Capture the Colorful Cosmos

Illustrated Processing Tools Guide

This illustrated guide was taken from the "Kids Capture Their Universe" curriculum. It provides additional information about the image processing tools used in the non-RGB processing challenges. More information about the full suite of processing tools in this software program can be found in the official MicroObservatoryImage manual. This PDF file can be found, along with supporting technical information, at

http://mo-www.harvard.edu/MicroObservatoryImage/mObs_Manual.pdf

or in the program folder that was downloaded with the MicroObservatory Image software.
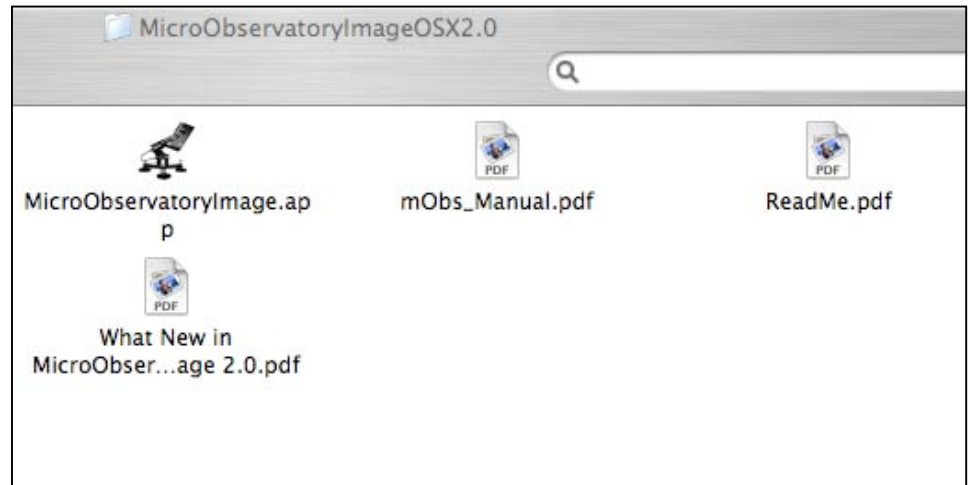
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How to start MicroObservatoryImage

This is what the contents of the program folder for this application should look like once you have downloaded and extracted the MicroObservatoryImage software:
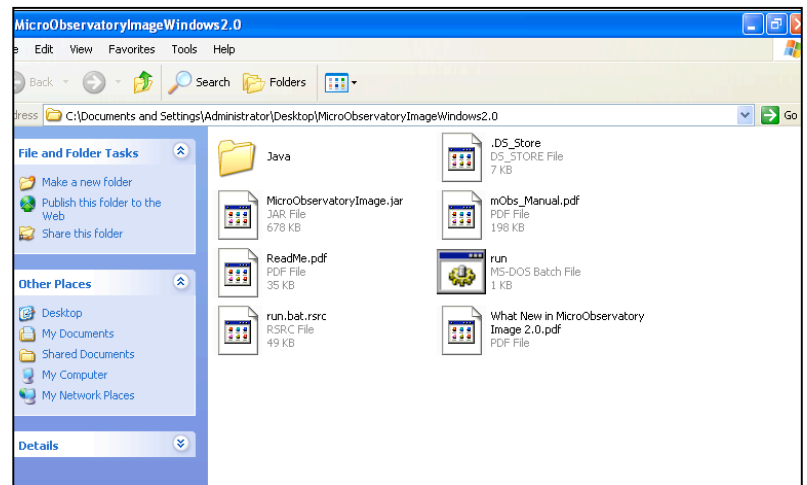
For Mac:

You can drag the MicroObservatory Image.app icon to your launch bar for convenience.
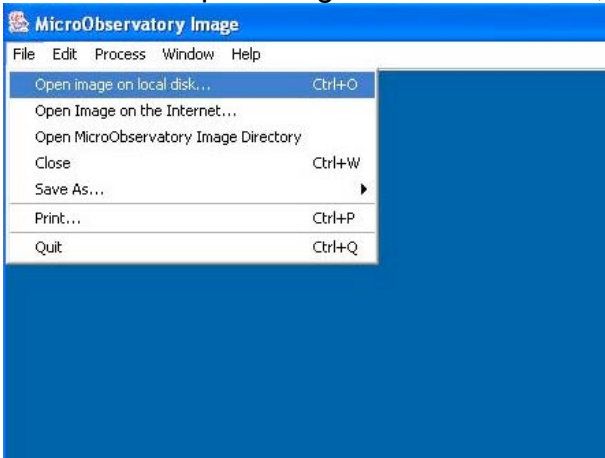

For PC:

