# Image Processing in JS9-4L

Goal: To process MicroObservatory images using JS9-4L image processing software.

JS9-4L image processing software includes a wide range of tools you can use to process images acquired with MicroObservatory or NASA telescopes. This includes tools to adjust image brightness and contrast, measure distances in pixels, and sharpen, crop, and false colorize. The software also includes tools to create full color images, discussed in detail in a following activity.

Open an Image in JS9:

1. Open up JS9-4L in the Observing with NASA (OWN) Portal (MicroObservatory.org) by selecting the "Observing With NASA" box.
2. Once in the OWN portal select "Analyze Images" from the header menu.

3. To open an image expand the first drop-down list in the menu bar. If you have not yet collected any images, or are waiting for the telescope to collect them, you can use one of the images from the selected archive of images we have added for you found under the "Archive Images" drop-down. Once the drop down menu is open, click on any image label to open the corresponding image.
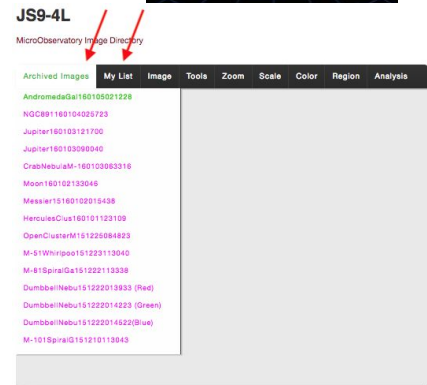
Process an Image:

Hint: Be sure to pay attention to the color bar just below the image as you adjust these values.

1. One of the first things you'll want to do is adjust the scale. There are four scale functions that can help you in adjusting the image. These can be found by selecting the "Scale" drop-down menu. The scale setting is automatically set to "linear." If you have a dim image, like a galaxy or nebula, we suggest selecting "log" to enhance the dim areas of your image.
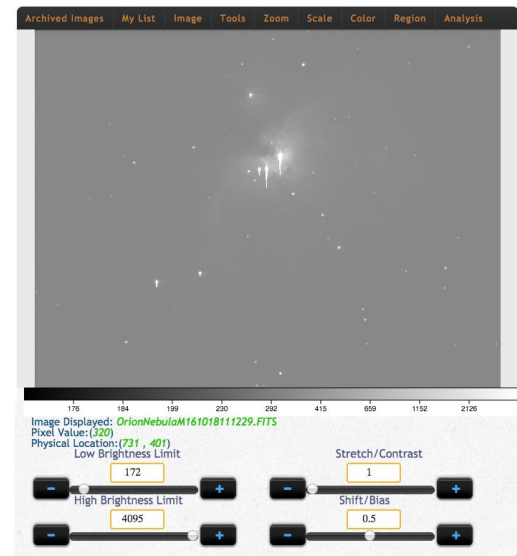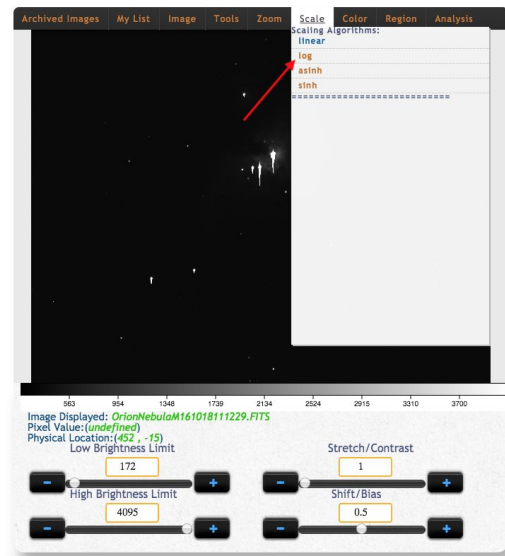
2. When you move the cursor over the image, the pixel information (value and physical location) is displayed just below the image name. Move your cursor over the image and observe how the "pixel value" is displayed.

