NITARP Workshop

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prepared by

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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?**

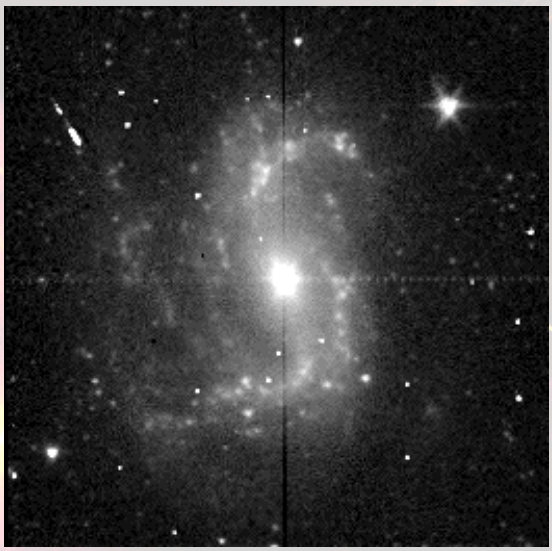
VG

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

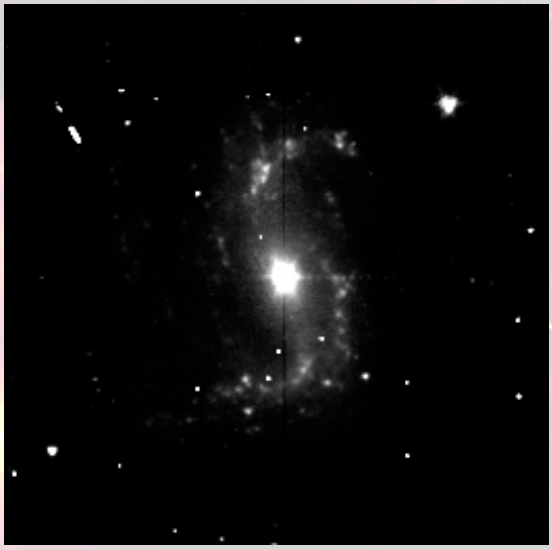
VG

NGC 4051 at 3.6 microns



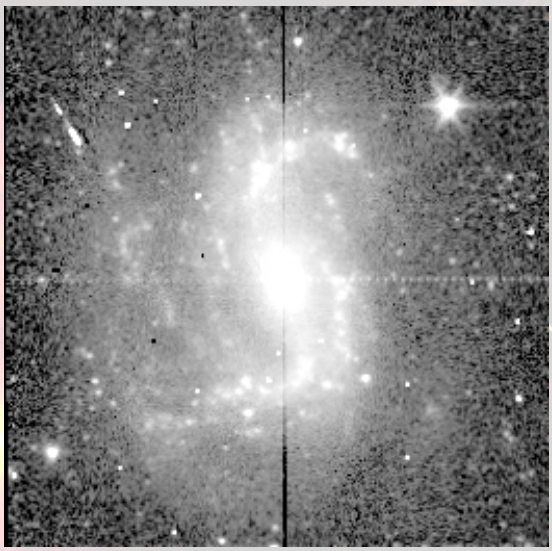
VG

NGC 4051 at 3.6 microns

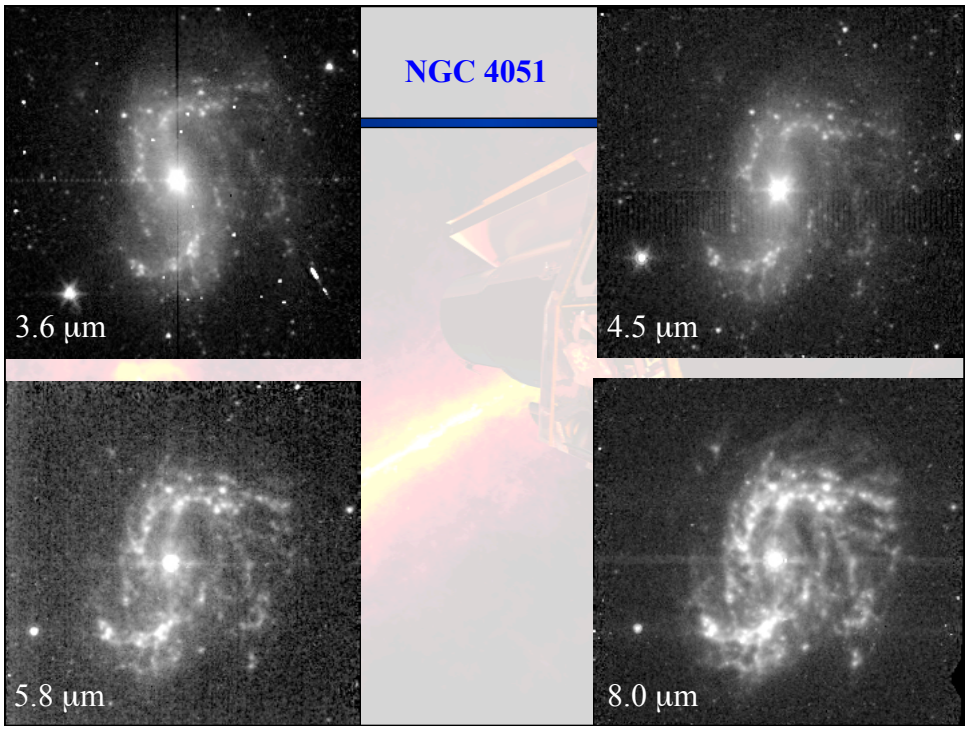


VG

NGC 4051 at 3.6 microns

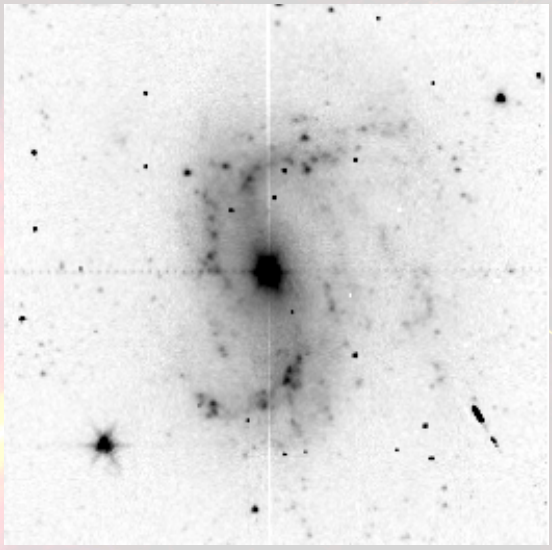


VG


NGC 4051
3.6 μm
4.5 μm
5.8 μm
8.0 μm


NASA
JPL
NGC 4051 in Combined IR Colors
NITARP
VG

NGC 4051 at 3.6 microns



VG

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

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

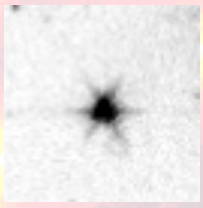
1.0	1.3	1.2	1.2	0.9
0.8	4.3	4.0	3.8	0.7
1.1	3.7	6	4.1	1.5
0.9	4.2	4.3	3.9	1.0
1.2	1.4	1.1	0.8	1.3

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

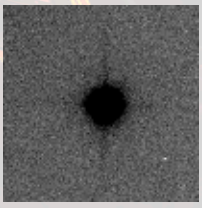
VG

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

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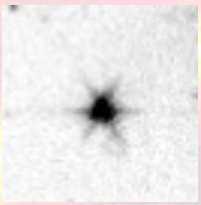
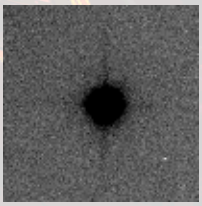
Noise and Background

- 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.



