Capture the Colorful Cosmos

Processing Challenges

The activities and challenges below are designed to help you become comfortable using the image processing tools in the MicroObservatoryImage program to bring out detail in your images.

Use the stock images in the FITSImages zip file to download the source images.
Then, try these challenges using your OWN images!

1. Tower Activities – familiarize yourself with the basics of the image processing program as you compare an image taken with a MicroObservatory telescope to an image of the same object taken with a digital camera from the same location. In these activities, you will learn how to **Open** an image, explore the **Pixel Value**, change the **Color Table** or **Invert Color**, and **Save** your final image.

2. Tower Challenges – learn how to **Open** a FITS image, **Adjust** the contrast, and **Save** your image as a .GIF file

3. Moon Challenges – learn how to **Sharpen** your image, **Zoom** in to see more detail, and **Crop** an image to your desired size

4. Orion Nebula Challenges – learn how to use the **Auto** and **Log** buttons to further **Adjust** the contrast in your image

5. Star Cluster Challenge – review the tools from previous challenges

6. Galaxy Challenge – learn how to **Reduce Noise** in your image

7. RGB Challenges – learn how to create "true color" images by **Stacking** images taken with red, green, and blue color filters and **Converting the stack to RGB**. The second RGB challenge also uses the **Shift** tool.

Each set of challenges builds on the skills learned in the previous set.

The pages that follow provide "answers" to the challenges described above. **Do not read the rest of this document until you have attempted the challenges yourself.**
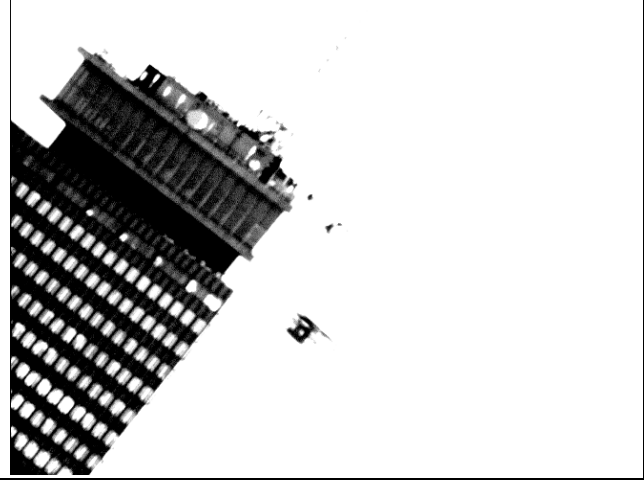
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Tower Challenge 1: Increase the contrast between the windows on the left side of the building and the building itself.

SOURCE IMAGE: TowerChallenge.FITS

FINAL IMAGE: Tower1.GIF

How to get from this…	…to this

1. Go to File > Open image on local disk… and select TowerChallenge.FITS from the appropriate location on your computer

2. Go to Window > Image Info

3. Go to Process > Adjust Image…

4. Click on image window and observe the pixel value of the building's windows (left side) in the "Image Info" window

5. Enter approximate pixel value of building windows into "Max" field of "Adjust Image" window (~300)

6. Determine approximate pixel value of the building surrounding the windows and enter value into "Min" field of "Adjust Image" window (~275)

7. Save image as GIF (File > Save As… > GIF…)

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Tower Challenge 2: Make the name of the building appear white with a black background.

SOURCE IMAGE: TowerChallenge.FITS

FINAL IMAGE: Tower2.GIF

How to get from this…	…to this

1. Go to File > Open image on local disk… and select TowerChallenge.FITS from the appropriate location on your computer

2. Go to Window > Image Info

3. Go to Process > Adjust Image…

4. Set "Max" value to match approximate pixel value of the letters in the word "PRUDENTIAL" (~500)

5. Set "Min" value to match approximate pixel value of the building *around* the word "PRUDENTIAL" (~350)

6. Apply a new color table and/or Invert Color if desired

7. Save image with a unique, descriptive name (don't forget .GIF at the end!)

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Moon Challenge 1: Get a better, more detailed view of a chosen crater on the surface of the Moon