Click "run.bat" to start MicroObservatory, but feel free to rename it something like "MicroObservatory Image Processing" and create an shortcut on the desktop, for convenience.
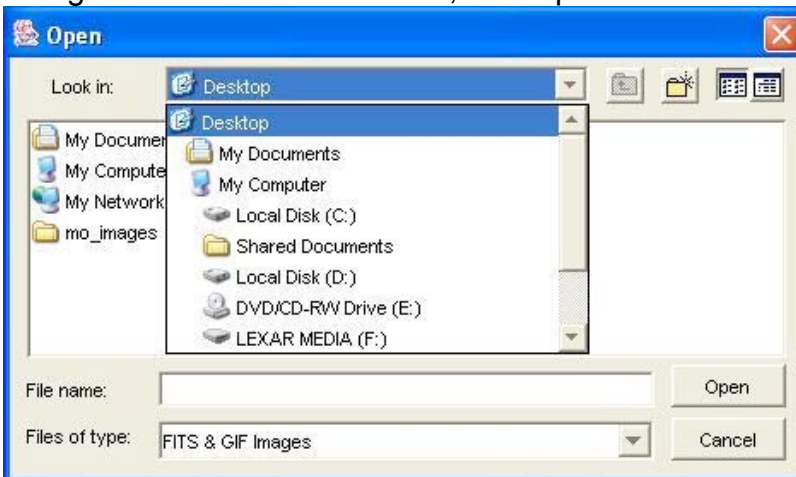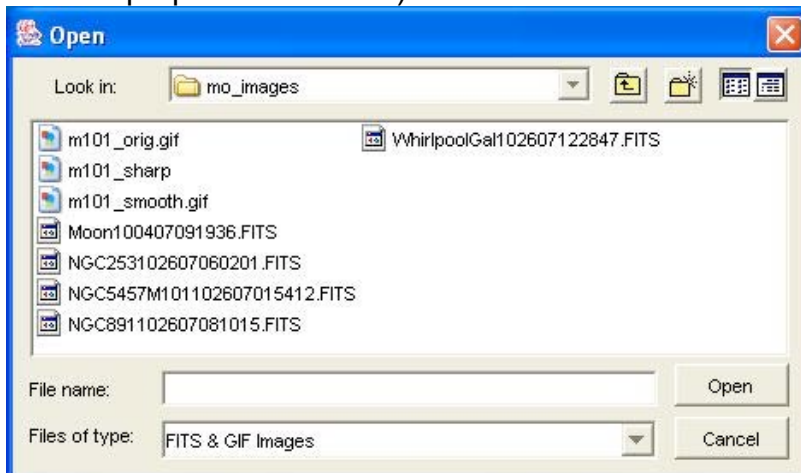
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Open:
- Click "File…Open Image on Local Disk…",

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- Navigate to desired file location, click open.

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 Default is to look ONLY for .fits and .gif extensions. You can change the bottom selector box to look for "All files" if you have FITS or GIF files without that extension, and MicroObservatory will still open them. (However, it's a better habit to save files with the proper extension…)
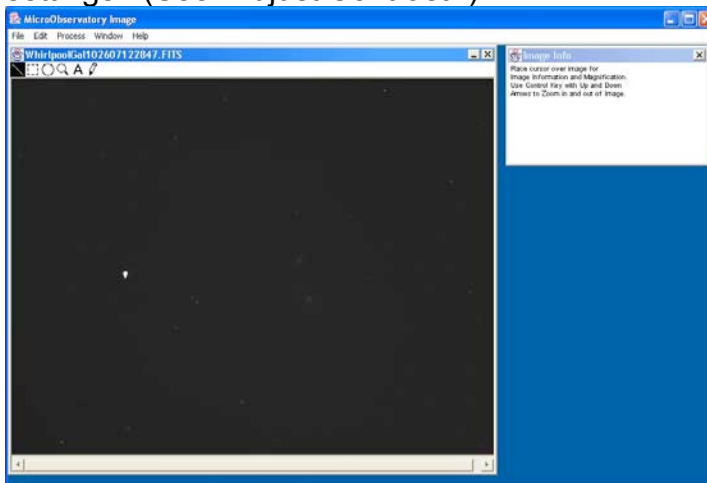
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- If names do not have this extension, select "Files of type: All files" in the bottom selector box.

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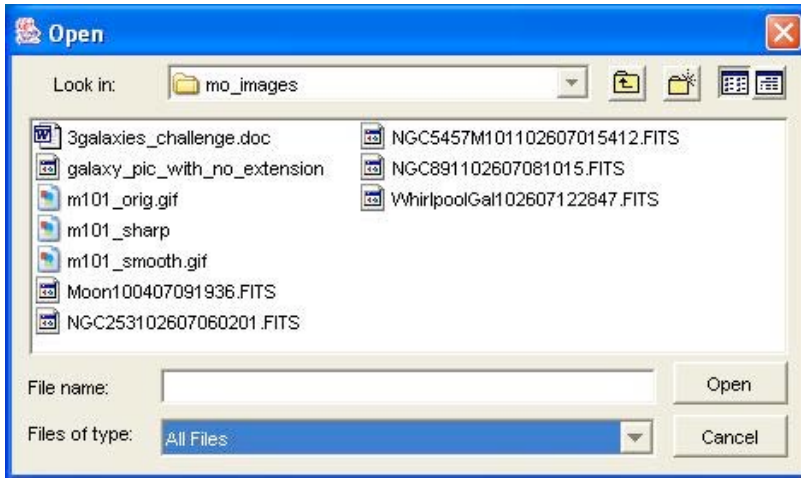
- A 'Drag and Drop' feature is available which allows you to drag an image, a file, or a URL address onto to an open MicroObservatory Image home window (the one with the blue background).
- Note: you will likely not see much detail in FITS images at the default contrast settings. (See "Adjust Contrast".)


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"Adjust Image" (changing contrast):

Rescales or remaps the brightness values of each picture element (pixel) of the image to a different scale of values

- Select "Process…Adjust Image…" from the menu bar.

- A new window pops up with the title 'Adjust Image'. At first the contrast (the range of brightness or "pixel value" we choose to display in an image) is set to show the WHOLE range of pixel values present in the image. (Which may mean that you're "wasting" viewing range on parts of the image that aren't important. In most cases, the image looks mostly dark.)

