

ASTRO 1050

MicroObservatory RGB Image (if cloudy)

ABSTRACT

For this assignment, you will be using the MicroObservatory Robotic Telescope Network, run by the Harvard-Smithsonian Center for Astrophysics to take a real image of an object in the night sky. You will then use the MicroObservatory Image software (free download) to combine images from multiple filters into a single color image.

Step One If you are willing to participate in the surveys that will be part of some important astronomy education research, please first go to this link to electronically sign the consent form and to complete the short pre-activity survey. This is being done to improve the instruction in this class and others by determining how best to engage students in authentic astronomical observations. You will not be compensated for your participation nor will participation or non-participation in any way impact your course grade.

<http://www.surveymonkey.com/s/Q2GC98N>

Step Two Go to <http://mo-www.harvard.edu/OWN/training.html> and click “How to request an image” to watch a short, 1-minute video that will explain how to use the MicroObservatory.

Following those instructions, choose your target and request your images.

1. From the training page, click “Control Telescope”.
2. You will see a list of targets. Any object that is greyed out is not visible in the sky tonight. Choose one from the list in the table below, and click “Observe.” Feel free to also observe other objects, but for this activity, these are the objects that will allow you to create a multi-color image. The designation in parentheses is the objects Messier number, a catalog of beautiful deep-sky objects compiled by Charles Messier in 1771.

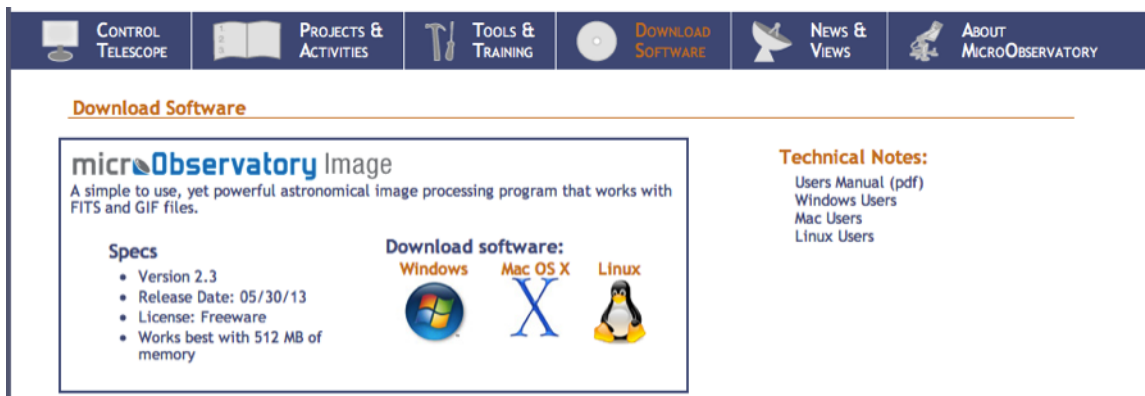
Andromeda Galaxy (M-31)
Orion Nebula (M-42)
Ring Nebula (M-57)
Dumbbell Nebula (M-27)
Trifid Nebula (M-20)
Lagoon Nebula (M-8)
Eagle Nebula (M-16)
Crab Nebula (M-1)
Messier 46 (M-46)

3. Select your Field of View (some objects will have a choice, others won't).
4. Select your Exposure Time (the website may suggest that your selection might result in an under- or over-exposed image...select accordingly).
5. Select "Multiple Filters." You want all three filters (red, green, and blue), so that you get three images that can be combined into a color image. If multiple filters aren't an option, choose a different image. I want you to have the experience of building a color image.
6. Click "Continue."
7. Enter your email address (your images will be emailed to you as soon as they're ready). Fill out the rest of the information if you wish, and click Submit.
8. A confirmation window will appear.

Note: Since our images won't arrive until tomorrow, we'll use the MicroObservatory database to make our color picture now. That way, if you'd like, you can make your own colored images on your own with your own pictures you took with the telescope later.

Step 3 In a new tab, open "Download Software", then download the windows version (if using the lab's computers).

1. Either on your Desktop or in your Downloads there should be a MicroObservatoryImage folder. Open the folder. Then click MicroObservatoryImage. This will open the software you need.
2. In the program, go to FILE→Open MicroObservatory Image Directory. It will open a new window with a list of objects.



3. This is where you will get your images. You need **THREE** images. One in the Red filter, one in the green filter, and one in the blue filter.

When you click...

