due south, and 270^o azimuth is due west. The height of an object is refered to as its altitude. Zero degrees altitude is at the horizon and

90^o is at the zenith, (i.e., straight up).

Using your fists and fingers on the roof of Hoyt, measure and record the altitude and azimuth coordinates of the radio tower roughly north of Hoyt.

Using your fists and fingers measure the altitude of the joint between the wall and the ceiling in each of the cardinal directions (NSEW). Record both the Altitude and the Azimuth coordinates of those places.

Planetarium

In the planetarium we will start to get aquainted with the night sky both how it would look tonight in New Wilmington if we could see through the snow clouds and how it is different at different times of year and in different places in the world.

Stars in New Wilmington Tonight

You will observe the stars as they appear when the clouds are lifted.

Tasks:

1. Learn how to read a star map.
2. Find North star.
3. Find Little Dipper and Big Dipper.
4. Measure the angular separation between the bowl of the big dipper and the north star. Record it here.

5. Find Orion.
6. Find the constellation Gemini.

Stars in New Wilmington Through the Year

You will now observe how the stars move through the sky at sunset over the course of a year. To do this we will step through the year stopping on the 20th of each month. Record the constellation that is near the setting sun for each month

- January
- February
- March
- April
- May
- June
- July
- August
- September
- October
- November
- December
- January of next year.

City	Location (Latitude and Longitude)	Altitude of North Star
Khartum Sudan		
Cairo Egypt		
Budapest Hungary		
Oslo Norway		

Stars Around the World

Motion of the Planets

For each of the planets below describe the motion of the planet through the sky, what part of the night it is visible during, and how it moves with respect to the stars from one night to the next.

- Mercury

- Venus

- Mars

- Jupiter

- Saturn

Questions

1. How does the circle you drew around your lab bench relate to the way that the location of stars was conceived in ancient models of the universe?

2. Will every lab group get the same result for the distance between each pair of stars? Explain why this is. Explain how this is related to Tycho Brahe experiment to determine if the earth or the sun is at the center of the universe. What faulty assumption lead Tycho Brahe to falsely deduce that the earth must be at the center of the universe.