An Introduction to Imaging - Taking the first steps...

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Back in the days of film camera options were fairly limited…

Homebuilt
4x5 Sheet Film Camera
50mm f/11 Refractor Lens
(Polaroid Film Back)

Kodak Brownie
Target 620
Box Camera

Voigtlander Bessa I
120 Roll Film Camera

Olympus OM-1
35mm SLR

Nowadays the options are staggering…

- Cell Phone Cameras
- Video Cameras
- Planetary Cameras
- Guide Cameras

- Color Cameras
- Monochrome Cameras
- Cooled Cameras
- Un-cooled Cameras

- DSLRs
- Modified DSLRs (H-alpha & Full Spectrum)
- Full-frame DSLRs
- Crop Sensor DSLRs

Telescopes: Visual vs. Imaging

Visual tends to emphasize the largest scope you can manage on an adequate mount…

Bigger is usually better.

Imaging emphasizes a more modest scope on the best mount you can manage; physically and financially…

Bigger is rarely better.

You are seeking a balance of camera, mount, telescope, and budget.

Converging to a solution with what you have...

My first 'modern' imaging system: a 4.5" f/4 Orion StarBlast on a Meade DS-2000 mount (borrowed from a DS-2130) and a Meade DSI color camera.

I used a 15' USB repeater cable on the camera and a 14' Ethernet extension cable on the handbox so that I could control the camera and telescope from inside my house.

I used this system for about a year before moving up to my first 'real' imaging platform.

Starting Point: An 8" altaz-mounted SCT and a Stock DSLR

Fairly common 8" altaz mounted SCT

DSLRs offer an excellent balance of cost, quality, capability, versatility, simplicity, and opportunity for growth.

They can be used for deepsky, lunar, and planetary imaging, and once modified and used with the right techniques their performance can rival modern cooled astro cameras.

They can be used as stand-alone, with a computer, or operated remotely.

To connect the camera to your telescope you will need…

A) EOS to t-Thread Adapter
B) t-Tread to 1.25" Nosepiece
                    …or…
C) t-Thread to 2" Nosepiece
D) 1.25" IR Blocking Filter
                    …or…
E) 2" IR Blocking Filter
F) Remote Switch or Interval Timer

EOS to t-Thread adapters are often sold with a nosepiece pre-assembled as a unit

A 2" nosepiece is preferred as it provides a solid support and reduces vignetting

An *imaging* light pollution or multi-band filter can be substituted for the IR blocking filter
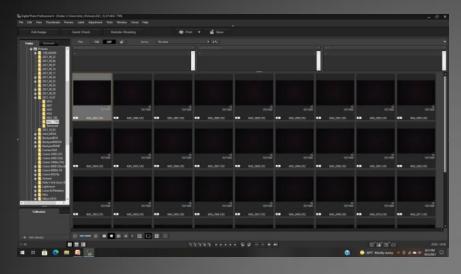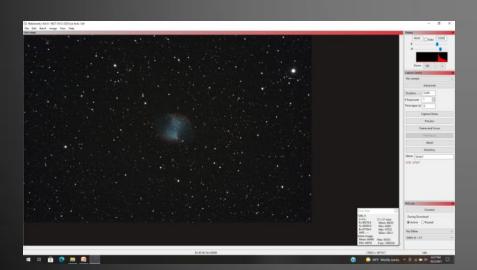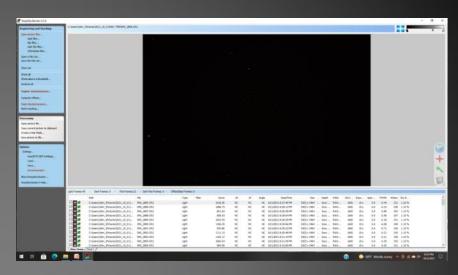
Things you will need…

Focusing Mask

White Cloth

Visual Back

Focal Reducer

Balance Weights

Things You May Want…

AC Adapter

Spare Batteries

Photographer's Puffer Bulb

High Capacity Memory Card
32 GB or Larger

Small Handheld Mirror

Software for checking, stacking, and processing your images…

Checking: Digital Photo Professional or View NX

Stacking: Deep Sky Stacker

Processing: Nebulosity
Soon to be released as Open Source

For Lunar and Planetary Imaging: AutoStakkert and/ or Registax

Getting ready for your first night out…

Become familiar with your camera and you equipment.

Set everything up in daylight and practice taking and previewing images of distant objects.

You should be very familiar with controlling your camera

- Changing the ISO and exposure

- Previewing images

- Calling up the histogram

- Zooming in and out
- Turning the live view on and off and zooming in and out.