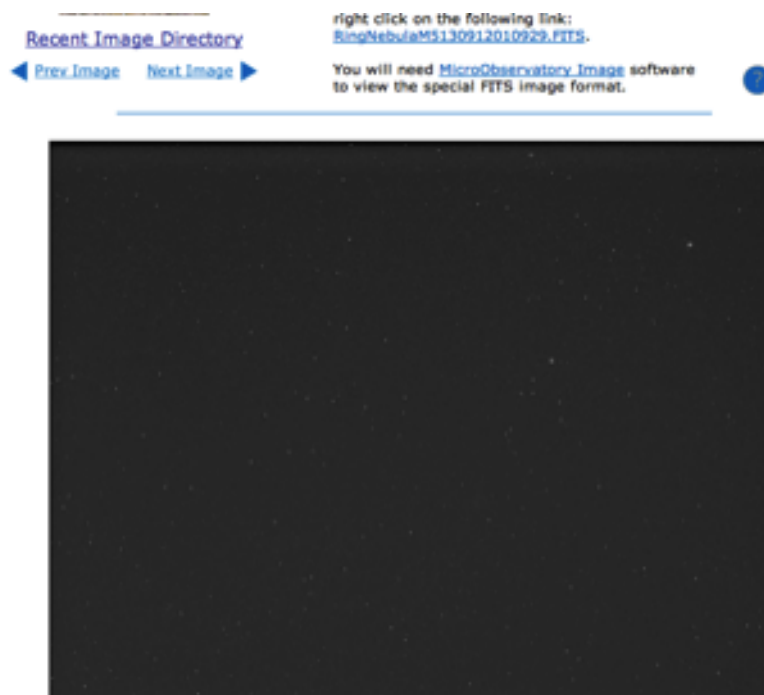
- (a) The filename: will show you a “raw” picture of what youre looking at.
 - i. If you want to download that image click “filename.FITS” at the top of the picture. Be sure to label your images clearly to include which filter the image was taken with. (i.e. filenameRED.fits)
- (b) The Info: Under “Camera” it will show you the type of filter used.
 - i. Look to the top of this page, make sure you check the weather!!!

Note: If you can figure out where the telescopes are located (Ben, Donald, or Ed) then you can use a weather website to figure out which nights are clear.

Most students have success with objects such as the Eagle Nebula, Orion Nebula, or the Dumbell Nebula.

Step 4

1. **Open your three images:** Launch the MOImage processing program on your computer. Open the image taken through the red- passing filter. Do the same for the images taken through the green- and blue-passing filters. You should have three images open.
2. **Adjust brightness and contrast:** Under the **Process** menu, select **Adjust Image**. When the Adjust Image window opens, select the **Log** button, and then click the **Auto**



button to get a good first look at the image. Then go back to the **Process** menu and select **Reduce Noise**. Do the same for the other two images: Hit the auto button to automatically adjust brightness and contrast.

3. **Color each image red, green or blue:** Work with the red-filtered image first. Under the **Process** menu, select **Color Tables**→ **Red**. Your image will turn red. Then work with the green-filtered image, selecting **Color Tables**→**Green** under the **Process** menu to turn the image green. Finally, color the blue-filtered image blue by selecting **Process** → **Color Tables** → **Blue**.

***Whats going on?** The areas in the original scene that had a lot of red became the brightest areas in the red-filtered image. In turn, these bright areas in the red-filtered image will become the reddest areas in the final image. The same holds for the green- and blue-filtered images.*

4. **Stack the images.** Under the **Process** menu, select **Stack** → **Convert Images to Stack**. You can flip through these images if you like, to see them individually.
5. **Align the images:** Your three images will probably be out of alignment. Youll need to align, or “shift” the images so that when you combine them the result wont be

blurred. Under the **Process** menu, select **Shift**. As prompted, select the green image (its easiest to see) as the **background** image over which you'll shift (i.e. align) the other two images. Then in the **Foreground** dropdown menu, select either the red or blue image to shift. (You should see the background image through the slightly transparent foreground image.) Find patterns to match up (use groupings of bright stars that are easy to see, for example). Using the mouse keys and the i,j,k,l keys as prompted, align the two images and then hit the Okay button. Align the third image in the same way and hit **Okay**.

6. **Create the final color image.** Under the **Process** menu, select **Stack→Convert Stack to RGB**. The program now merges the three red, green, and blue images to create the final image. Congratulations!
7. **Save the final image.** Go to **File → Save As...** and choose **Save as GIF**. Make sure you save your final image and label the filename clearly with .GIF as the file extension.

Step 5 Now that you have your own color image that you've created, click on the appropriate link below to download a professional image of the same object.

Step 6 Email your GIF and an “internet-searched version” of your object to your lab TA.

Step 7 Finally, please go to this link to complete the post-activity survey. Thanks so much for contributing to astronomy education research!

<http://www.surveymonkey.com/s/QCMN7QK>