

Exercise set five

1 Telescope: Phase of Venus

Materials

lab notebook, writing implement, telescope setup

Observation

Observe Venus through a telescope. **Draw what you see. Is Venus to the East or West of the Sun?**

Analysis

Why does Venus have phases like the Moon (i.e. why does the disk of Venus cycle from fully-illuminated to partially illuminated, to totally dark and back)?

Why doesn't the disk of Mars ever appear totally dark?

What is the phase of Venus (what fraction of the disk is illuminated)? Is it waxing or waning?

From the phase of Venus (and its position relative to the Sun) you should be able to figure out where it is in its orbit in relation to the Earth. **Draw a diagram looking down on the Solar System showing the Sun, Venus, and the Earth. Make sure to indicate which direction the planets are orbiting.**

2 Finding the length of the sidereal day

You will now analyze the data you took to determine the length of the sidereal day. Please do all your work in your lab notebook and follow all of the directions carefully.

I want everyone to analyze at least six different pairs of observations. If you have four observations of the same star from the same place, then you have six different pairs of observations. If you have fewer than four of your own observations, then you will need to use pairs of observations taken by someone else.

First, record the data you will be using (even if you have it somewhere else in your notebook). For each set of observations: **Indicate the name of the person who took the data. Record as much information as you can about what star was used and from where it was observed. List the date and time of each occultation.**

Analysis

Using each pair of observations, calculate the length of the sidereal day. (Hint: start by calculating how much earlier, in seconds, the later occultation occurred, then divide that by the number of days between the observations. This gives you how many seconds shorter a sidereal day is than a solar day.) **Do you trust some pairs of observations more than others? Why?**

Now you have six values for the length of the sidereal day, but we want to end up with one. **Calculate the average value using at least four of your calculated values (you may discard up to two pairs that you find particularly suspect).**

Remember that in a year the Earth actually rotates one more time with respect to the stars than it does with respect to the Sun. **Use that fact to calculate the length of the year.** In other words figure out how many solar days it will take for the offset between the sidereal and solar day to equal 24 hours (based on your measurement of the length of the sidereal day). Hint: calculate the difference between the length of

one solar day and one sidereal day, then figure out how many solar days it will take before that difference adds up to 24 hours.

Look up the accepted value of the length of the sidereal day and compare it to your answer. **What do you think were your major sources of error? How could you improve your observational technique if you were to repeat this project?**

3 Telescope and binoculars: Features on the Moon

Materials

lab notebook, writing implement, telescope setup and or binoculars

Introduction

In the exercise you will observe and draw the Moon at several magnifications. Some terms you should know: the “limb” of the Moon (or other celestial object) is the edge of the disk seen against the sky. The “terminator” of a celestial object is the line that separates the lit and unlit portions of the disk. “Craters” are, of course, the large, roughly circular features with raised rims formed (usually) when meteoroids slammed into the surface. “Rays” are the lighter lines of scattered debris seen around some craters. “Highlands” are the relatively light, mountainous regions. “Maria” (singular: “mare”) are the darker, flatter areas thought to be formed from seas of cooling lava.

You will use maps of the Moon to identify features you see. Be aware, though, that the surface of the Moon can look quite different under different lighting conditions and that some lunar maps are composites of the Moon at different phases. So just because a map shows the whole face of the Moon does not mean it looks like the full Moon.

Binoculars

Go outside and examine the Moon with binoculars or a finder scope. Pick a feature that you would like to observe more closely. **Draw a circle representing the limb of the moon and sketch your chosen target inside it. Draw the terminator if the Moon isn't full. Use a lunar map to identify your target or at least identify some features around it.**

Telescope

Now draw your target as seen through a telescope. Is your target in the maria or the highlands?

See if you can identify any additional features using the map of the near side at http://planetarium.wr.usgs.gov/luna_ccsr.html.

Naked eye

Figure out what constellation the Moon is in tonight (you may want to refer to a sky chart). What constellation is Mars in?