Photographing Star Trails

For this project you will take photographs of the sky to see the motion of the stars. This is easy to do if you have the right camera.

Find a dark site and a moonless part of the night. Avoid streetlights, places where car headlights will go by etc. Put the camera on a tripod or on a stable surface while taking the photos. Find a place with a view of the North and also a view in another direction.

The camera shutter is left open for 10 minutes or longer. The main **material** requirement is that you have a camera that is able to leave the shutter open. The flash must not operate during this time. If you are unsure of whether your camera will do this, bring the camera in and we will check.

The observations can be completed in a few hours on one night. Leave time to get the film processed and possibly reprocessed. When film is processed, first the film is developed and negatives are made. This is always done for every picture on the film. If you did not take all of the pictures, you will just receive the blank negatives along with the rest.

After the film is developed, prints are made from the negatives. The people who make the prints OFTEN think that photos with just stars are not worth printing. If that happens, make sure you can see the stars on the negative and then take the negatives back to the processor, You may be able to persuade them to print the photos. Some stores only use a machine to decide where one negative starts and ends. They may be unable to print your negatives. If that happens, go to a photography store (like Action Photo in Concord),

Camera Particulars
Some older SLR (single lens reflex) cameras have adjustable exposure times. The bulb, or B, setting the one that allows the shutter to be held open. This setting would be marked on a knob or in a list along with other exposure time numbers, like 1000, 500, 250, 60, 30, 15, 8, 4, 2, 1 (which mean 1/1000 second etc.). Students who take photography classes normally buy a manual camera. So you may be able to borrow a camera. Some newer, electronically controlled cameras have a similar long exposure time setting.

If you have a sensitive digital camera or camcorder, you may be able to take a series of images of the stars and combine them. Use the preview screen to see whether your camera detects stars if you want to do this project. If it does, take several images a few minutes apart rather than a trail. Print the pictures. Make a composite with all the images on one picture if you can. It should look like a dotted trail where the star would have produced a curved trail.

Disposable cameras do not have adjustable shutters, but some do-it-yourselfers have been able to open the case and force the shutter open with a toothpick.

For this project, use sensitive film. The ASA value tells the sensitivity of film. Larger numbers indicate more sensitive film. ASA 800 is readily available in supermarkets and drugstores. That is fine. If you prefer, ASA 1600 and 3200 can be found at camera stores. It doesn't matter whether the film is color or black and white, but it's usually cheaper to have color film developed and printed. The film in disposable cameras is quite sensitive.

The bulb setting on a mechanical camera usually opens the shutter when the button is pressed, and closes it when the button is released. To hold the button down, one can push it and hold. But it is hard to do this for many minutes without jiggling the camera. Or one can use a "cable release". This is a tube with a wire inside it. One end screws onto the camera and the other end has a little plunger. When the plunger is pushed down, the button on the camera is depressed. Because of the tube, you will not jiggle the camera. There is a screw to hold down the plunger. So you don't have to hold it for the entire exposure. Cable releases can be bought at photography stores, like Reed's in Walnut Creek for about $10 and up. You could borrow one from DVC.

Most mechanical cameras use the power from the battery to open the shutter. The shutter will close if the battery isn't strong enough or if it is cold out and the battery loses power. If this happens, you star trails will be interrupted. If your battery is old, you may want to buy a new one.

The Fnumber is a measurement of how much light the lens lets when the shutter is open. Use the smallest Fnumber possible, to get the largest amount of light, The F number is defined as $\mathbf{Fnumber} = \frac{\mathbf{Focal\ length\ of\ objective}}{\mathbf{Diameter\ of\ objective}}$ The objective is the lens at the front of the camera. The focal length is the distance that this particular lens takes to bring parallel light rays to a focus. It is a feature of the curved glass in the lens and doesn't change. The diameter of the glass doesn't change. But there is an iris, a covering like the colored part of a person's eye in the camera. It can be adjusted to cover more or less of the lens, The Fnumbers are printed on the camera. The values are typically like 22 16 11 8 5.6 4.8 2.2 1.6 (or just some of these) and they are usually printed on the lens. A small mark indicates the current value, Usually you twist the lens and it clicks around from one Fnumber to another. Choose the smallest possible Fnumber.

Don't forget to focus the camera for the stars. Just look through the view finder and adjust the focus until it looks right. If you are not positive, the proper focus is all the way to one side or the other.

To Do

1) Take at least two pictures of the North and two pictures of the other direction. Make one picture an exposure of at least 7 minutes and the other an exposure of at least 12 minutes for each direction (total of 4 or more pictures).

   Record the information describing each picture on the sheet attached. Number consecutively for every picture or exposure you make. If there is a problem or you take a picture of your feet etc, just write in the row what happened and USE the number. The point is to have a table with the same sequence as you will have in the negatives. If you are combining the digital images, just make one long combination with at least the 12 minutes of data for each direction.

   2) Get the pictures processed and printed. If you are using a digital camera, print the individual pictures. Combine all the images to make one track

   3) Write the information describing each photo on its back. Turn in the photos AND the negatives. You can put the pictures and the negative in the envelope from the processing company and staple it to everything else.

   4) What causes the stars to appear to move?

   5) As you look at the photos, and imagine that you could leave the camera shutter open for a long time. Can you see some stars that would make a complete circle without touching the horizon (assume that daylight is no problem)?

   If you see such stars, are they on the pictures from both directions?
   Show which of the stars would make such a circle above the horizon by either marking them on the photo(s). If you would rather not mark directly on the photo, write on a copy or put a piece of tissue paper on top of the photo and write on it.

   Stars that never go below the horizon for your location are called "circumpolar". All the stars seem to go around the pole, but these are typically closer to whichever pole you can see.

Turn In
Photos of North and South Star trails
Answers to questions
Photo data sheets
Objective and Conclusions

Photo Data Sheet Name_____

Camera type (brand, model) _____ Focal Length of lens_____
(printed on the camera) (written on the lens)

Photo Number	Date	Time	Location/ Direction of photo (N, S,E,W)	Film ASA	Fnumber	Exposure Time