

**NITARP Workshop: Astronomical Imaging**

January 5, 2014  
*prepared by*  
Varoujan Gorjian  
NITARP Scientist



**Images in talks and posters**

- Many posters and talks will have astronomical images
- Some will be in color and some will be in black and white
- This is what you should know about those images:

VG



## What is an image?



- There is nothing unique about an astronomical image
- All images on film or on an electronic detector are a recording of different brightnesses of light
- There is/has never been a color photograph. All present color images, whether taken by your digital camera or from Hubble, are a combination of several black and white images.
- So what is a black and white image?

VG

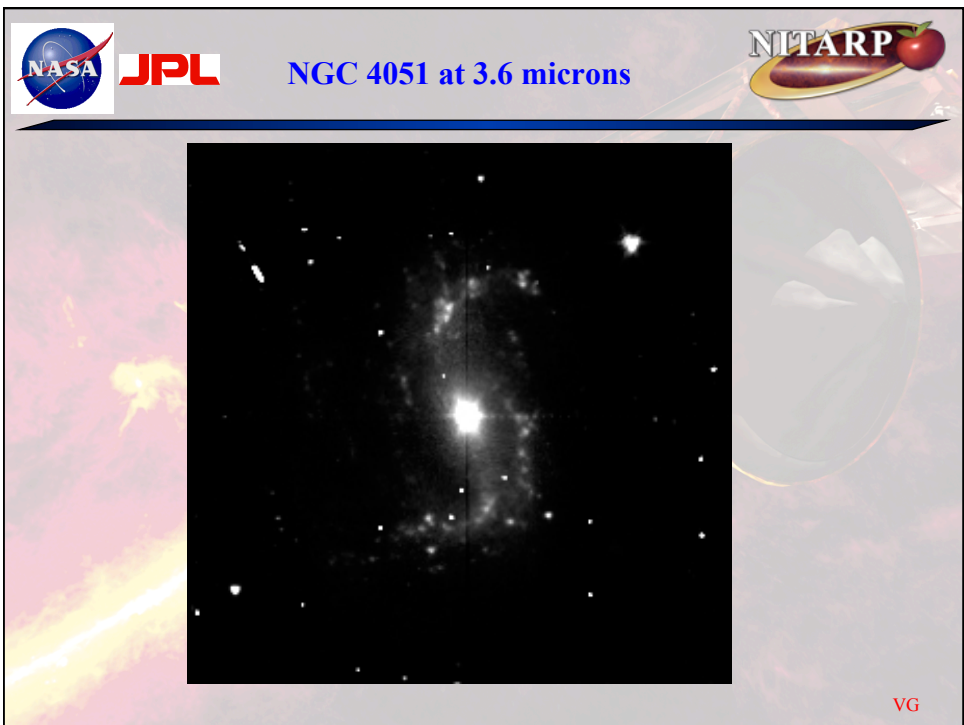
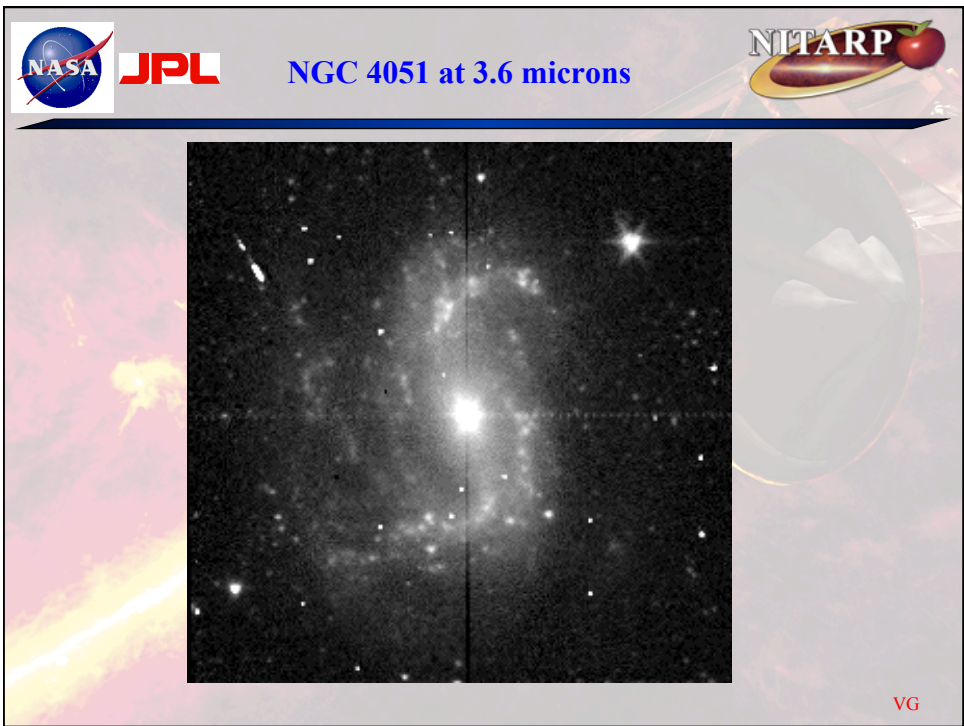


