

Name \_\_\_\_\_

## JS9 – Learning to use the Online Imager Processor JS9

Besides making a picture look interesting, image processing software for astronomy images can get astronomical information out of ccd images. This lesson will help you figure out how to use the software to find out the following type of information.

- Find out how much relative light is coming from an object in an image**
- Compare light across a certain area in an image**
- Explore the sizes of objects in an image**
- Expose hidden details in an image**

### A. Setup

1. Open the JS9 webpage (<http://mo-www.harvard.edu/OWN/software.html#>). Spend a few minutes looking through the menu options.
2. Open our class webpage or our resource page. Click on the link for JS9 Images. You will need to download these images onto your desktop so you can open them in this web page. The open from url command isn't working at this point, hopefully in the future. If it does, then you would only have to have the url of the image, instead of downloading.

### B. Find out how much relative light is coming from an object in an image

1. From that folder open *browser 1*. You should see an image of the moon. Under the **Color** in the menu bar, choose the palette you prefer and set your slide bars so you are happy with the brightness. Notice what happens to the **Color Palette Bar** below the image when you adjust the slide bars.
2. Under the image, there are x & y positions and the pixel value for each pixel. This pixel value is the brightness of the pixel you mouse is currently on. Sometimes it is called brightness counts. Move your mouse around and find the brightest spot (or pixel) on this image and then the dimmest pixel. Record the following for your brightest and dimmest pixel:

Brightest X = \_\_\_\_\_ Y = \_\_\_\_\_ Pixel Value = \_\_\_\_\_

Dimmest X = \_\_\_\_\_ Y = \_\_\_\_\_ Pixel Value = \_\_\_\_\_

3. Close *moon*.

### C. Compare light across a certain area in an image

1. Open *browser 4* image. Choose a palette and set the brightness. This image is the Ring Nebula, the most famous example of a planetary nebula. Planetary nebula have nothing to do with planets. They got that name because they looked more like a planet instead of a star to the first observers. Planetary nebula are shells of gas shed by stars late in their life, after using up their nuclear fuel. All that is left of the star is the core. Our own star is expected to undergo this same process in a couple of billion years.
2. In the menu, under **Region**, choose **Box**. This tool will allow you to compare the brightness along a line you draw on the image. Draw a thin box that includes part of the nebula and the two stars in the center of the nebula.
3. Go to **Analysis** in the menu and choose **X projection**. A graph will appear with the brightness counts across an x plane from your box. If no graph appears, you may have to click on your box.

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4. Compare the peaks on the graph. How do the stars at the center compare with the nebula?
5. Close *browser 4*.

#### D. Explore the sizes of objects in an image

1. Open image *browser 3*. Set the slider bars to adjust the brightness to figure out what this is an image of. Set the palette you prefer. What is this object?
2. This image was taken in Hawaii in 1991 during a solar eclipse. Adjust the min/max so you can see the sun's rim. You should see a solar flare on the right – the large blotchy light on the left side of the image is an over exposure of the ccd chip in the camera and not a solar flare. Record your setting.

High of Brightness Limits \_\_\_\_\_ Low of Brightness Limits \_\_\_\_\_

Stretch Contrast \_\_\_\_\_ Stretch Bias \_\_\_\_\_

Palette \_\_\_\_\_

3. We can measure distance by comparing distances in pixels to actual distances; Ratios! You will find the real size of a solar flare by comparing the real size of the sun to its pixel size in the image. This ratio will help you find the real size of the solar flare. Using the mouse and the x and y in the status bar, measure how far the flare shoots out from the surface of the Sun in pixel units. Record your data.

Height of flare in pixels \_\_\_\_\_

4. Measure the diameter of the Sun in pixels. You can start from any point on the Sun's rim. Use the x and y to help you get a line through the center of the Sun. Record your data.

Diameter of Sun in pixels \_\_\_\_\_

5. Figure out how high the flare is in kilometers. Use the following ratio. The sun's diameter in kilometers is 1,390,000 km.

$$\text{Sun's diameter km} / \text{Sun's diameter pixels} = \text{Flare's height km} / \text{Flare's height pixels}$$

6. How many Earth's would fit inside the height of this small solar flare?  
The earth's diameter is 12,756 km

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7. Our sun is BIG!! In the Universe, our sun is only a medium to small size star. There are many that are much, much bigger. When you are done, close the image.

### E. Expose hidden details in an image

1. Open *browser* 2. Under the menu **Image**, click **Display FITS Header**. This opens a window with information about the image. Find the date (DATE-OBS) and the time (UT) the image was taken. The time is in Universal Time. Universal time is 5 hours ahead of Central daylight time (Chicago) during daylight savings (April – October) and 6 hours ahead of Central standard time (Nov – March).

Observation Date \_\_\_\_\_ Time \_\_\_\_\_

3. On the menu, there is a tool called **Scale**. This tool allows you to “stretch the image” different ways. The tool called **log**, takes the brightness counts in the middle of the scale and enhances them so it is easier to see things that might be hidden. Click on **log**. What happen to the numbers and colors Color Palette Bar below the image? What happen to the image? What is this image showing?

5. Close the image. Go ahead and open the other browser images (*browser 5-7*). Describe what they show. Try using some of the other tools like 3DPLot.

6. Now that you know how to use JS9, download your MicroObservatory Image and then use JS9 to make a beautiful image of your object. You can save your image as a jpeg and then create a document that shows your object and explains what it is.