

Star Party

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Introduction

You will attend a star party where lots of telescopes will be available. The owners set the telescopes up and point them for you. You will observe at least three different objects, draw what you see and then compare what you saw with what is recorded from large telescopes. You will also compare the way at least one of the objects looks when seen through two different telescopes. The observing can be done on one evening or can be done over several evenings.

Several amateur groups have regular observing in the Bay Area. These are your best bet for seeing lots of things. Usually there are amateur astronomers who are delighted to find things and show off their telescopes. It is your responsibility to find out exactly when the observing is scheduled and to get there. In the SF bay area, many groups schedule observing from April through October due to the weather.

Some observatories, like Lick and Chabot, have public observing through their telescopes. If you go, be aware that there may be MANY people and a few telescopes. It may be too crowded for you to draw what you see (or you may be able to wait until most of the folks have left and then draw). Sometimes, the telescopes look at only one or two objects. Phone first to be sure that they plan to observe several different things or plan to go more than once.

Dress in layers, lots of layers for most locations. Some of these locations are quite windy,

Bring a flashlight, covered with red cellophane or cling wrap. When people are in the dark, the pupils of our eyes open to accept more light. It takes about 20 minutes for our eyes to adapt. It really helps to be dark adapted when we look through a telescope at dim objects. The red covering is to keep your (and everyone else's) eyes dark adapted.

Materials: Paper, pencil, hard surface to write on (like a clipboard), flashlight with red cover over the light, warm clothes. Red cellophane or nail polish on the glass can be used to cover the flashlight.

Where to observe

Other events not listed here are entirely acceptable. There is no need to ask first.

Astronomical League of Northern California (<http://www.aanc-astronomy.org/aanc.html>) has links to a variety of local associations

Mount Diablo Astronomical Society has observing on some Saturday nights on Mount Diablo. You need to be inside the gates of Mount Diablo Park BEFORE sunset. Volunteers lead groups of cars down the road with your lights out when you leave. The web site has links to other associations. Check at <http://www.mdas.net>

Lawrence Hall of Science has observing on the patio the first and third Saturday of each month, Phone 510- 642-5132 to verify the dates.

Chabot Planetarium has observing Friday and Saturday nights. There are two large telescopes.

Lick Observatory, south of Milpitas is sometimes open on Friday nights.

DVC There are usually several observing nights scheduled near the beginning each term. They are usually very crowded and the weather is iffy. If you come, you may need to wait until quite late for the crowd to clear. But TELL the people working at the open observing what you need to do. There are also lab classes (Astro 130) on campus during the week. Lab classes use telescopes several times a semester. You may be able to attend one or more of these, but you **MUST** ask the instructor's permission and must come on a day that observations are scheduled.

What to do

Observe at least THREE different objects and draw what you see. Document the date, time, location, and properties of the telescope. The circle represents the entire field of view of the telescope. Draw what you see. The object may not be very large. Ask whoever is at the telescope to tell you what type, what eyepiece etc. You can ask what magnification, but also compute it when you get home. Sometimes people know just what brand and model. That will allow you to look up the type.

Get the person in charge of the telescope to sign on your paper (so you will have four signatures for the four papers).

Observe one (or more) of the objects TWICE, with different equipment. Different equipment should be a different type or size of telescope or binoculars. If there are not any different telescopes, then observe with a different magnification.

Messier objects, planets, star clusters, galaxies, gaseous nebulae are all interesting to observe. Double and multiple stars are fine too. Single stars and unnamed areas in space are **not** all right. The person pointing the telescope will tell you what you are looking at. It would probably help to have them spell it.

The Moon is exciting to observe, but it is complicated to draw. If you draw the Moon, draw carefully. After the observations, look at a map and identify at LEAST 6 different named features on each. Most telescopes show only a small part of the Moon, making it tough to relate to the overall map of the Moon. If you observe the Moon twice, be sure that the two observations are at different magnification. You will be able to tell this because the Moon will look very different in the field of view.

This will make a total of FOUR observations (minimum) and TWO (minimum) types of equipment.

After you have drawn the objects go home and

- a) Find a picture and description of the object on the internet. Print out the information. These images will generally show more than you will be able to see with an amateur telescope. Write a paragraph comparing and contrasting what you saw with what is on the photo for each object. **UNLESS** you have drawn the Moon. In that case:
- b) If you observed the Moon, get a map of the Moon and label at least 6 of its features on each drawing. Tell the proper name for each (e.g not Crater, but Copernicus, the name of the crater) One site with a lunar map is <http://www.inconstantmoon.com/cyclopedia.htm>. The physical and nomenclature maps that say features and show maria, bright, or other are the best ones to look at. If you observed the moon in the early evening and it wasn't full, you were looking at the right hand side of the map. If you observed well after midnight, you saw the left side features.

