Uncovering the Cosmos
(Intro to Image Processing)

OBSERVING WITH NASA
MicroObservatory for everyone!

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LEARNING

Process MicroObservatory images using JS9-4L. This browser-based software includes a wide range of tools to process astronomical images including tools to: adjust image brightness & contrast, measure distances in pixels, sharpen, crop, false colorize, and create full color images (discussed in detail in a later activity).
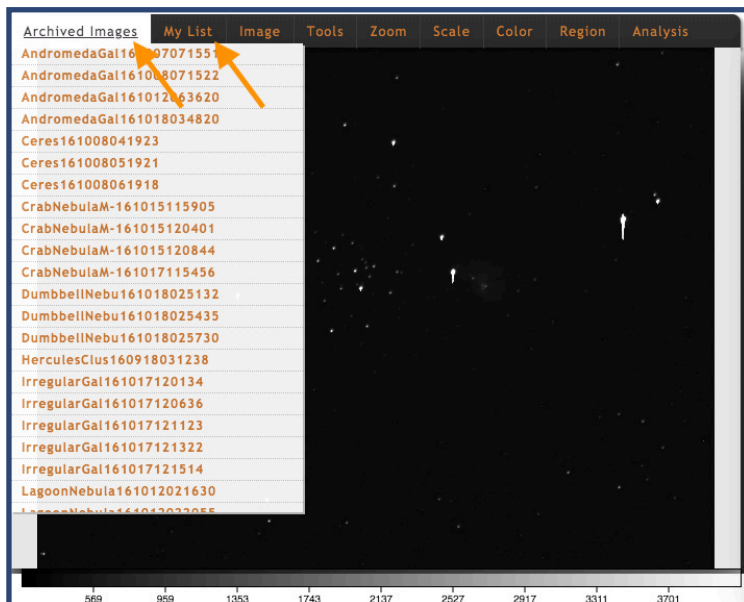
Before you start:
Open up JS9-4L in the Observing with NASA (OWN) Portal by selecting the "Observing with NASA" box at MicroObservatory.org

Once in the OWN portal select "Analyze Images" from the header menu

Step 1: **Open an image**
There are multiple options for opening an image in JS9-4L.
- An archived image of the Lagoon Nebula will automatically open in JS9-4L.

- If you have not yet collected any images expand the first drop-down list in the menu bar, and open an Archived Image.

- Click on the JS9-4L link in your email from the MicroObservatory telescopes

- Access the MicroObservatory Image Directory, and drag the image link ending in .FITS into the JS9-4L window.
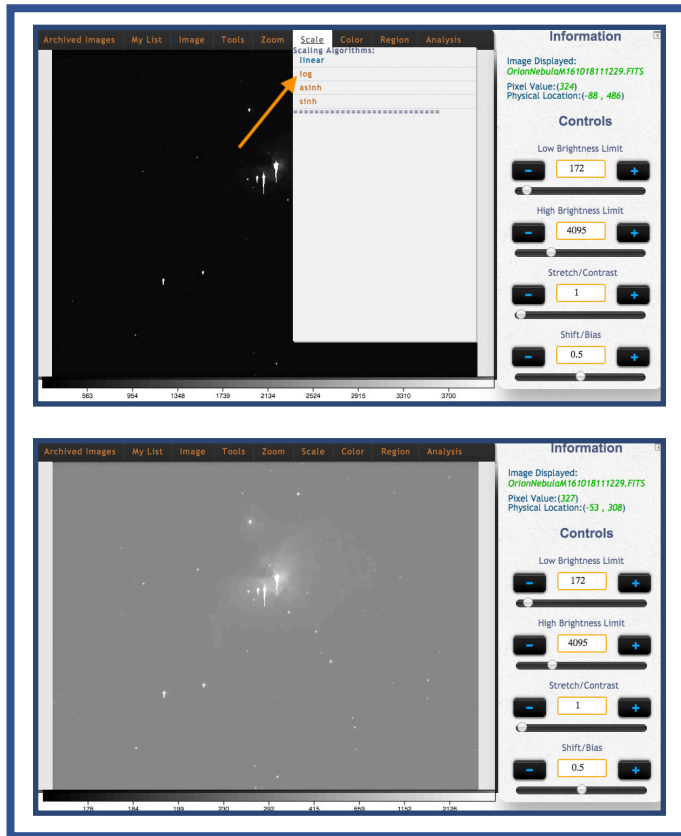
Step 2: Adjust the Scale

Adjusting the scale is the first step in processing dim images (galaxies and nebulas).

There are four scale functions that can help 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.

Hint: Be sure to pay attention to the color bar just below the display as you make adjustments to your image.
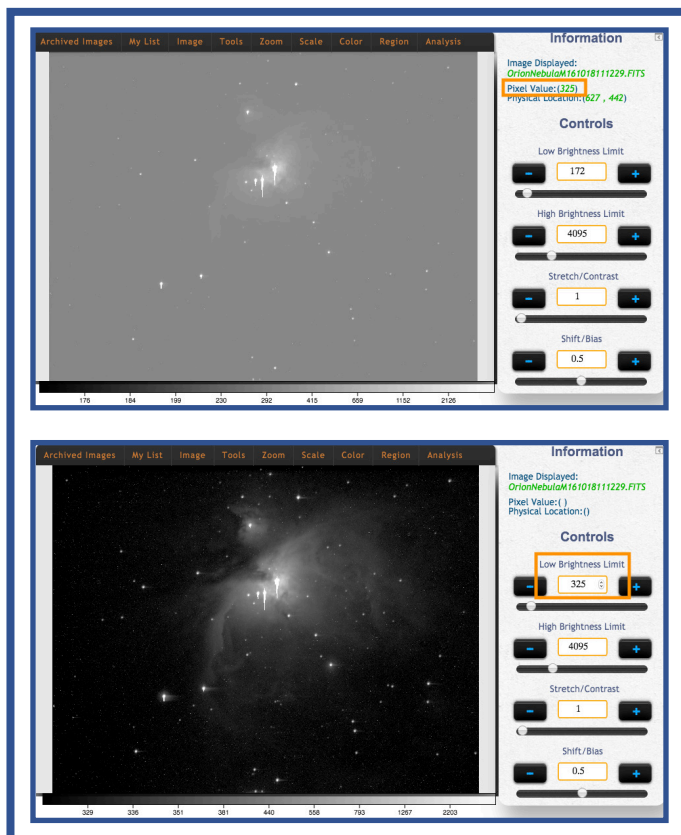