It is helpful to practice enough that you can find the buttons in the dark or with the help of a red headlamp.

Camera Settings – Deepsky

Camera Mode: Manual

Quality: RAW

Image Preview: Off

Auto power off: Off

Auto rotate: Off

Sensor Cleaning/Auto cleaning: Disable

High ISO Noise Reduction: Disable

Long Exposure Noise Reduction: On

Flats:
- Gain: ISO 1600
- Exposure 1/250 sec or longer
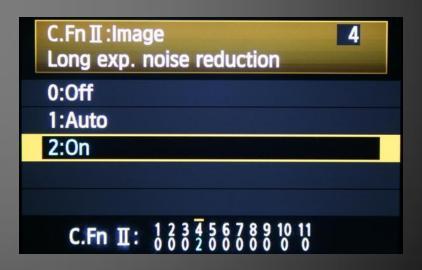
Frame & Focus
- Gain: ISO 6400
- Exposure 1-2 seconds

Images
- Gain: ISO 1600
- Exposure 10 seconds or longer

Interval Timer Settings

Startup Delay: 0 seconds

Length: 1 second (holds the shutter button for 1 second)

Interval: 26 seconds

- 10 second exposure +
- 10 second dark +
- 6 seconds for image transfer

Number of exposures: 40

Beep: Off

Total time for 40 images: 40 x 26 sec = 1,040 sec = 17.3 minutes

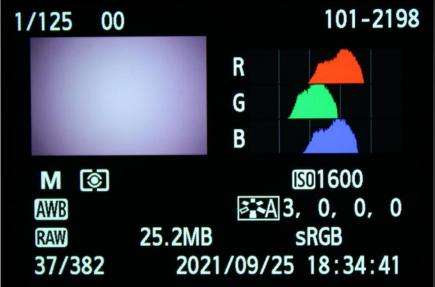Note: use the 'hold' button to take single frames

Putting it all Together...

Align the finder and camera in daylight.

Set the rough focus near infinity by focusing on a distant target.
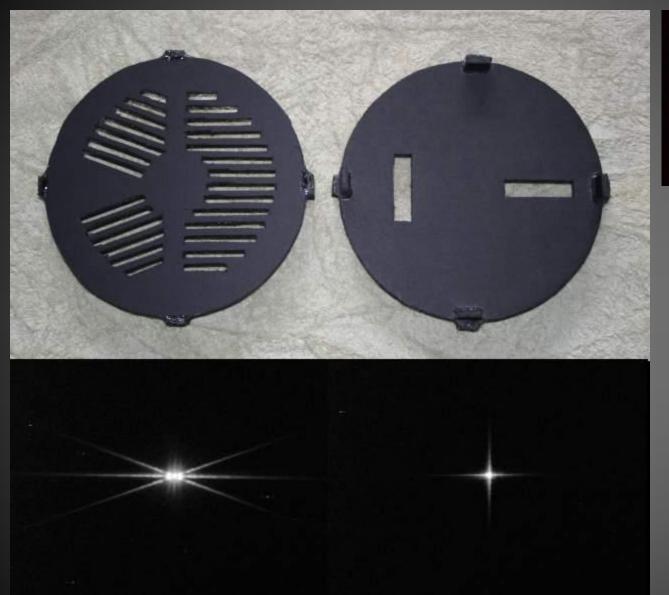
Taking Flats

Near the onset of dusk, cover the scope with a clean white cloth.

Using ISO 1600, set the exposure so that the histogram lies between 25% and 75% and no faster than 1/250 sec.

Take 16-32 flats saved as RAW.

Remove the cloth and align your mount as you normally would.