Turn in

Observation sheets (4 or more)

Print out of Internet information about the objects

Objective and Conclusion

Describing the equipment

Binoculars are specified by two numbers like 7 x 35 or 8 x 50. These would be read, "7 by 35". The first number is the magnification, 7 times or 8 times. Generally the magnification is between 6 and 10. Binoculars generally do NOT have any way to adjust the magnification.

The second number (the 35 or 50) is the number of yards visible in the binoculars at a distance of 1000 yards. So the second number is a measurement of the field of view. If you want the number of degrees, multiply the second number by 0.0573 degrees. So 35 translates to about 2 degrees and 50 translates to 2.865 degrees field of view.

Binoculars are not generally sold by aperture, but that is what matters the most for finding faint objects. Aperture means the diameter of the lenses in the front of the binoculars. Generally the aperture diameter is printed on the front end of the binoculars. If you can't find it, measure the diameter with a ruler.

The larger the area of the lenses, the fainter an object you can see. The fact that there are two sets of lenses in the binoculars doesn't add to the amount of light that can be seen, it just makes it possible to use both eyes.

Telescopes come in two basic kinds, reflectors and refractors.

Refractors are telescopes with lenses, no mirrors. They look like pirates' spyglasses. Light from all over the area of the front lens is collected. This is the lens furthest from your eye, and also the biggest. These diameters are generally less than 5 inches for telescopes that are commercially available. The large ones are very expensive.

Reflectors are telescopes with a curved mirror collecting the light. There are a variety of reflecting telescope designs. These telescopes all have a mirror that you can see. It is generally near the closed end of the tube. Diameters of the mirrors start at about 3 inches and go up. Telescopes over about 17 inches are tough to move even with a car.

Reflecting telescopes are much more popular than reflecting telescopes because they are much less expensive. Reflecting telescopes come in a variety of designs.

Newtonian telescopes have the eyepiece on the side of the telescope, close to where the light comes in. The front end of the telescope is open. Traditional Newtonian telescopes are mounted roughly from the middle. Dobsonian telescopes have Newtonian optics but are mounted at the bottom, the end where the mirror sits. This type is named for the designer John Dobson of San Francisco. They are very popular because the mounting is compact and it is possible to have a portable telescope with large diameter.

Some telescopes have a hole in the mirror and the eyepiece is on the back end. The design of Telescopes with an open front end and the eyepiece at the back are usually Cassegrain type. Large observatory telescopes are usually this type. Many telescopes have a hole in the mirror, an eyepiece at the back end and a thin lens at the front. These telescopes tend to be quite short. The design is called Schmidt Cassegrain or Maksutov depending on the type of correction and the curvature of the small mirror near the front. The owner of the telescope will know.

Diameter of Objective

Regardless of whether the telescope is a reflector or a refractor, the largest lens or mirror is called the "objective". The area of the objective determines how much light is collected and how faint an object can be seen. Since area of a circle is πr^2 , the square of the radius is what matters. So a 6 inch diameter telescope (area $\pi 3^2 = \pi 9$) gathers four times as much light as a 3 inch telescope (area $\pi 1.5^2 = \pi 2.25$).

Magnification

Telescope magnification depends on the eyepiece being used. It can be changed. There is no maximum magnification, but typically it is not good to use magnification more than 50 x diameter of the aperture in inches.

So for a 6 inch telescope diameter, 300x is the maximum magnification to use. For an 8 inch diameter telescope, 400 is the maximum magnification.

If the image is magnified too much, the image gets weak and watery looking. It's the same kind of thing that would happen if you tried to use a home projection TV to project on a giant screen like at a drive in. The picture would be big, but too faint.

The magnification a telescope produces is given by the formula

$$\text{Magnification} = \frac{\text{focal length of the telescope}}{\text{focal length of the eyepiece}}$$

Magnification has no units. The focal lengths should be in the same units as one another. The units cancel and magnification has no units. Typically magnification 50 would be written 50x.

The focal length of the telescope depends on ALL of the glass parts except the eyepiece. The focal length is never printed on the telescope or given in the brochure. In stead, a ratio called the "F number" is provided. It WILL be printed on the scope or in the brochure in most cases. It might look like F10, or F/10. Telescope F numbers range from about 4.6 to 20.