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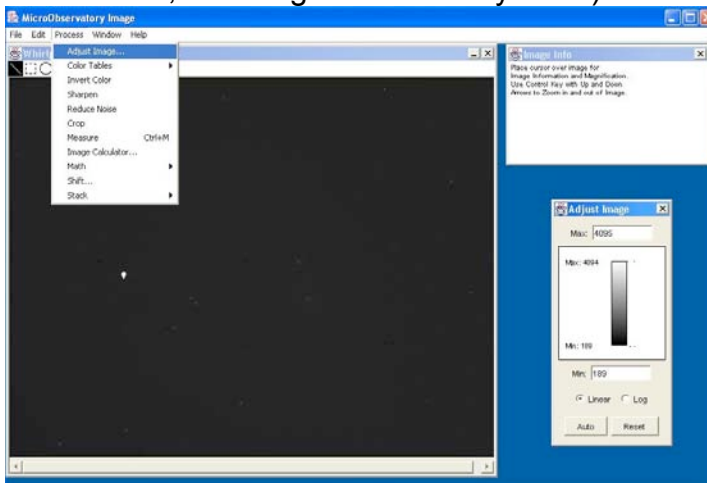
- You can change the contrast in 3 ways: click auto, click and drag arrows, or enter new values for min/max

  - Auto: this process examines the range of pixel values and sets the contrast range to something that allows you to see most of the important details.


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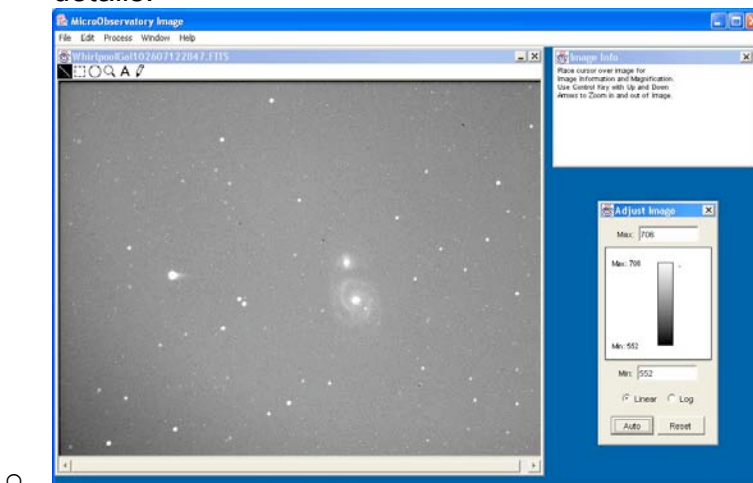
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- o Click and drag arrows to the right of the scale: You can shrink the range of pixel value to be displayed from the Min and max values. (These arrows are not easily visible on PC computers.)

- o
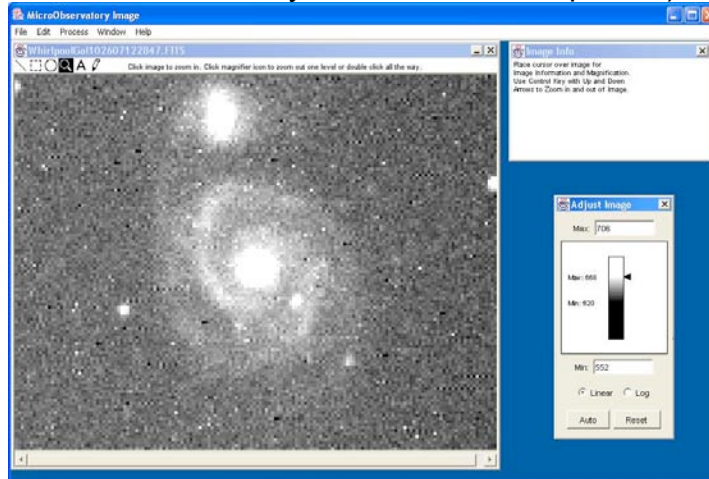
- o Enter new integer value for min/max: This allows you to shrink or expand the range of pixel values to be displayed. You must hit "Enter/Return" after typing in a new value for it to take effect.


- o
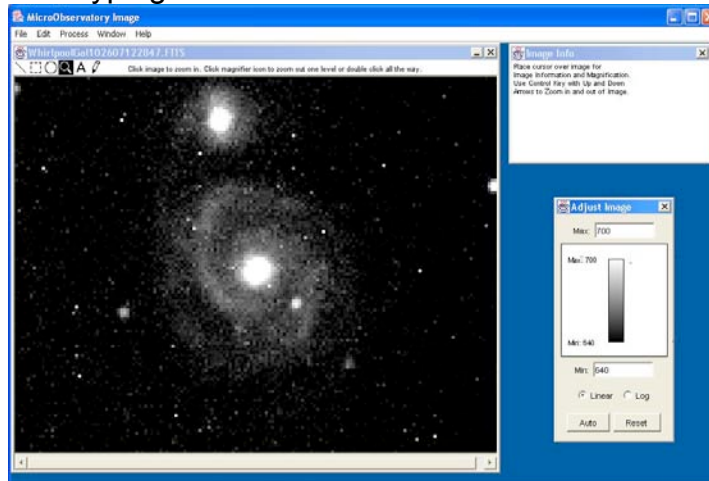
- • Log vs. Linear scale: the "Log" scale helps us to see differences across a wide range of brightness.
    - o Usually, very bright regions in an image change brightness a lot between pixels right next to each other. The logarithmic ("log") scale represents big differences of image brightness at the high end of the scale as smaller differences in displayed brightness. (Note in the image that a large difference in location along the bar at the top of the scale is not a big change in displayed brightness.)
    - o Usually, less bright regions change brightness only a little between pixels right next to each other. The logarithmic ("log") scale represents small