      SOURCE IMAGE: MoonChallenge.FITS
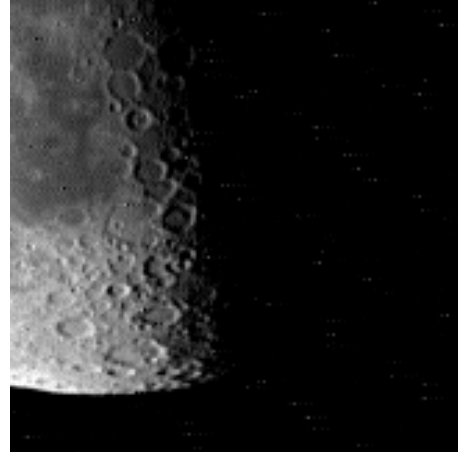
      FINAL IMAGE: Moon1.GIF

How to get from this…	…to this

1. Open image MoonChallenge.FITS

2. Click "Process" > "Sharpen"

3. Click on the 'zoom' tool (magnifying glass)

4. Click on the crater to be observed (middle of image)

5. Adjust the contrast on the image in the by moving the triangles in the "Adjust Image" window

6. Change the color table and/or Invert Color if desired

7. Click on the 'select area' tool (dotted rectangle)

8. Select the area to be cropped

9. Click "Process" > "Crop"

10. Save the new image as a GIF with a descriptive name

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Moon Challenge 2: Create a sharp, detailed view of the craters at the bottom of the Moon

SOURCE IMAGE: MoonChallenge.FITS

FINAL IMAGE: Moon2.GIF

How to get from this…	…to this

1. Go to File > Open Image

2. Open image MoonChallenge.FITS

3. Go to Process > Sharpen

4. Zoom in on the chosen area

5. Adjust the contrast of the image by moving the triangles in the "Adjust Image" window and/or setting the "Min" and "Max" values to match the pixel values of the background (~280) and bright spots on the surface (~550)

6. (Optional) Change the color table and/or Invert Color if desired

7. Select and crop the chosen area of the image

8. Save image with a unique, descriptive name (don't forget .GIF at the end!)

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Nebula Challenge 1: See more detail in the star-forming nebula

SOURCE IMAGE: NebulaChallenge.FITS

FINAL IMAGE: Nebula1.GIF

How to get from this…	…to this

1. Open image NebulaChallenge.FITS

2. Open the "Image Info" and "Adjust Image" windows

3. Click the "Auto" button in the "Adjust Image" window

4. Set the "Min" field to the approximate pixel value of the background (~289)

5. (Optional) Change the color table and/or Invert Color if desired

6. Crop and save image as a GIF with a descriptive name

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Nebula Challenge 2: See the full extent of the cloud and as many details as possible in the center of the nebula where stars are forming

SOURCE IMAGE: NebulaChallenge.FITS
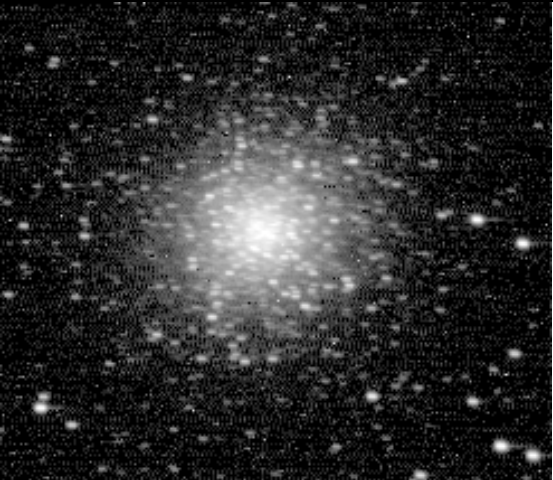
FINAL IMAGE: Nebula2.GIF