The F number is defined by

$$\text{F number} = \frac{\text{Focal Length of the telescope}}{\text{Diameter of Objective}}$$

Since you know, or can use a ruler to measure the diameter of the aperture, the F number allows you to find the focal length by rearranging to

$$\text{F number} \times \text{Diameter of Objective} = \text{Focal Length of the telescope}$$

The focal length of the eyepiece is normally printed on the eyepiece itself. Typical focal lengths are from 3 mm to 32 mm (with occasional large eyepieces to 56 mm). Larger focal lengths produce lower magnification and are easier to look through.

The lower the magnification, the larger the field of view of the telescope and the easier it is to find things. Most telescopes have an attached finder scope with a fairly large field of view.

The point of the finder is for you to get the object into the center of a large field of view so that it will be easier to find in the smaller telescope field of view. It only works if the finder and the main telescope are aligned so that they both point the same. Many telescopes have finders that shift when the telescope is put away. So be sure to realign it at the start of the evening. Look at the Moon or a bright planet and adjust the finder pointing so the same thing is in the middle on both large and small telescope

Star Party Observation Sheet

Name _____

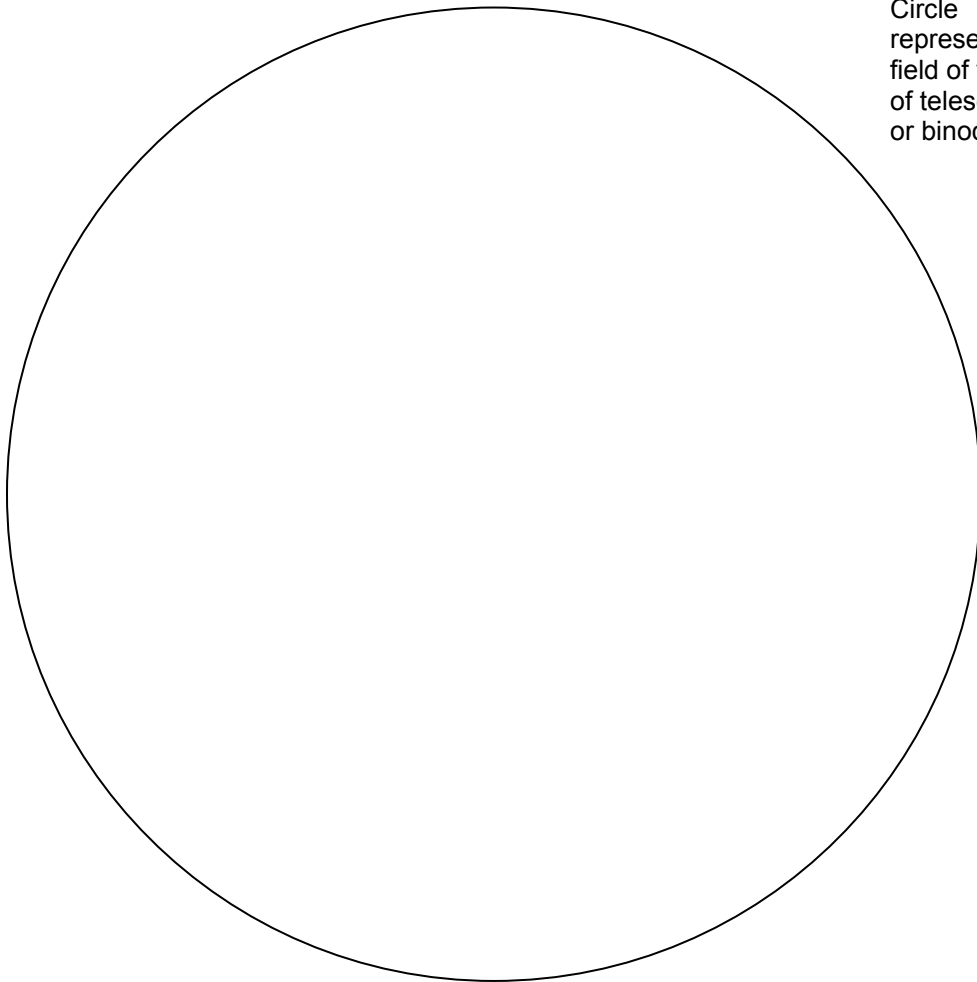
Location of Star Party _____ Date _____ Time _____
(tell zone and whether standard or daylight savings)

Type of Telescope _____ Diameter of Objective _____
(refractor, reflector and design e.g. Newtonian)

Fnumber _____ Eyepiece Focal Length _____

Magnification _____

Name of Object _____ Telescope of _____
(signature of telescope expert)



Circle
represents
field of view
of telescope
or binoculars

If drawing is of the Moon, label at least 6 features with their proper names, attach map(s)
Comparison with image from photograph, use back for your analysis and attach data sheet.