Setting the Focus using a Focusing mask…

Bahtinov Mask   Modified Hartmann Mask

Focusing using Live View with a Bahtinov mask…

If you don't have Live View you can take a series of 1 sec test shots and use the preview function to zoom in on the focusing star.
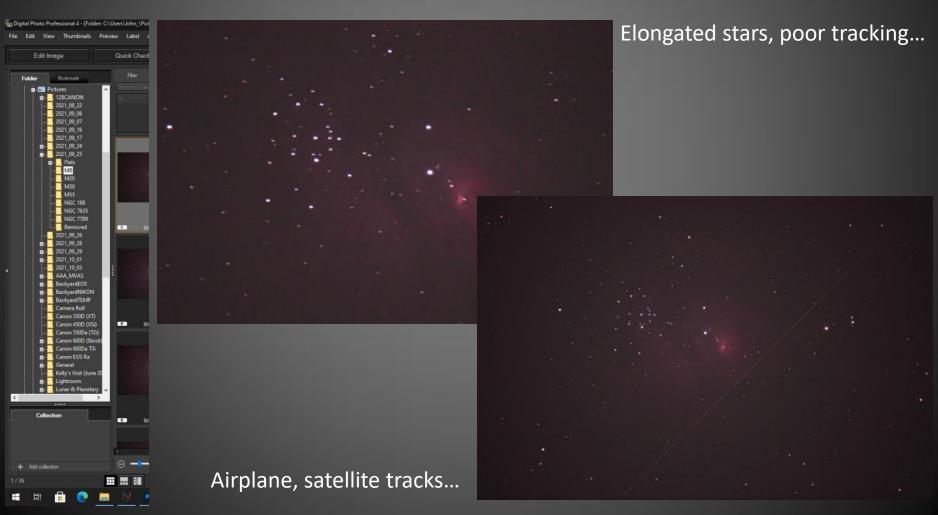
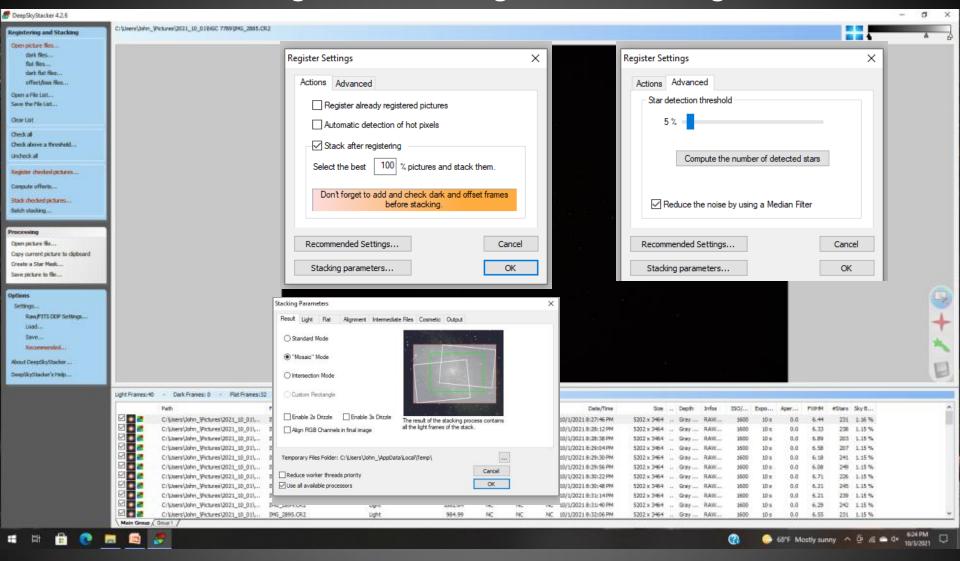***Always* set the focus turning the knob CCW!**

Framing & Centering…

Frame the field by taking a series of short exposures (1-2 sec) using the highest useable gain (ISO 6400) making small changes between each frame until the field is centered

Pause between each frame to allow the tracking to settle

Once framed, reset the gain (ISO 1600) and exposure (10 sec) and start the interval timer

Sorting the Source Images

- Separate the source images into individual folders

- Move rejected images into a temporary folder

- Preview each image, removing the images that show trailing or other flaws

- Try not to be too picky, ideally you will keep at least 50% of your source images
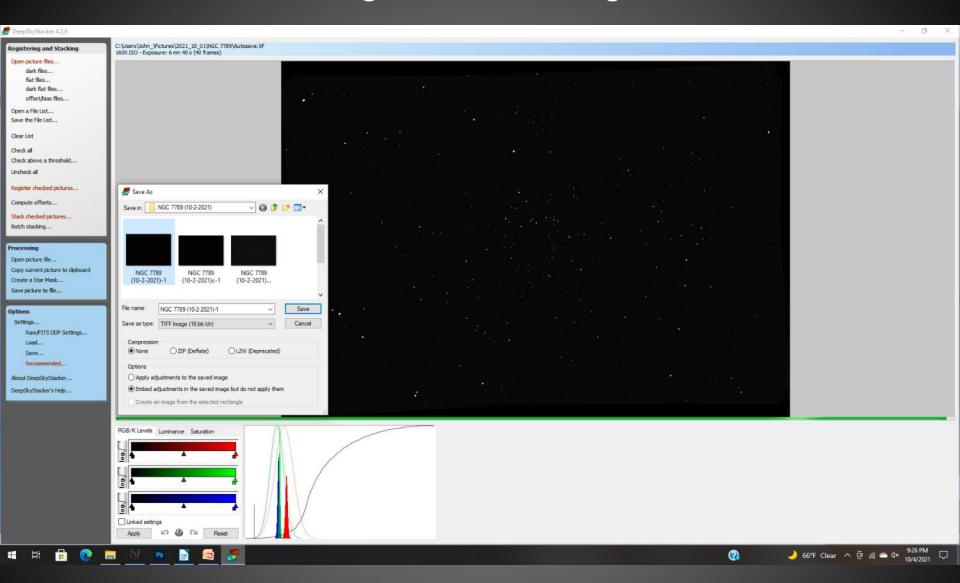

