You may recall from the previous labs that stars have distinct colors. We are now going to demonstrate that galaxies also have different colors. You can measure color quantitatively by measuring how much light you receive from the galaxy when viewed through two colored filters: here red and blue. For this analysis we will examine the elliptical galaxy NGC 2768 and the irregular galaxy NGC 4449. The tool we will use for this analysis is labeled js9 below. Click on "Start js9" to open up js9 on the internet, and use the following recipe to determine the colors of the two galaxies.

1. Click on “File” and choose “Open local file…”

2. Append one of the filenames below

n4449r.fit if you want the red-filter image of NGC 4449.

n4449b.fit if you want the blue-filter image of NGC 4449.

n2768r.fit if you want the red-filter image of NGC 4449.

n2768r.fit if you want the red-filter image of NGC 4449.

3. Once you have loaded an image, use the mouse with the left button held down to change the brightness and contrast of the image. You should see that in some cases the faintest light from the galaxy nearly fills up the whole image.

4. We want to determine how much light is coming from each galaxy in each filter, but we have to account for the fact that the night sky contributes a uniform, faint light to each image. So first, click on Region, choose Box, and a box will appear on the center of the image. You can drag the box around with the mouse’s left button and change the size by dragging on the small rectangles along the edge of the box. Make the box big enough to cover all the light from the galaxy. The third and fourth numbers on the line starting “physical; box“ give the current size of the box. Note this down. Now click on Analysis and choose Histogram. This will display the mean brightness in the galaxy, in units we’ll call “counts”.

5. Now choose a box far enough from the galaxy that it has only dark sky brightness in it (this may be only the very corners). Repeat the above procedure to find the mean brightness from the sky in the box.

6. Since the sky is about uniformly bright, we can now subtract our mean sky brightness from our mean galaxy brightness to remove the sky background and get the net mean brightness from the galaxy. Take the result and multiply it by the area of your galaxy box to give you the total brightness of the galaxy for this filter.

7. Repeat the above for the other galaxies and filters.

8. Determine the color ratio of each galaxy by dividing the net brightness in the red filter by the net brightness in the blue filter: i.e. color ratio = net (red) / net (blue). This is a measure of the color of the galaxy.