3. Now that you know where to find the pixel value, you'll want to adjust the background brightness of the image. Note the pixel value for the dark regions and type that value into the "Low Brightness Limit" box. **You need to press Return after any changes.**
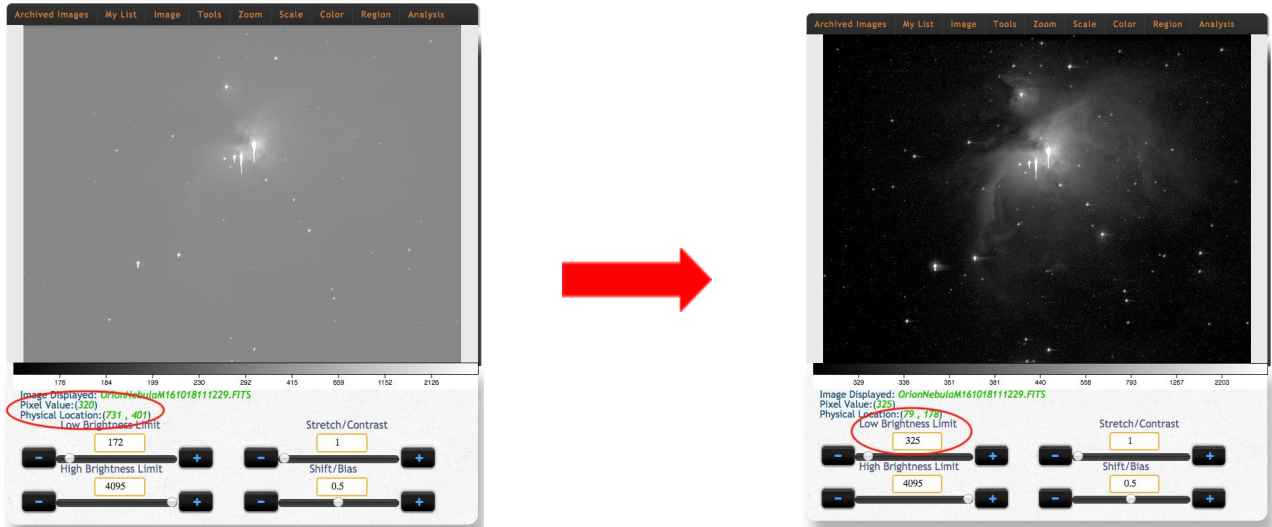

Try the same for the "High Brightness Limit" box after scanning the bright regions. Try other values to see what combination of "Low" and "High" gives the best image. You can also change how pixel values are being displayed by adjusting the "stretch" and "shift" slider bars at the bottom of the page using the plus and minus signs at either end or directly moving the sliders.

4. Now's the opportunity to add some fun colors to your image! The colormaps can be found by selecting the "Color" drop-down menu. Click on any color map to assign it to your image. Remember: when you assign a colormap to your image you are assigning "false color." This means that this is not the real color of the object, but that you are assigning specific colors to different brightness values.

Congratulations! You've just processed your first image, and learned what some of the image processing tools do along the way!!! If you're happy with your image, don't forget to save it as a PNG, by selecting the "Image" drop down menu, then clicking on "Save as PNG."
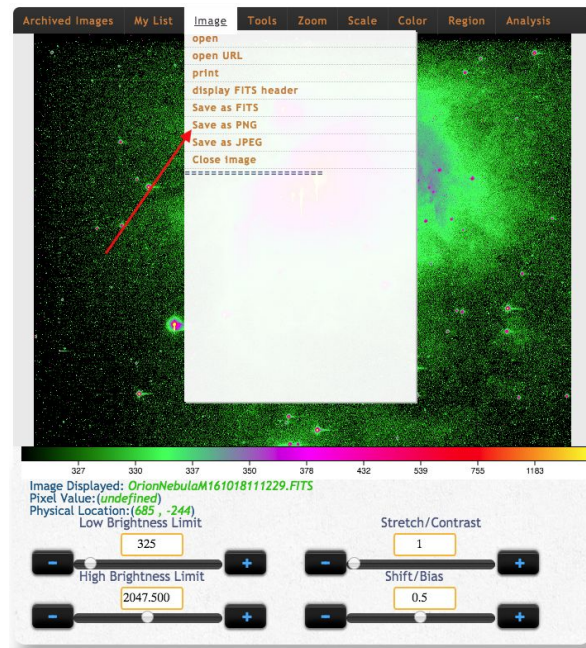
Want to learn more? Here's some optional image processing techniques and tools you might want to give a try!

- "Stretch/Contrast" and "Shift/Bias" are valuable tools in bringing out the most detail from your image. To understand how these tools work, first change the color of your image from the "Grey" colormap to "rainbow0." You'll notice that this colormap is made up of only 9 colors, making it easier to see what happens to your colormap as you make adjustments. Start by increasing your "Stretch/Contrast" value. Notice that the colors squish to a smaller set of brightness values. Once you've adjusted the "Stretch/Contrast," you can move the "Shift/Bias" up and down to change where in the range of brightness values the colors are being displayed.
- You can highlight areas or add text to your image by selecting "Region" from the drop down menu. Options include; box, circle, line, and text. Once open you can move them around and resize them with your mouse.
- JS9 also has tools that will provide information about your images. Selecting "display FITS header" under "Image" in the drop down menu will provide numerous details about your image to explore, including location, telescope, and weather. Under "Analysis" you can find a number of additional tools such as the "Histogram" and "region Stats" which provide data that can help you define the best "Low" and "High" brightnesses of an image, or the size of a particular feature. In order to use these tools you must first select a box or circle under the "Region" drop-down menu.

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