Lab #51: The Size of the Moon

Sizes of celestial objects as they look in the sky cannot be given in feet or miles or meters, because they look small or large depending on their (usually unknown, and always nontrivial) distances. An airplane "is" large at the airport but small when you see it flying high up in the sky. The apparent sizes are measured as angles.

PROCEDURE AND LAB REPORT

Date:_____ Your name: _____Partner's name: _____ Section: ___/___

Maximum two students may work together as partners!

This laboratory is in a large part done outdoors. For this reason, the report must be printed out and the paper copy must be used.

1. *Look at the Moon through a straw. Does it fit? How many times do you think the Moon would fit in the hole in the straw?*

Measure how long the straw is: _____ mm. Measure the diameter of the straw: _____ mm. Then the straw is ____times longer than it is wide. Any object that is 100 times farther than its size will appear as 1/2 degree in size. You conclude that the hole in the straw appears to be _____ degrees. Because the Moon appears _____ times smaller than the hole in the straw (estimate!), its size is measured to be _____ degrees.

2. *Compare the size of the Moon to a penny.*

Take a penny and hold it at arm's length. Is it large enough to cover the Moon? _____.

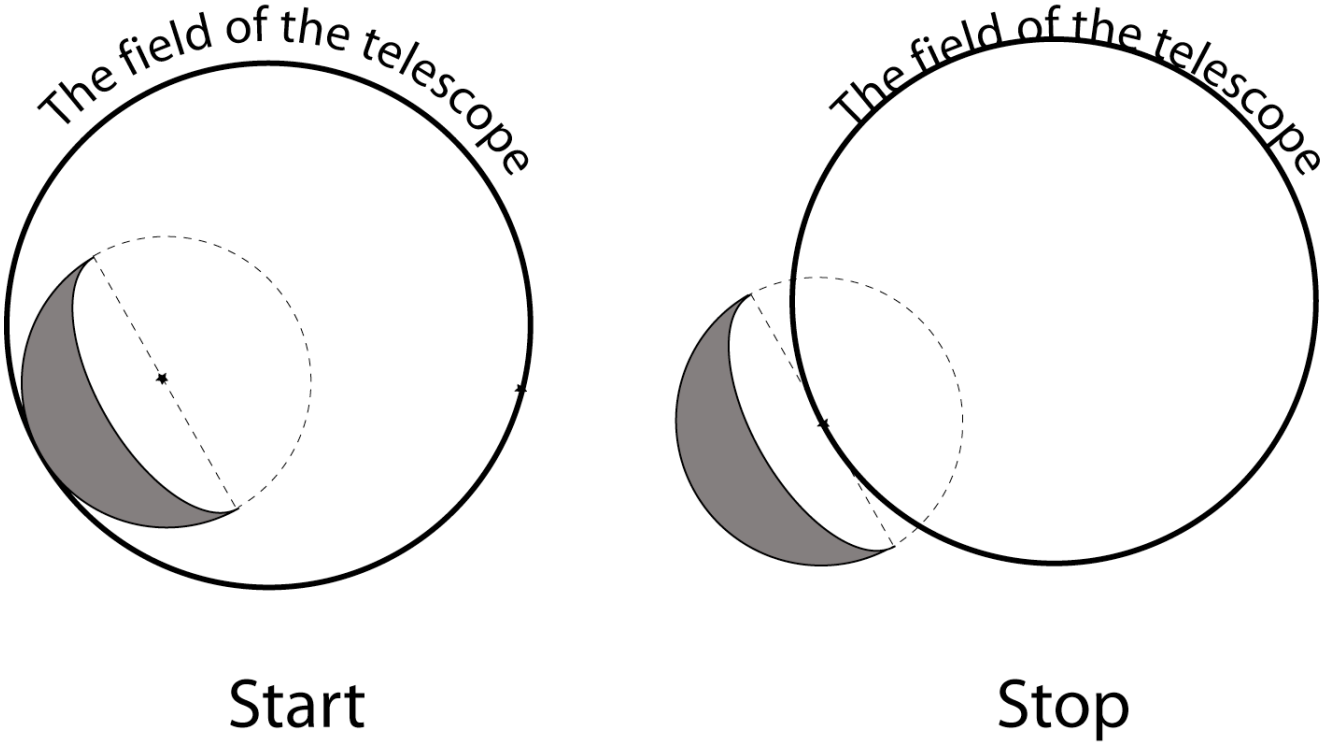
Take one of the sticks with a penny attached to the end. The length of the stick is 180 cm. Try to cover the Moon with the penny, holding the stick in front of your face.

Now measure the diameter of the penny, _____mm. The penny was held at _____mm from your eyes, so it was _____ times as far as its size. Then the penny looked _____ degrees in diameter. If it can just cover the Moon, then the Moon is also _____ degrees in size.

