

<p>Imaging a cluster Earth & Sky</p>

Name: _____

Introduction

When astronomers look at the distribution of stars, they find some appear in clusters. These clusters are gravitationally bound groups of stars, not just patterns that appear on the sky (such as constellations). There are two main types of clusters: open and globular. In general, open clusters have up to thousands of stars and are relatively young, while globular clusters have up to hundreds of thousands of stars and are relatively old. In this activity you will take color images of an open cluster. These images will be used in a later activity to create a Hertzsprung-Russell diagram.

Pre-test

1. Are all the stars in a cluster the same color?

Eyepiece observation

The open cluster you will be imaging is M103 (NGC 581), which is located in Cassiopeia.

Get the telescope and camera ready for observing (as in previous labs). Since you will be taking longer exposures, the CCD temperature should be set to -5°C or below. This will minimize the dark current. Find M103 in ACE's Messier catalogue and move the telescope to it. Once you're there, take a look through the eyepiece. (Make sure the focus is at the eyepiece setting.) You'll probably want to use the hand paddle to center the cluster. Also, remember to try using averted vision (looking out of the corner of your eye).

1. Draw a sketch of what you see in the eyepiece. Be sure to note any colors you see.

Imaging

Once you're done with eyepiece observations, slide the mirror to the camera position and move to the warm room. First, change the focus to the CCD setting. Then, use the controls in the ACE **Observations** window to take a 10 second unfiltered image. Once the image has downloaded, use the **Process > Calibrate** command to clean up the image. (Remember to also adjust the **Screen Stretch** settings.) Then use the **Center CCD** window in ACE to center the cluster, and take another 10 second image. The cluster is actually bigger than the CCD field of view, so try to get a final image that looks like Figure 1.

2. Draw a sketch of what the cluster looks like on the screen:

Once the cluster is properly centered, change to the red filter in the **Expose** tab of the **MaxIm CCD** window. From this window take a 1 minute exposure. Once the image is downloaded, be sure to save it with a recognizable filename (e.g., **m103-r.FITS**). Repeat this procedure for the green and blue filters.

Since you will be making measurements from these images in a future activity, be sure you have good images in each filter before you move on.

Color processing

When you have a good image through each filter, open them all in MaxIm DL and use **Process > Calibrate All**. Then use **Color > Color Combine** to make a color image the same way you made a color image of the Ring Nebula (see the instructions from that activity). Note that a two-star align will probably serve you best here. Once you have a color image, save it and use **Screen Stretch** to bring out more detail.

3. How does the color image compare to what you saw in the eyepiece?

Post-test

1. Are all the stars in a cluster the same color?

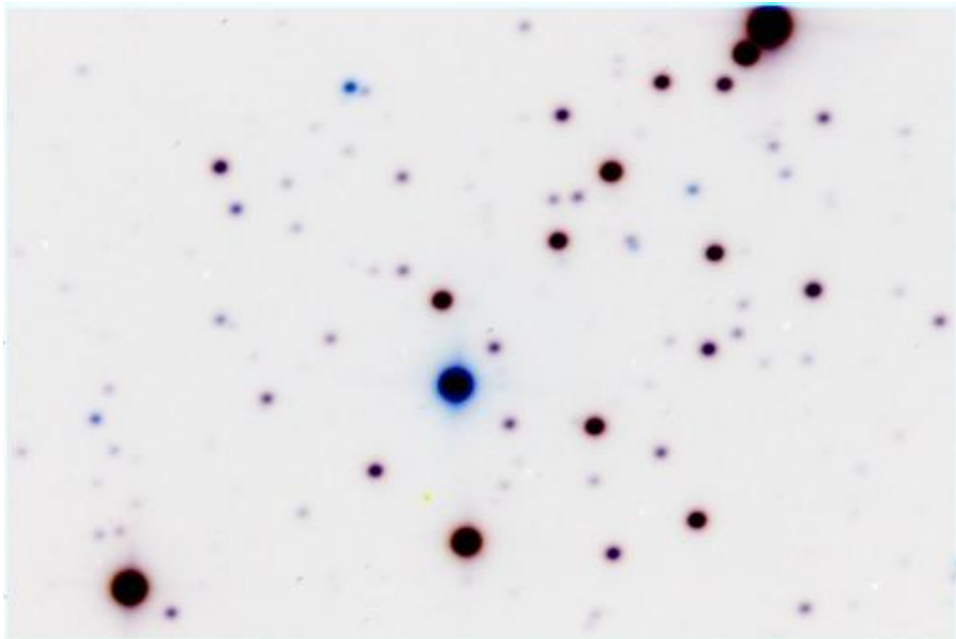


Figure 1: The center of the open cluster Messier 103.