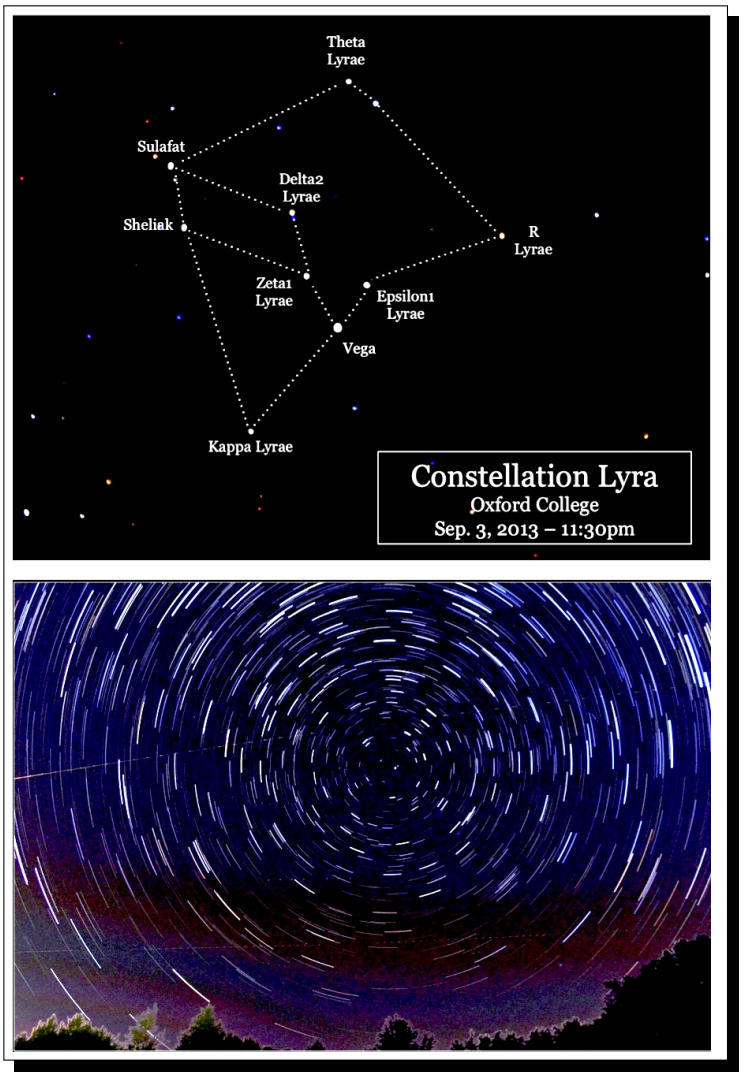
NAME: _____ DATE: _____

The Orion Constellation and Star Trails

In this observing lab, you will photograph the constellation of Orion and create a star trails image.



Contents

Procedures for Photographing the Night Sky

1. At Night: Photographing the Constellation Orion.

Dr. Segre will help you with setting up the camera and computer to do this, but there are several things to pay attention to. The most important is the **exposure time** of the camera. The exposure time is how long the camera is recording the image. In normal daytime photography, in sunlight for instance, typical camera exposure times are only about $1/100^{th}$ of a second. At night however, because there is so little light, the camera needs much longer exposure times to collect enough light to form an image. Typical exposure times for star photography are 5-30 seconds.

1. Look towards the SouthEast and locate the constellation Orion by eye. Look for Orion's belt, the three bright stars in a line located in the middle of the constellation. Dr. Segre can help with this, and you can also use the Voyager planetarium program.

2. Once you've found Orion, point the camera in its direction and take a series of test photographs with a 5 second exposure while you move the camera around until you are sure that the whole constellation is in the field of view of the camera. Finally, increase the exposure time to 10-20 seconds and take a single bright image of the Orion. You should able to see in the photograph most, if not all, of the stars that make up the constellation.

2. At Night: Making a Star Trails Image.

You will now make a star trails image (see the cover image for an example) of your chosen constellation. A star trail image is created by taking a series of 20-30 photographs over 10-15 minutes of the same region of the sky (i.e. the camera never moves). Over time, as the Earth rotates, the stars will move slightly across the camera image. After you obtain the images, you will use a software program, StarStax, to 'stack' all of the photographs on top of each other and create a single star trails image.

