SIERRA COLLEGE OBSERVATIONAL ASTRONOMY LABORATORY EXERCISE		
NUMBER I.E.	**TITLE: Star Counts and Rediscovering the Milky Way**	
DATE- **DAY-** **LOCATION**	**PRINT NAME/S AND INITIAL BELOW:**	**GROUP** ☐

OBJECTIVE:

- To observe the importance of dark adaptation and establishing night vision.
- To employ a method of statistical sampling in estimating the number of stars visible to the unaided eye.
- To utilize a very small telescope and interpret the path of light known as the Milky Way.

DESCRIPTION:

At higher light levels, sensor cells called cones allow the normal eye to see a variety of colors. At lower light levels (night sky), the cones become insensitive to light and other sensor cells called rods allow us to see various shades of gray. It takes time for the rods to become active and hence a period of dark adaptation must occur in order to perceive dim celestial objects. Once dark adaptation is established, any moderate to bright light will disrupt rod cell light sensitivity and the process of adaptation will have to be repeated. The eye is most sensitive to blue/green wavelengths of light and least sensitive to red. Therefore, the number of stars visible to the unaided eye is not only dependent upon sky conditions, but 'eye' conditions.

Sampling of a number of regions of sky will be done with a hollow tube (no optical components) to arrive at an estimate of the total number of stars visible on the celestial sphere to the unaided eye. Sampling of similar areas of the sky with a small 'finder' telescope will be employed to detect regions that contain higher concentrations of stars. A test to see if these regions lie along a path known as the Milky Way will be attempted using a properly oriented celestial globe.

PROCEDURE/OBSERVATIONS: (Instructor will elaborate)

1. In the classroom, review **altitude, azimuth, sidereal time,** and use of a **celestial globe.**

2. Before beginning the star count, allow your eyes to dark adapt for a period of at least 10 minutes. Always be careful where you aim your flashlight (even red ones) to avoid disturbing the dark adaptation of someone else. Stray light around your observing environment may limit your adaptation.

3. Using a hollow tube, sample the regions given in Table **A**. Aim the tube in the directions approximating the coordinates given in the table. Sight through the tube once it is aimed and **do not move it** as if 'searching' for stars. If no stars are seen, enter '0' as the count. Repeat these counts until all the areas are sampled. The complete process should only require about 10 minutes.

4. Carefully measure (in millimeters) the length **(R)** of the sighting tube and its inside diameter **(D)**. Enter this information at the bottom of table A. Also include other information requested below the table.

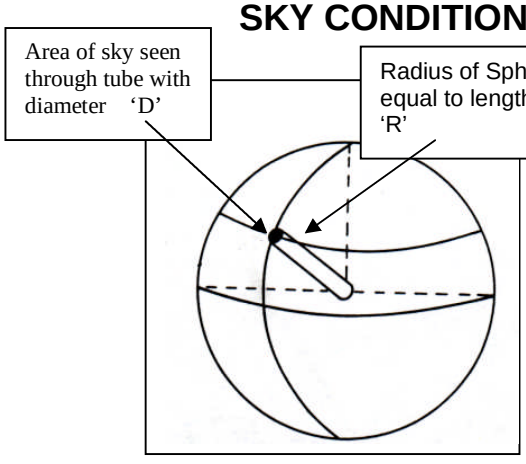
5. While your eyes are still dark adapted, repeat the star count using a small hand held telescope provided by the instructor. Instead of counting all the stars spotted with this telescope simply indicate (with an 'x') in the appropriate coordinate box of **Table B** sightings of more than 10 stars. Be sure to indicate the Pacific Standard Time (24h) of the observations for table 'B'.

TABLE A

VISUAL COUNTS (AZIMUTH-ALTITUDE)								Totals
0 – 25	45 - 25	90 - 25	135-25	180-25	225-25	270-25	315-25	=
0 - 45	45 - 45	90 - 45	135-45	180-45	225-45	270-45	315-45	=
0 - 65	45 - 65	90 - 65	135-65	180-65	225-65	270-65	315-65	=
zenith	Tube Length = _____mm					Sub Total		=
	Tube Diameter = _____mm					Zenith Count		=
						Total Stars Counted (T)		=

DATE _____ **LOCATION**_____ **TIME**_____ **(PST 24H)**

SKY CONDITIONS_____ **MOON PHASE**_____



$$N = \frac{16R^2T}{25D^2} \quad \text{or} \quad N = \frac{0.64R^2T}{D^2}$$

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TELESCOPE COUNTS (AZIMUTH-ALTITUDE)							
0 – 25	45 - 25	90 - 25	135-25	180-25	225-25	270-25	315-25
0 - 45	45 - 45	90 - 45	135-45	180-45	225-45	270-45	315-45
0 - 65	45 - 65	90 - 65	135-65	180-65	225-65	270-65	315-65
zenith	**Date** _____ **P.S.T. =** ___^{h}___^{m} **S.T. =** _____^{h}_____^{m} **Observer's Latitude =** _____						

QUESTIONS AND ANALYSIS:

1. Calculate the total estimate of the number of stars visible to the unaided eye? Show work here.

Estimate = ☐

Is this an estimate for the entire celestial sphere? _____
What would be the corresponding estimate for the entire visible 'sky'?
_____

2. How would the inclusion of a 'planet' affect the above 'star' count, and by how much?

3. How could each of the following factors affect the outcome and statistical accuracy of the total estimated number of stars **'N'?**
   a. the observer
   b. the conditions of the sky
   c. the number of areas sampled

4. Set up the celestial globe for local latitude and sidereal time determined for Table B observations. Locate on the globe by azimuth and altitude the positions of the 'high-count' areas you observed with the hand held telescope. Do these areas lie along the path of the Milky Way?

5. **STAR COUNT (MAP EXERCISE)**

   Toss five pennies randomly onto the field of your SC-1 star map. Carefully lift each penny and count the number of stars underneath (0 or more). Calculate the total estimated number of stars on the SC-1 map. Describe your method and show calculations.

   _____ +_____ + _____ + _____ + _____= _____

   Estimate =

6. Examine someone's right or left eye and notice the size of the pupil. Shine a light (not too bright) in that eye and observe any change. What happened? _____

   Did the size of the pupil in the other eye also change? Describe.
   _____

   After the light was removed, how long did it take for the pupil to return to its original size? _____seconds

7. Once your eye is dark adapted, would you expect the pupil to assume a larger or smaller diameter?_____

8. Why do you suppose red filters are used on flashlights during observing sessions?