Step 3: Set the Low Brightness Limit

a. 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.

b. 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. Press Return after any changes.

Try the same for the "High Brightness Limit" box after scanning the bright regions. You can also change how pixel values are being displayed by adjusting the "stretch" and "shift" slider bars at the bottom of the page.
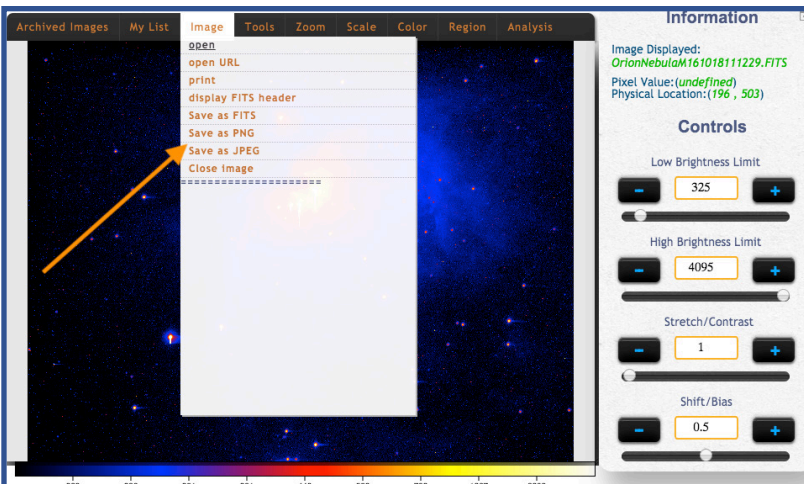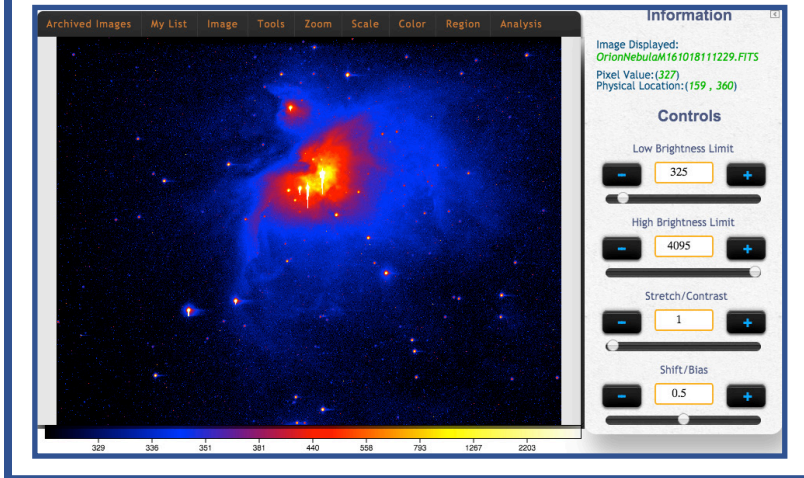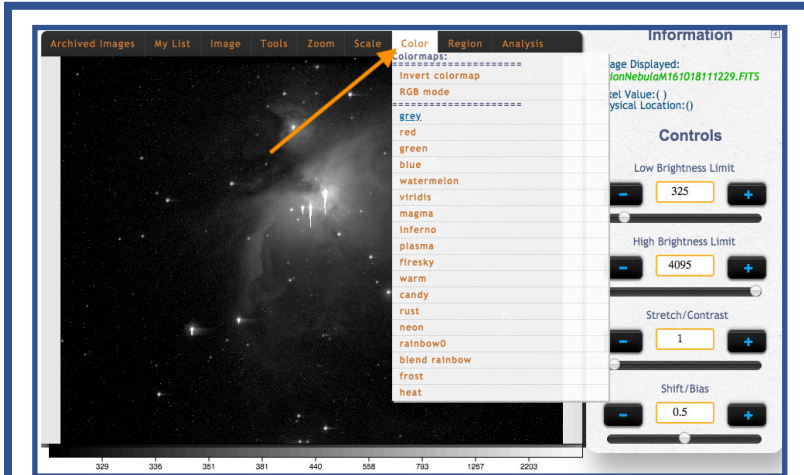
Step 4: Add Color

Now is 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.

Note: 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.

Step 5: Save Your Image

Congratulations! You've just processed your first image!

Save your image as a PNG or JPEG by selecting the "Image" drop-down menu.

Note: Do not save as FITS as this file format will only save the data, and not your processing.

Want to Learn More? Here are some optional image processing techniques and tools you might want to try out!

- 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.

- 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. You can also change their color.

- JS9 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.