Star trail images are a great way of demonstrating the rotation of the night sky over time. It's important to note that the actual appearance of star trails will vary according to where you're looking. The cover photograph shows an example of one looking North, and the North star Polaris is in the center of the 'spiral'. A circular type pattern will also occur if looking South, although the center of the 'spiral' is below the horizon. If you look East or West, the trails should look more vertical as stars rise upwards or set downwards.

1. You should use the same constellation that you used in part 2 above to make a star trails image. Use the same camera settings that you used in part 2 to capture the images. The procedure is to take consecutive images, without moving the camera, for a period of about 12 minutes. For example, if you find that you get a good single image with an exposure time of 20 seconds, then take 36 consecutive images, one after another, for 12 minutes total. Later on, back in the lab, you will take those 36 images and create a star trails image using StarStax.

Analysis Back in the Lab

To complete this observational lab, you will need to do two things:

1. Create an image of Orion with the names and temperatures of all of the stars labeled.

2. Create a star trails image of Orion.

You will first need to get all of the photos that you took. To do that, go to **www.philsegre.com**. Choose **ASTR116→2-27-14 Photographing Orion**. Scroll to the bottom of the page, find you group (1, 2 or 3), then select **Download**. You will get a page saying "This content cannot be displayed in a frame. Click on **Open this content in a new window**, then **Save**, then **Open Folder**. Finally click on the folder (the icon is a zip file) and finally you should see all of your images in the folder labeled **Downloads**. Copy the folder with all your photos onto the Desktop.

Photograph of Orion

Choose any one of your photos of Orion. **The goal is to make an image of Orion like the cover image of Lyra (but with the star temperatures listed also).** To do this you will need to be able to write text and draw lines on the jpg's, and this can be easily done in Powerpoint.

1. Begin by opening Powerpoint. Drag any one of your Orion images onto the blank page and rescale the image to fill almost the entire page. To increase the brightness of the image, **right click on the image** then choose **Format Picture**, then set the **Brightness=50%** and the **Contrast=50%**.

   (a) To properly label the stars in your photo, open the Voyager program, set the time to the exact time the photo was taken, and scroll over to Orion. By comparing side by side your photo and the image in Voyager, you should be able to identify the names of the stars in Orion. To find the temperature of the stars, on the popup Info panel, click on the Physical tab. You will see listed the Temperature of that star.

   (b) Draw the outline of the constellation with white lines connecting between the constellation stars.

   (c) Write, using a textbox, the names and temperatures of as many stars in Orion as you can.

   (d) If there are other bright stars not in Orion, label them too in the same way.

   (e) Put your name, date, and constellation name somewhere on the slide.

Star Trails Image

You can make a star trails image from your collection of sequential photos using the software program **StarStax**.

1. Begin by opening **StarStax** which is on the desktop. Choose **File** ⇒ **Open Images** and select all of your Orion images. You should now see them all listed on the left panel of the program.

2. Click on the top purple icon on the upper right of the program, this brings up the analysis panel.
3. Look on the panel on the right, make sure that the **Blending Mode** is set to **Lighten**. This is the option to make a star trail image.

4. Click on **Edit** ⇒ **Start Processing**. You should now see the star trails image on the screen.

5. Click on **File** ⇒ **Save As** to save your image.

6. Now make a second (blank) slide in Powerpoint, drag your star trails images onto that slide, and resize it to fit.
7. To increase the brightness of the image, **right click on the image** then choose **Format Picture**, then set the **Brightness=50%** and the **Contrast=50%**.

8. Put your name, date, and constellation name somewhere on the slide.

9. Finally, you are to save both Powerpoint slides in .jpg format. To do that, cick **File - Save As - Save as Type JPEG**. Before emailing them both to me, change the names of the two .jpg files to include your name, and the name of the constellation, like **Segre-Orion-1.jpg** and **Segre-Orion-2.jpg**

Star Colors, Distances, and Temperatures

You might have noticed that the stars, and the stars trails, display a variety of colors. We will talk about this much more when we talk about stars later in the semester but for now, you can examine whether there is any correlation between the colors of stars and their temperatures.

1. Examine the brightest stars on your photo, and fill in the table below.

Orion Constellation

Star Name	Color on Photo	Temperature	Distance

2. Looking at the table, is there any relation between the temperature of a star and it's visual color?

3. Are all of the stars at the same distance from Earth, in other words are all the stars really close to each other or do they just appear that way to us?