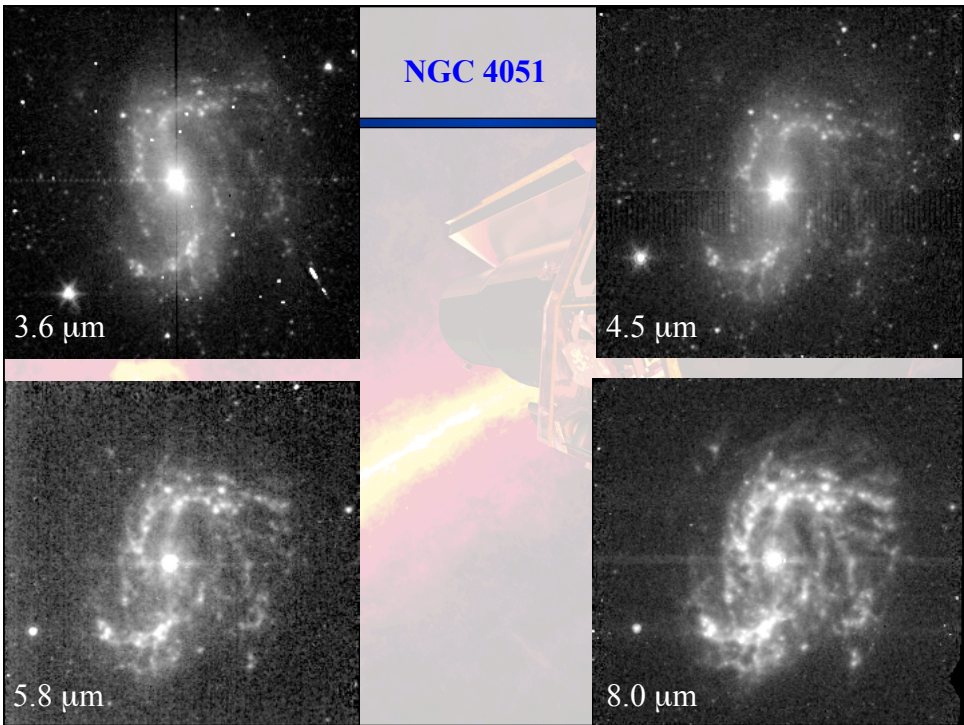
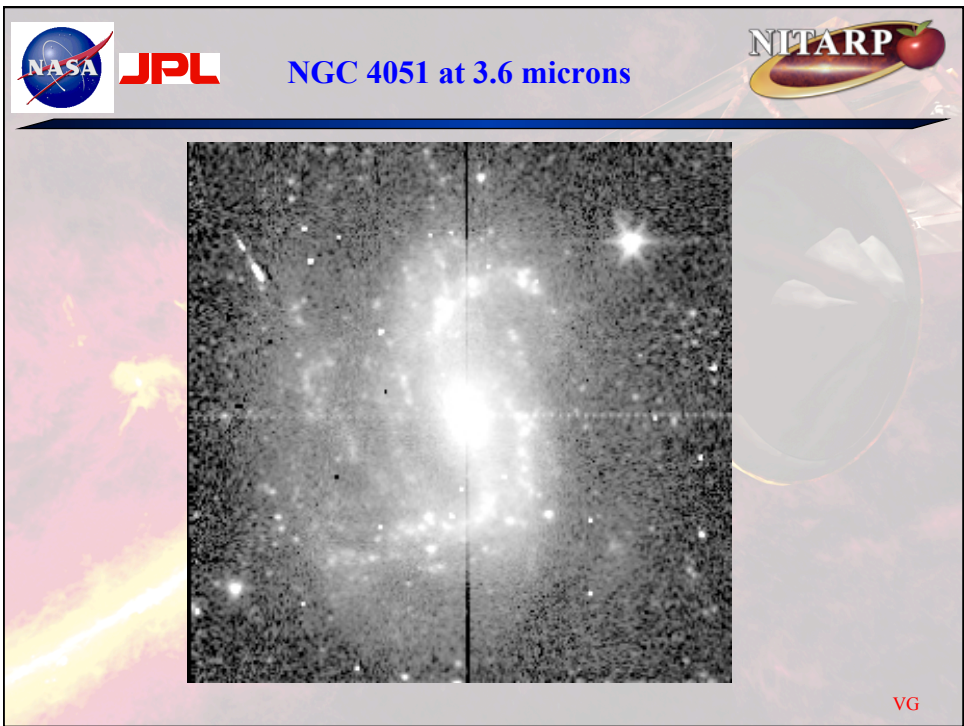
## What is a Black and White Image?