How to get from this…	…to this

1. Open image NebulaChallenge.FITS

2. Open the "Image Info" and "Adjust Image" windows

3. Choose "Log" and click the "Auto" button in the "Adjust Image" window

4. Zoom in on the center to see more detail

5. Set "Max" field to the highest pixel value in the image (~4000, at the heart of the nebula)

6. (Optional) Change the color table and/or Invert Color if desired

7. Crop and save the image as a GIF with a descriptive name

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Star Cluster Challenge: Make visible as many stars as possible in the Hercules star cluster

SOURCE IMAGE: StarClusterChallenge.FITS

FINAL IMAGE: StarCluster1.GIF

How to get from this…	…to this

1. Open StarClusterChallenge.FITS and the "Image Info" and "Adjust Image" windows

2. Click the "Auto" button in the "Adjust Image" window

3. Set the "Min" field to the approximate pixel value of the background (~295)

4. Click the "Log" in "Adjust Image" window

5. Set "Max" field to the highest pixel value in the image (~950, at the center of the cluster)

6. Apply color tables/invert color if desired

7. Crop and save the image as a GIF with a descriptive name

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Galaxy Challenge: To create a clear, detailed image of another galaxy outside of the Milky Way

   SOURCE IMAGE: GalaxyChallenge.FITS

   FINAL IMAGE: Galaxy1.GIF

How to get from this…	…to this

1. Open image GalaxyChallenge.FITS

2. Open the "Image Info" and "Adjust Image" windows

3. Choose "Log" and click the "Auto" button in the "Adjust Image" window

4. Adjust the "Max" value by moving the upper triangle in the "Adjust Image" window

5. Click on "Process" > "Reduce Noise"

6. (Optional) Change the color table and/or invert color if desired

7. Zoom in, crop, and save the image as a GIF with a unique, descriptive name

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RGB Challenge 1: To create a "true color" image of a sunflower, using three pre-aligned images taken with different color filters

      3 SOURCE IMAGES: flowerR.gif, flowerG.gif, flowerB.gif

FINAL IMAGE: FlowerRGB.GIF

1. Open the MicroObservatoryImage program

2. Open the three images: flowerR.gif, flowerG.gif, flowerB.gif

3. Apply the Red color table to flowerR.gif

4. Apply the Green color table to flowerG.gif

5. Apply the Blue color table to flowerB.gif

6. Go to Process > Stack > Convert Images to Stack

7. Go to Process > Stack > Convert Stack to RGB

These particular images are pre-aligned; that is, you do not need to use the "Shift" tool to make sure they are lined up before you convert them to a Stack. The next challenge (RGB Challenge 2) does require the use of the "Shift tool, as will any RGB exercise you do with your own telescope images.
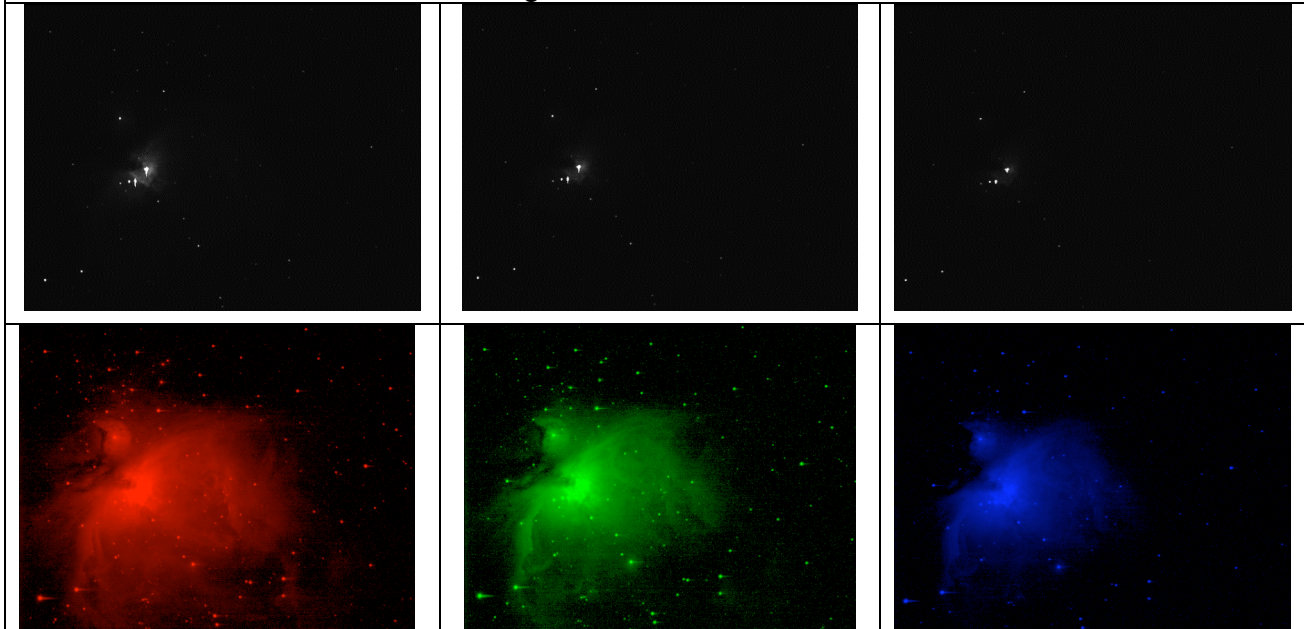
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RGB Challenge 2: To create a "true color" image of the Orion Nebula