A nearsighted person with too weak glasses usually overestimates the size of the Moon!

3. Measure the size of the Moon in the telescope.

Aim a telescope at the Moon. Use low magnification (50 × is best) so all of the Moon fits in the field. Observe that the Moon moves due the rotation of Earth.



Use your wristwatch, a timer, or a stopwatch (many cell phones also include one) to measure the time the Moon takes to leave the field. More precisely, measure the time between when the Moon touches the edge of the field and when the center of the Moon's disk leaves the field. The result was _____seconds.

You know that the sky turns 360 degrees in 24 hours. How many degrees did it turn during the time you found? _____degrees.

Note that this is the radius of the Moon. Its diameter is twice as much, _____ degrees.

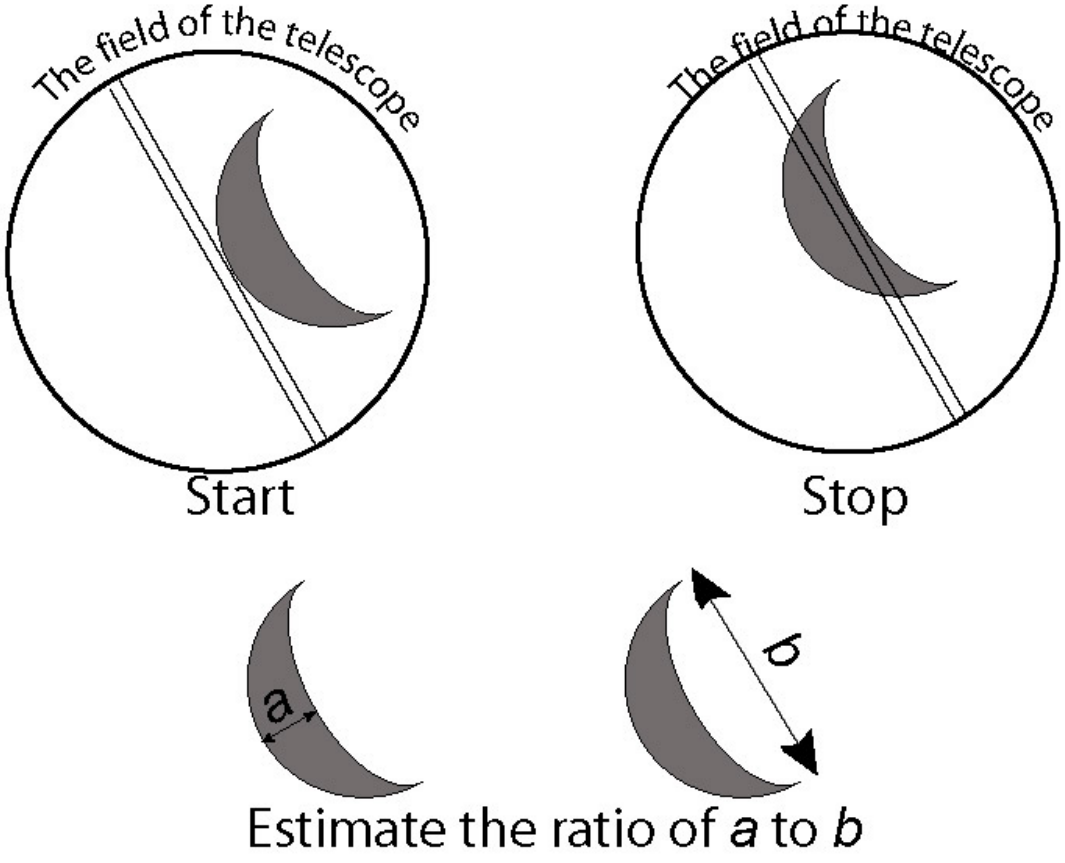
4. *Compare your results in parts 1, 2 and 3. Do they come reasonably close?*

___ _____ _____

5. ***The distance to the Moon is a known 384,400 km.***
In the previous parts you found that the Moon was _____ degrees in size. Based on that, what is the size of the Moon? Found: _____ km.

6. ***For extra credit:*** If the size of the Moon is what you found above, how large is the crater Copernicus? Find it on the map, and measure its diameter in millimeters on the map. Also measure the diameter of the Moon on the map in millimeters. Find the actual diameter of this crater: _____ km. Would you be able to see an astronaut on the Moon?_____.

7. ***For extra credit: find a method to measure the size of the Moon more accurately.*** Use a reticuled eyepiece. Align the reticule in the N-S direction. Time how long it takes between when the edge of the Moon touches the reticule and when the center point of the terminator touches the reticule.



Then you'll have to draw the shape of the Moon, and calculate how long it would have taken for all of the Moon to leave the field. Turn in your calculations on a separate sheet.