differences of image brightness at the low end of the scale as large differences in displayed brightness. (Note in the example image that a small difference in location along the bar at the bottom of the scale is a big change in displayed brightness.)
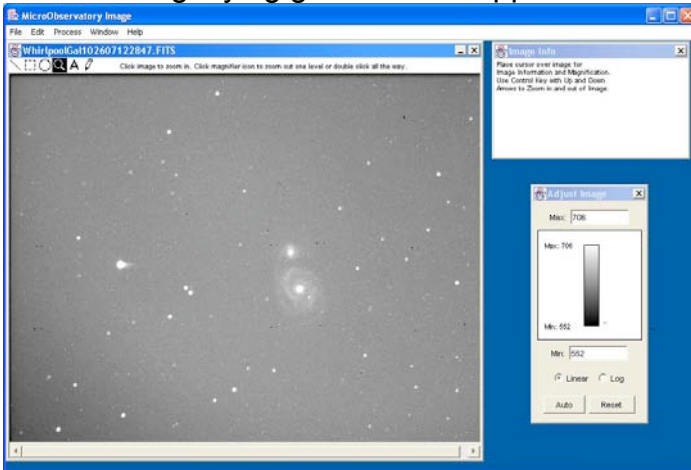
o   Thus, using the "log" scale, we can see details in the highest brightness parts of an image along with details in the lowest brightness parts of an image.
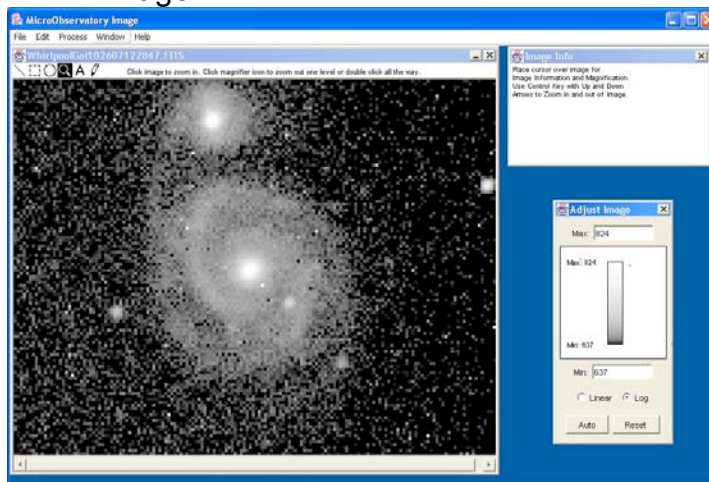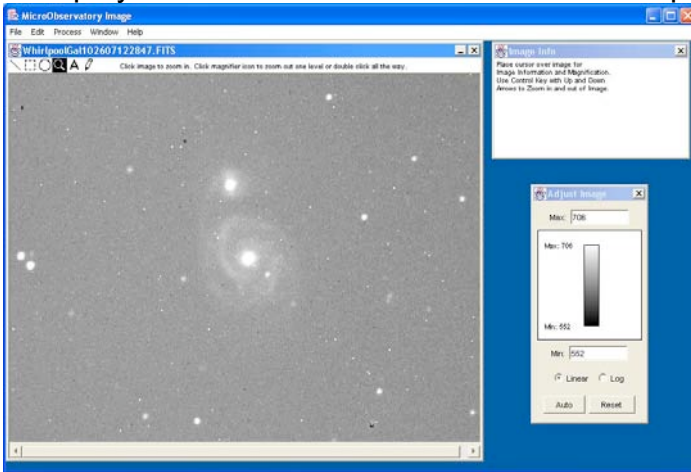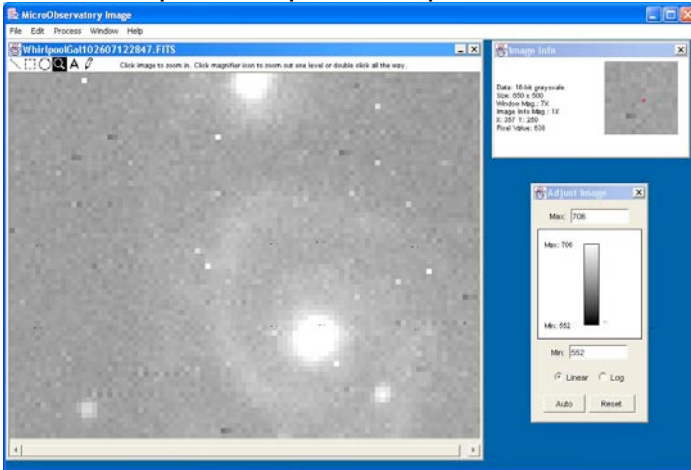
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Zoom:

- Click on magnifying glass icon in upper left corner of image window.

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- Click the mouse in location where you would like to zoom in. The image is redisplayed centered at that location with each pixel larger (i.e. zoomed)

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- You can repeat this process up to 15 times.