1.0	1.3	1.2	1.2	0.9
0.8	4.3	4.0	3.8	0.7
1.1	3.7	6	4.1	1.5
0.9	4.2	4.3	3.9	1.0
1.2	1.4	1.1	0.8	1.3

VG





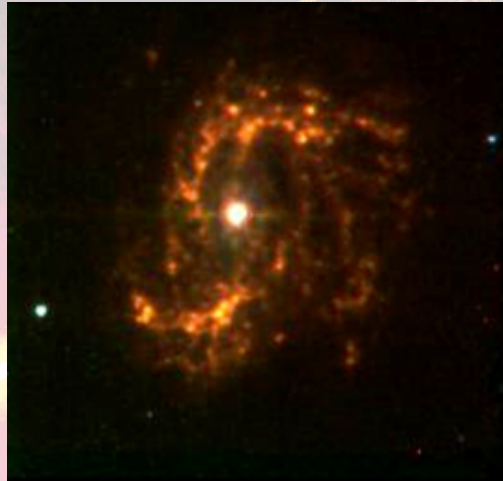


JPL

### NGC 4051 in Combined IR Colors



This is often called a “false color” image. But there is nothing false about it. It is simply an image that is representing the IR colors with optical ones. So it is a representative color image.



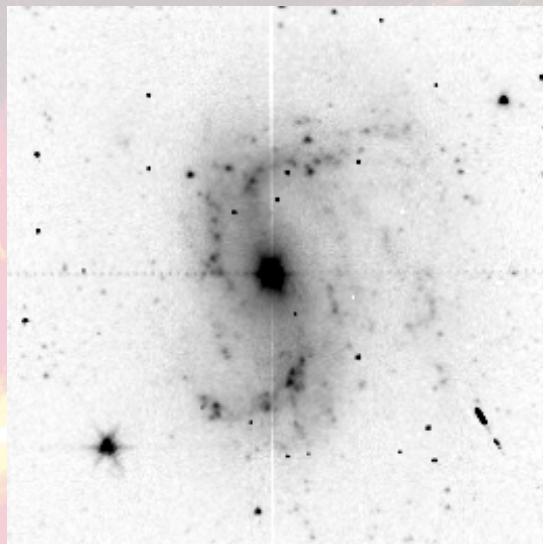
Blue=3.6 $\mu$ m  
Green=4.5 $\mu$ m  
Red=8.0 $\mu$ m

VG



JPL

### NGC 4051 at 3.6 microns



VG



JPL

## Photometry



- So how do we get information from these images?
- Since the electronic detectors ultimately record the amount of light as numbers, the process to measure that amount of light is just a matter of adding numbers.

VG



JPL

## Photometry



1.0	1.3	1.2	1.2	0.9
0.8	4.3	4.0	3.8	0.7
1.1	3.7	6	4.1	1.5
0.9	4.2	4.3	3.9	1.0
1.2	1.4	1.1	0.8	1.3

**So what is the brightness of the central pixel in this image?**

VG



### Photometry



1.0	1.3	1.2	1.2	0.9
0.8	4.3	4.0	3.8	0.7
1.1	3.7	6	4.1	1.5
0.9	4.2	4.3	3.9	1.0
1.2	1.4	1.1	0.8	1.3

**Well the amount of light recorded made for 6 units. But is that an actual physical measurement?**

VG



### Photometry



1.0	1.3	1.2	1.2	0.9
0.8	4.3	4.0	3.8	0.7
1.1	3.7	6	4.1	1.5
0.9	4.2	4.3	3.9	1.0
1.2	1.4	1.1	0.8	1.3

**Well the amount of light recorded made for 6 units. But is that an actual physical measurement? NO!**

VG

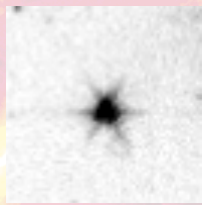


JPL

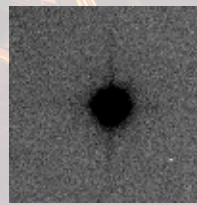
## Point Spread Functions



- Any optical system has a finite limit to how small an image it can generate. That is how the optics and the atmosphere spread out the light from a point hence the name Point Spread Function or PSF.



Spitzer PSF



Typical Ground Based PSF

VG

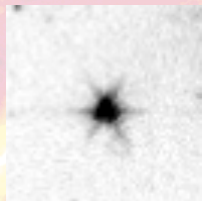


JPL

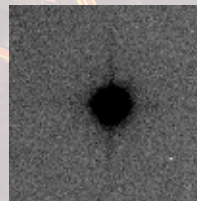
## Noise and Background



- Also any image is the sum of the light from what you are imaging combined with noise from your detectors as well as light which is not from your object: sky, telescope, etc.



Spitzer PSF



Typical Ground Based PSF

VG





## An aside on Images in talks and posters



- Many posters and talks will have astronomical images
- Some will be in color and some will be in black and white
  
- Now you have a sense of what astronomical images are in posters and in talks that you will see during the conference

VG



End



VG