Introduction to Astronomy	**Laboratory Excercise #10**
Name ____________________________	Date _______________
Partners __________________________	Section _____________

The Sun

Purpose:
To calculate the radius and density of the sun and to record the position of sun spots.

Equipment
Graph paper Note card Pin

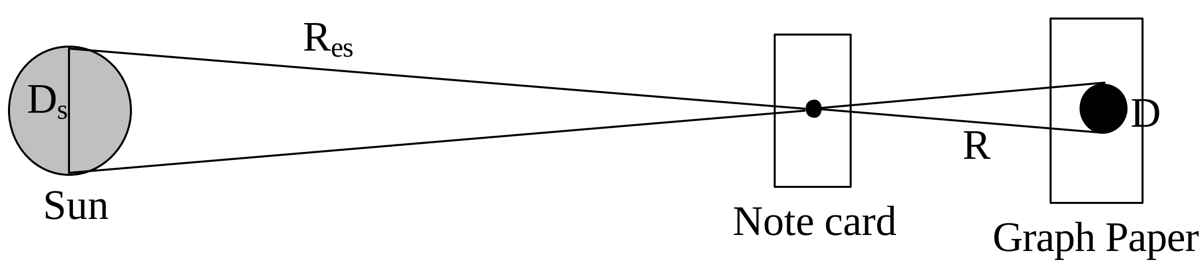
Size of the Sun
As in the previous lab, the distance to the moon was determined by the method of parallax. The same technique can be applied to determine the distance to the sun. Instead of calculating this distance, I will provide that distance below.

$$\text{Earth-Sun Distance } R_{es} = 1.496 \times 10^{11} \text{ m}$$

1. Determine the radius of the Sun.

Take a note card and place a pin hole in it. Go outside and place the surface of the notecard so that it blocks the most amount of sun. You will notice that the sun will shine through the hole in the notecard. Place some graph paper on the ground and place the notecard above it so that the light from the hole shines on the graph paper. As you move the graph paper further away from the note card, the light from the sun spreads out over a larger circle and becomes dimmer. Carefully mark the size of the light on the graph paper and measure the distance between the graph paper and the note card.

As the light of the sun travels through the pin hole, it forms an image of itself on the graph paper. The size of the image is dependent on three factors a) the diameter of the sun b) the distance from the sun to the note card and c) the distance from the notecard to the graph paper. From geometry you will notice that the two triangle drawn below are "similar triangles." That means the ratio of two sides of one triangle is the same to the corresponding sides of the other triangle.



Calculation:

a) Measure the diameter of the image of the sun on the paper.

D = ______________________ cm

b) Record the distance between the note card and the graph paper.

R = ____________________cm

c) Calculate the diameter of the sun. $\frac{D_s}{R_{es}} = \frac{D}{R}$

D_s = ____________________m

d) Calculate the volume of the sun.

$R_s = D_s/2 =$ _________________________m

$V = \frac{4}{3} p \; R_s^{\,3} =$ ______________________m^3

e) Calculate the mass of the sun by converting the time for one year into seconds. Use 365.25 days for one year.

P = _________________________s

Next use the earth-sun distance as the distance for the semi-major axis. From Kepler's Laws with Newton's form of gravitational force we get

$$P^2 = \frac{4p^{\,2}}{GM} a^3$$

Solving for M gives (G = 6.67×10^{-11} Nkg^2/m^2)

$$M = \frac{4p^{\,2}}{GP^2} a^3 = \text{\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ kg}$$

f) Calculate the average density of the sun using the mass and volume calculated above.

$r = \frac{M}{V} =$ ______________________kg

2. Sun spots

The sun goes through an 11 year cycle of sun spot activity. The presence of sun spots allow us to view magnetic effects taking place on the photosphere of the sun. View the image of the sun in the observatory on campus and draw the location of the sun spots for that particular day. Also record the date of the observation. Leave the second circle blank. If there is an opportunity at the end of the quarter, we will observe the sun spots at a later time and see how they have moved.

Date ___________________ Date ___________________

Questions:

1. How does the density of the sun compare to that of the earth?

2. How could you improve the procedure for measuring the diameter of the sun to get more accurate results?