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- To zoom out: click magnifier icon to zoom out one level, or double click the icon to zoom out to entire image.
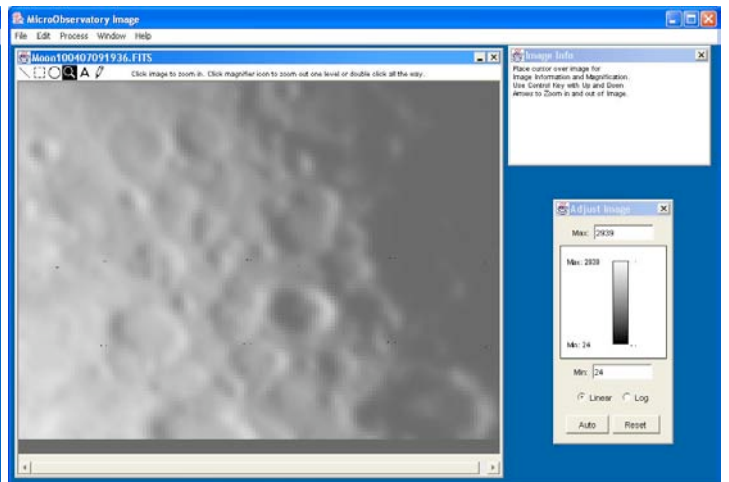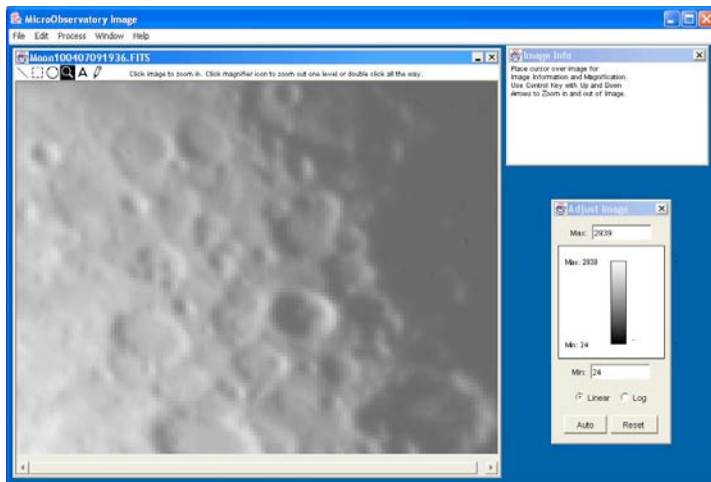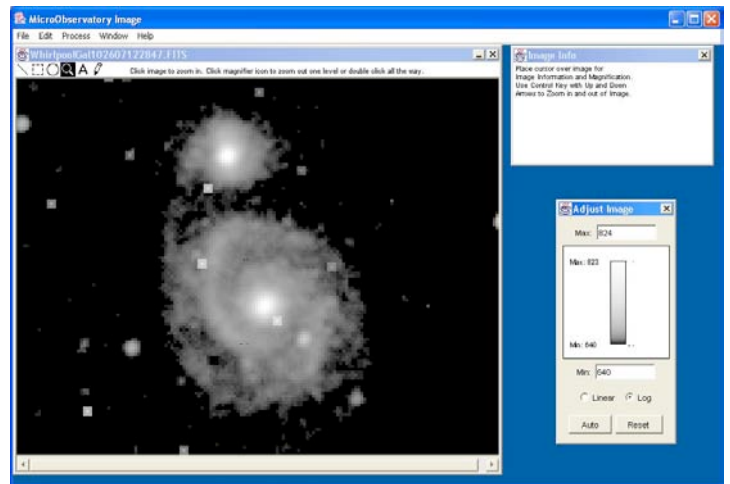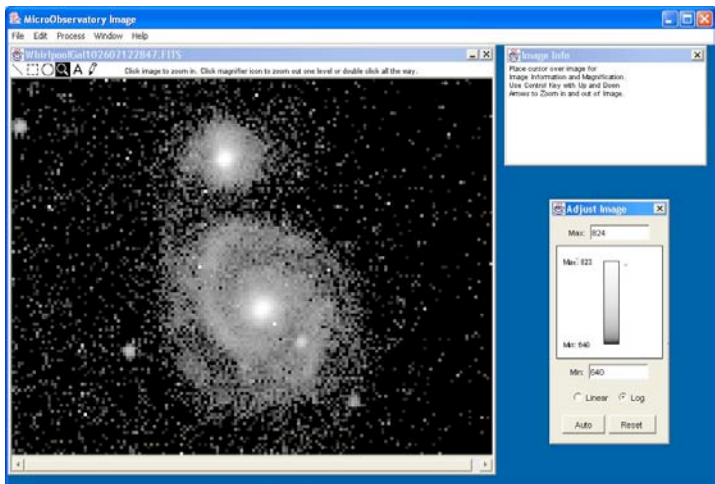
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Reduce Noise:
- Select "Process…Reduce Noise" from the menu bar.
- This tool averages a pixel's value with the surrounding pixels' values.
- The "reduce noise" tool actually **changes the image data** (i.e. changes the pixel values) unlike changing contrast, which does NOT change pixel values.
- This function reduces the noise viewed in an image but also reduces the detail or blurs the image.
- *How to "undo" reduce noise*: : Use "Edit…Undo" from the menu bar to reverse a "reduce noise" function. NOTE: You can only "Undo" the LAST action taken, so you cannot undo "reduce noise" if you've done another processing function after it. You must then open the image and start from scratch.
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BEFORE --→ AFTER

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Sharpen:

- Select "Process…Sharpen" from the menu bar.
- This tool emphasizes the edges between nearby regions of high and low brightness by changing the pixel values to increase the difference in brightness between a pixel and all the surrounding pixels.
- The sharpen tool actually **changes the image data** (i.e. changes the pixel values) unlike changing contrast, which does NOT change pixel values.
- This tool may show you more details, but also increases the noise in an image.
- *How to "undo" sharpen*: Use "Edit…Undo" from the menu bar to reverse a sharpen function. NOTE: You can only "Undo" the LAST action taken, so you cannot undo sharpen if you've done another processing function after it. You must then open the image and start from scratch.