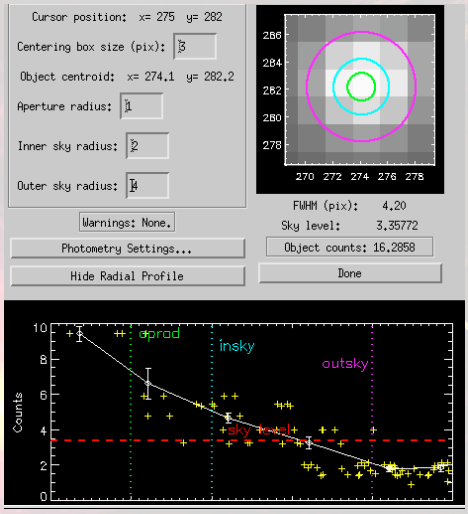
Spitzer PSF



Typical Ground Based PSF

VG

Photometry



So in measuring the light from a point we need to measure the PSF and subtract out the noise and non-source light

VG

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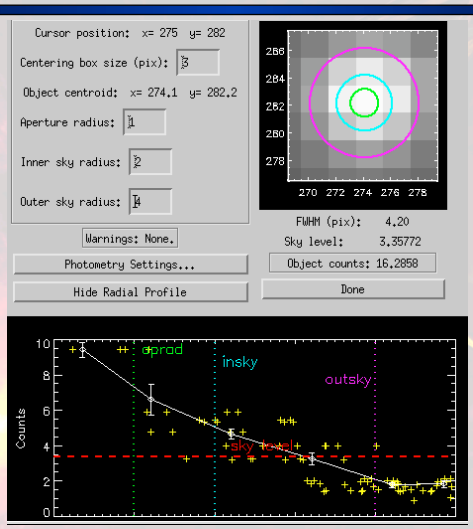
Photometry



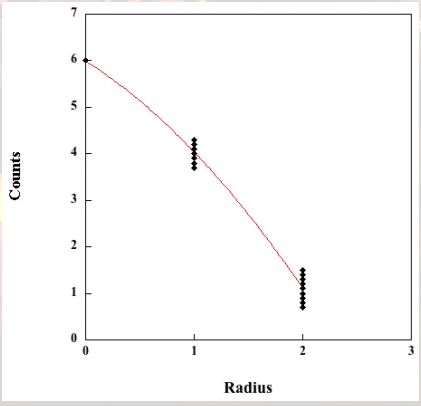
To be sure we are getting the whole PSF we need to take a radial profile

VG

Photometry

What is a radial profile?

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



A radial profile is the circularly averaged sum at increasing radial distance from the brightest point of the image.

VG

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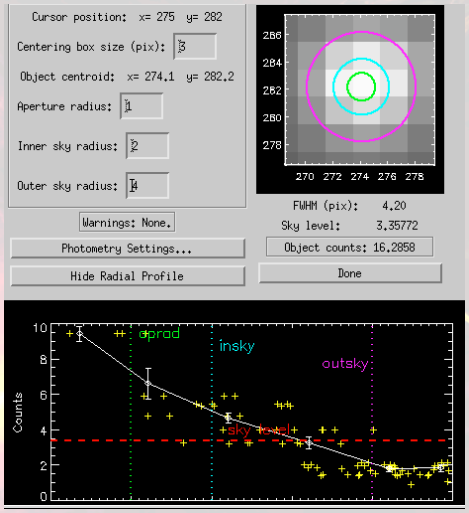
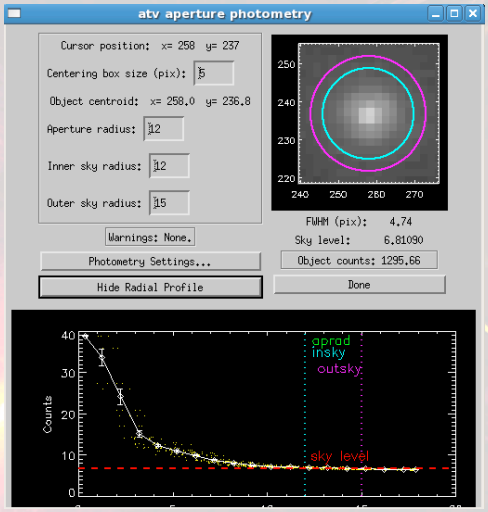
Photometry



A radial profile also shows where the PSF light ends and the non-PSF light dominates

VG

Photometry



The radial profile then tells us how far the PSF extends before we reach the background level of the sky.

VG

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Photometry

Aperture Photometry Tool

This is a Java based tool so as long as you have Java installed on your school's computer then you should be able to install it?

If you are running a web browser you should already have it!

VG

End Photometry

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