

## OBJECTIVES

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The objectives of this activity are intended to meet the following course goals:

- G2. Students will develop critical and/or analytical thinking skills.
- G3. Students will understand how astronomical instruments operate and their limitations.

After completing this lab exercise the student will be able to:

1. Make a list of telescope manufacturing and sales companies.
2. Know basic prices of amateur and/or professional telescopes and accessories.
3. Know the current types of telescopes and observing equipment available.
4. Know the limitations for setting up an observatory.

## STUDENT MATERIALS

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The student is expected to bring the following items:

pencil

## LAB MATERIALS

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The instructor should provide the following items:

- list of web sites for astronomical equipment
- list of web sites showing amateur and university observatories
- some copies of amateur astronomy magazines
- books on amateur observatories
- a slide show or some pictures of actual amateur telescopes and equipment (or have some actual telescopes set up in the lab room)

## INTRODUCTION

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Many schools such as high schools, colleges and universities have small telescopes. These telescopes are used to observe the sun, moon, and stars with students taking introductory astronomy classes and the general public. In addition many colleges and universities have required senior research courses for science majors and these telescopes are sometimes utilized for such projects. Many of these institutions build small observatories to house this equipment.

The actual structures of observatories range from simple to complex. The simplest structure is to store telescopes in a room and carry them outside to the observing location where they are set up on tripods or pedestals. The problem with this is the constant setup and takedown, which is hard on the instructor and the equipment. Many small observatories are rectangular buildings, such as a garden shed, which are designed with a removable roof. An advantage of this type of structure is that observers can view the entire sky while inside the structure. Also, the telescope can be permanently set up avoiding all the setup and takedown issues. The disadvantage is that the roof must be securely fastened down when not in use. Domes are popular because they are easy to open and close and are firmly attached to the building at all times. However, observers inside the dome can only see a narrow piece of the sky through the open shutters. When deciding upon the type of structure to house telescopes all of these advantages and disadvantages along with local circumstances need to be considered.

The location of an observatory needs to be considered. If you the telescopes are going to be set up and taken down for each observing session then the location of the observing site should be close to the storage room minimizing the damage to the equipment caused by the constant transportation of the telescopes. When telescopes are setup in an open

field it is also important to select a location with minimal external lighting. If the telescopes are large and heavy then they will need to be permanently housed in either a roll off roof style building or in a domed building. An additional advantage that a dome has is to shield the telescope from light shining directly on it from outdoor lighting. A major disadvantage to any permanent structure is that its physical size may limit the number of people that can be inside at the same time. Student convenience should also be considered. It might be better to place a telescope in an urban location if the students can actually have easy access for attendance of observing sessions. Placing an observatory in a dark remote location is great for deep sky observing. However, if students cannot travel to the observatory then it becomes less effective for teaching purposes. How an observatory is to be used is fundamental to the type of facility and its location.

Georgia State University has two observatories. One is for student use on campus. In Figure 1A students are shown using this observing site to take pictures of the Sun. The other observatory is shown in Figure 1B and is at a remote location. This facility is meant for more advanced research oriented projects and for hosting public observing. It has two 16-inch telescopes and several small portable telescopes that can be used on the lawn on public nights.



**A)** Observing platform on a roof top on the GSU campus in the middle of downtown Atlanta.

The two basic types of telescopes are refracting and reflecting. Refracting telescopes have objective lenses for gather light. The main advantage is that they can withstand a reasonable amount of abuse because the lenses are held in place inside a rigid tube. Their main disadvantage is that they are usually more expensive than reflecting telescopes and they are heavy and thus difficult transport from place to place. Reflecting telescopes are usually have a large diameter objective and are more portable. However, their mirrors are in constant need of realignment because of the constant banging around during transport to an observing site. Therefore, it is advantageous to have telescopes permanently mounted in an observatory building.

## PROCEDURE

Congratulations, you have been awarded \$20,000 to build a student observatory for your school, college or university.

The first thing you need to decide is how you intend to use the observatory. What types of things do you want students to observe? How will observations be performed, looking through an eyepiece, CCD photography, projected on a large monitor, etc. Will the observatory be used for senior research projects for science majors? All of these activities influence the type of facility needed.



**B)** Hard Labor Creek Observatory is located in state park far away from city lights.

**Figure 1:** Two observatory facilities operated by Georgia State University (GSU).

1. Describe the types of observations you want to perform.

Now that you know the intended use of this observatory you need to decide where the observatory will be located and if it will be a permanent location or portable. If it is portable you need to decide where the telescopes will be stored when not in use and how they will be transported to the observing site.

2. Where will the observatory be located? Why?
3. Will this be permanent location or portable?
4. If portable, where will the equipment be stored when not in use?
5. How will the equipment be transported to the observing site?

6. Make a tentative list of items you think should be purchased for this observatory.

7. Make a detailed list of all equipment you will purchase. Be prepared to justify why you are spending the money for each item. This list should include telescopes and accessories and any housing cost such as domes or other shelters. Granting agencies do not want their money returned. Therefore, you are required to spend all \$20,000.

ITEM	VENDOR	ESTIMATED PRICE

TOTAL PRICE \_\_\_\_\_

8. It is typical for projects to run over budget. If your observatory cost more than \$20,000 where are you planning to get the additional funds? Be realistic, the science department, or the Dean's office are not made of money and may only be able supply a few hundred dollars, if that. You maybe more convincing if you can show how they will actually gain funding in the future through additional enrollment, public nights (careful what you volunteer for), etc.

In the space below make a sketch of any structure you may need to build to house the telescope and its equipment.