BEFORE --→ AFTER
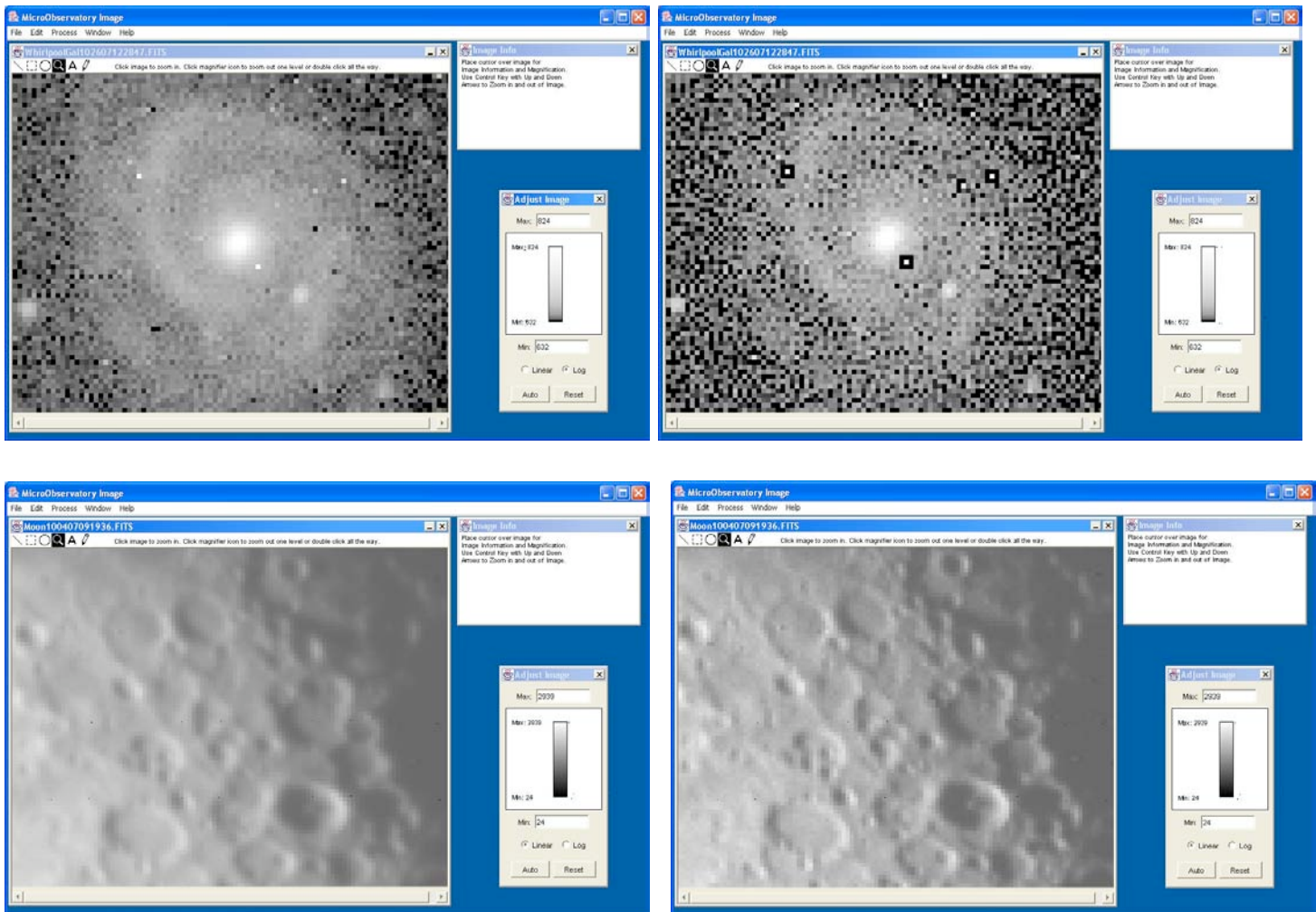
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Color Tables:

The image can be 'colorized', meaning that for each brightness level a specific color can be assigned to that value. The default 'color table' is a gray scale where the smallest value is black and the highest value is white, with intermediate values being darker shades of gray as pixel values increase.
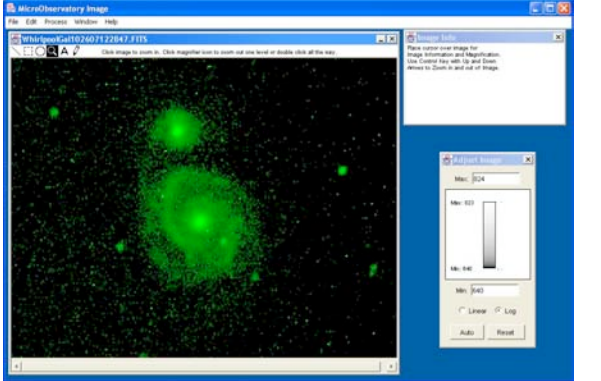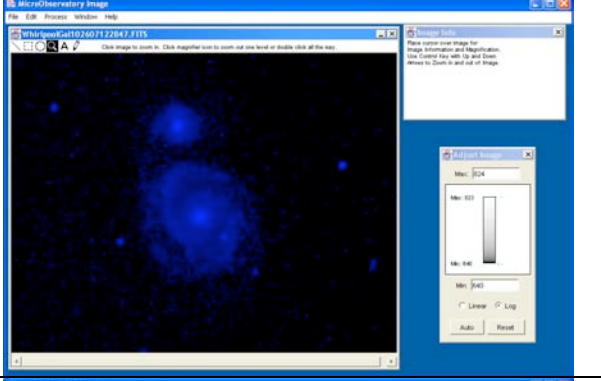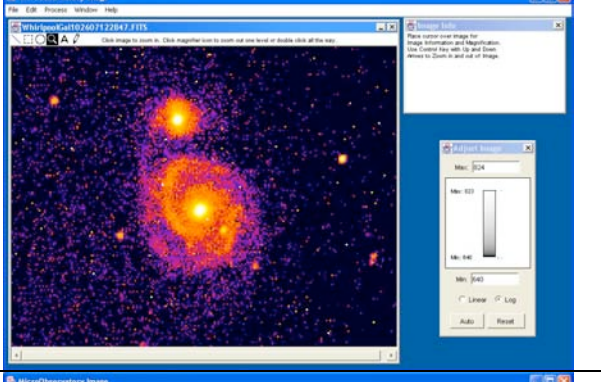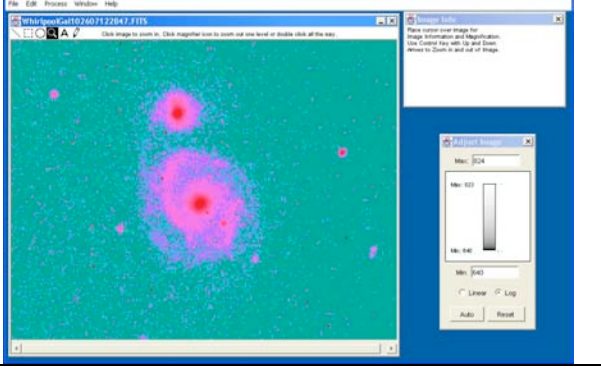
- Select "Process…Color Tables…Name of color table" in the menu bar.
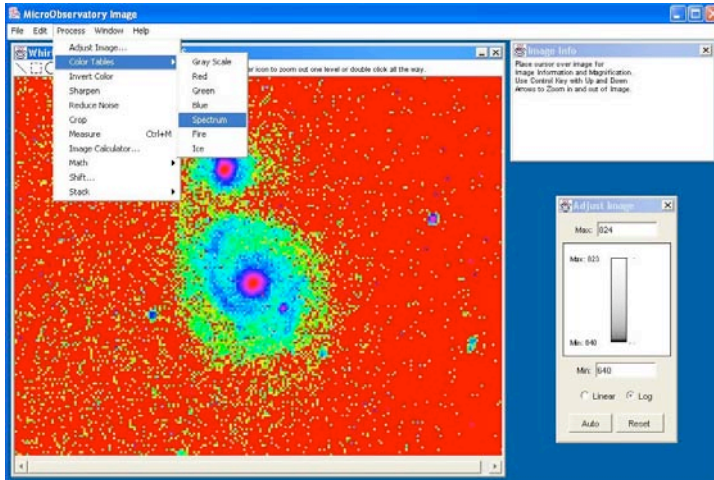
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- This example is "Spectrum." Other examples/choices are below.

Color table	Example
Gray Scale	
Red	

|	
Green	
Blue	
Fire	
Ice	

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Invert color:
- Select "Process…Invert Color" in the menu bar.
- For greyscale, and the red, green and blue color tables, this tool swaps the way the highest and lowest brightness pixels are displayed.
- For the spectrum, fire and ice color tables, this tool simply creates a different color table (i.e. the highest and lowest pixel values are NOT simply swapped.)

| Color table	Original	Invert Color
Gray Scale		
Red		
Spectrum		

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Crop:
- Choose box tool in upper left corner of image window.
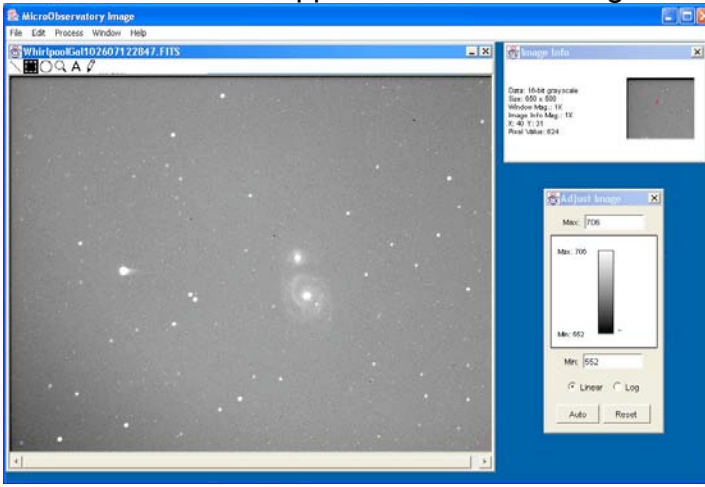
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- In the image, click and drag out the rectangle over the area you want to crop.
  - The box can be moved around the image by cliking and holding the cursor inside the shape, dragging, and then releasing the mouse.
 - Boxes cannot be resized—simply click and drag another box; the first box disappears.
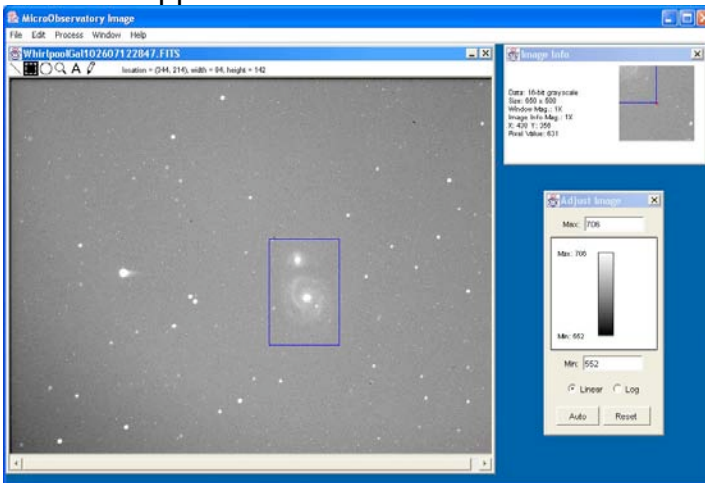
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- Select "Process…Crop" from the menu bar.