3 SOURCE IMAGES: OrionNebRed.FITS, OrionNebGreen.FITS, OrionNebBlue.FITS
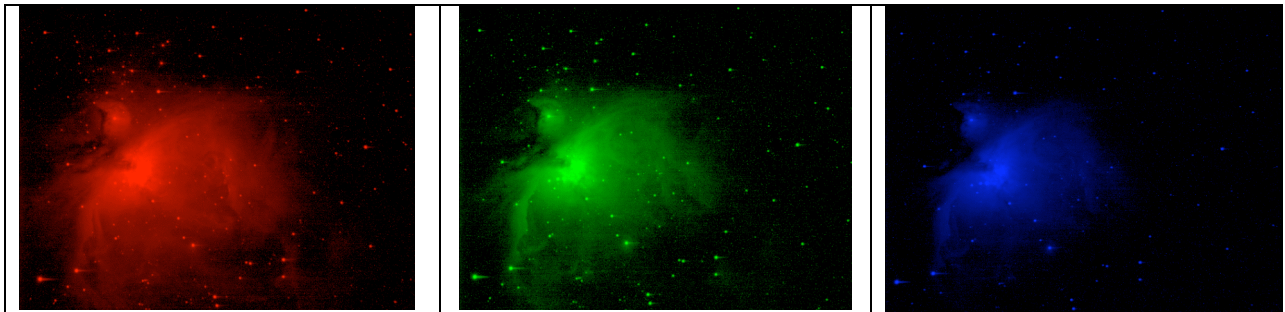
FINAL IMAGE: OrionNebRGB.GIF

Process each of the three color images.

1. Open the three FITS images in the RGB challenge folder

2. Open the "Image Info" and "Adjust Image" windows

3. For each of the three images, click "Log" and then "Auto" in the "Adjust Image" window

4. (Optional) If desired, process the images further using the "Adjust Image…" or "Reduce Noise" tools (the example image has no further processing)

5. Change the color table of OrionNebRed.FITS to "Red"

6. Change the color table of OrionNebGreen.FITS to "Green"

7. Change the color table of OrionNebBlue.FITS to "Blue"

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8. Go to Process > Shift…

9. In the "Shift" window that opens automatically, selectone of the images from the pulldown menu next to "Background" (it does not matter which)

10. One at a time, select the remaining images from the pull down menu next to "Foreground"

11. For each of these two foreground images, use the mouse or the "I" "k" "j" and "l" keys to move the image so the stars (dots) in the foreground image line up with the same stars in the background image

12. After aligning both foreground images to the background image, click OK

13. Go to Process > Stack > Convert Images to Stack

14. Double check that the images are properly aligned by flipping through the stack, using the arrows at the bottom of the Stack screen

15. Go to Process > Stack > Convert Stack to RGB