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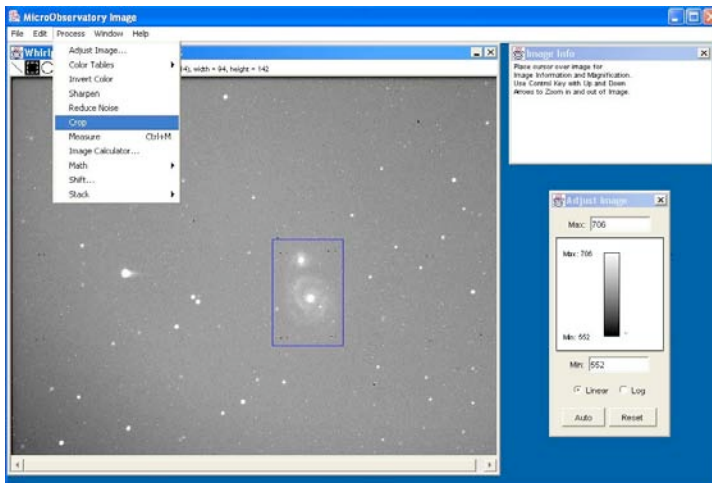
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- This process opens a new image window called "Untitled" with the cropped portion of the original image.
    - o Note: Cropping while zoomed works, but the cropped portion will show up as original size. Crop should be the last thing a student does just before saving the image.
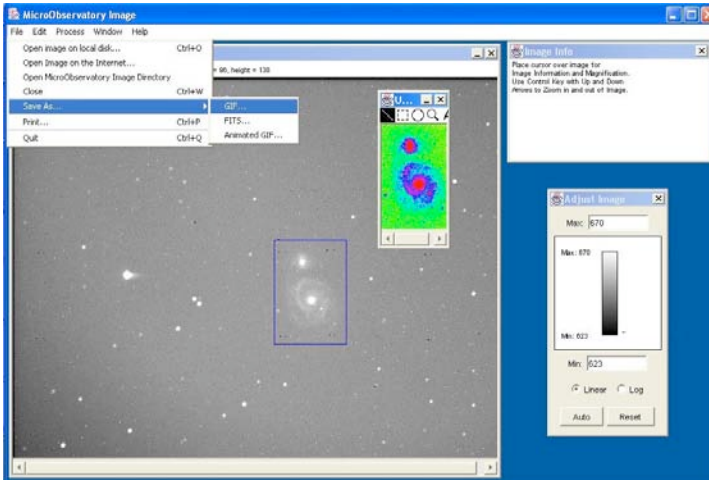


    - o
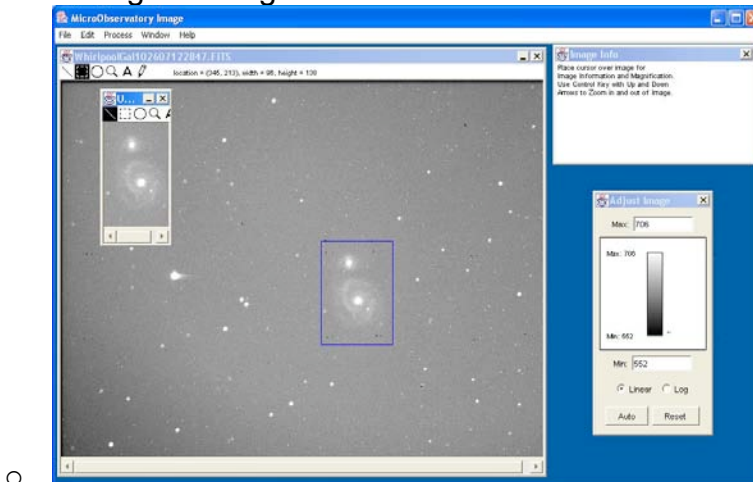
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Save:

- Once your image is in the processed form you want (including changed contrast, applied color tables and cropping), you should save the image as a .GIF file to save your processing. (Saving as .FITS will save the original image with no processing.)
- Highlight the image window you wish to save.
- Select "File…Save As…GIF…" from the menu bar.

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- Navigate to the folder where you put processed images, and name the file with an information-rich filename, **making sure to include the ".gif" extension!**
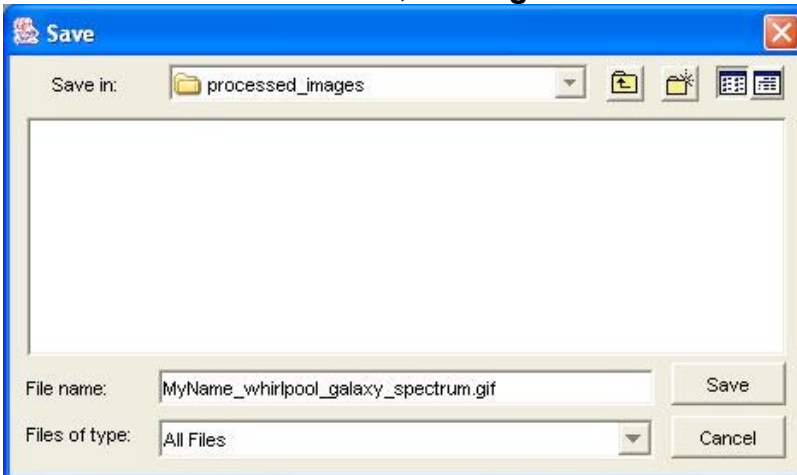
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- IMPORTANT NOTE: There may be a character limit to the length of the file name, so the basic information to include is the apprentices name and the name of the object in the image. Encourage students to avoid spaces in the titles, favoring the underscore character instead.