Elongated stars, poor tracking…

Airplane, satellite tracks…

Stacking and Calibrating the Source Images

Open picture files, load flat files, check all, register checked pictures…
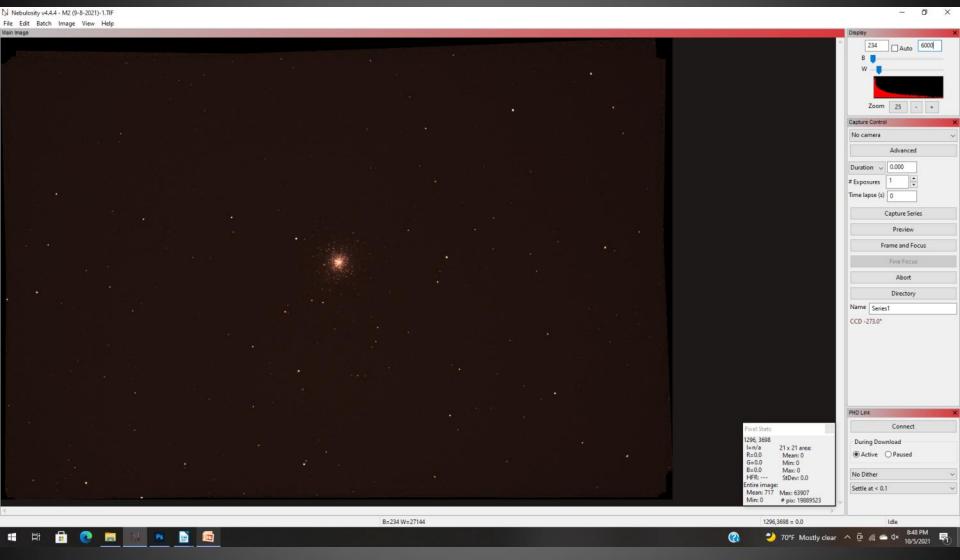Register settings; Actions, Advanced/Star detection threshold, Stacking parameters/Result/Mosaic mode

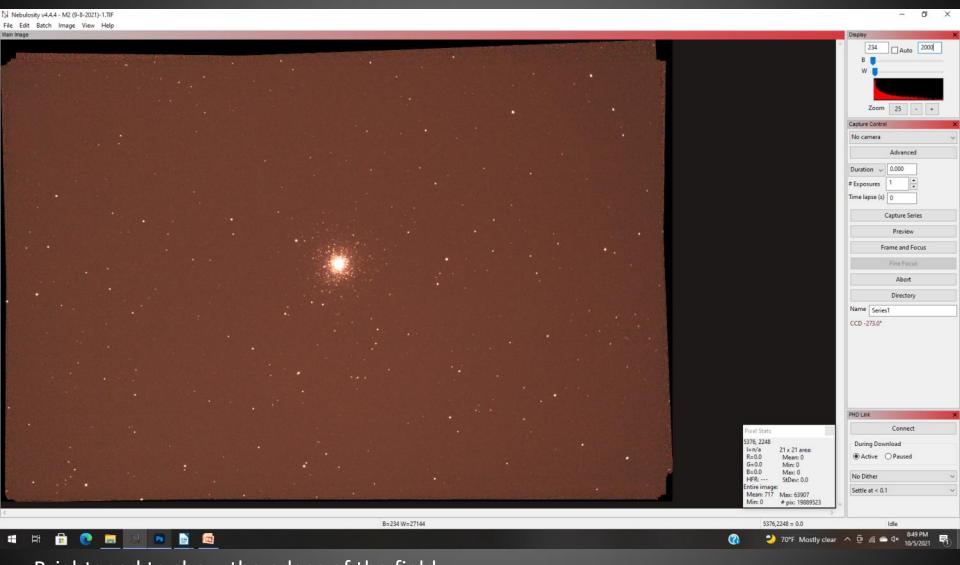After you first image set has been stacked you can use the Master Flat…

Processing the Stacked Image

M2: 24 x 10s, ISO 1600
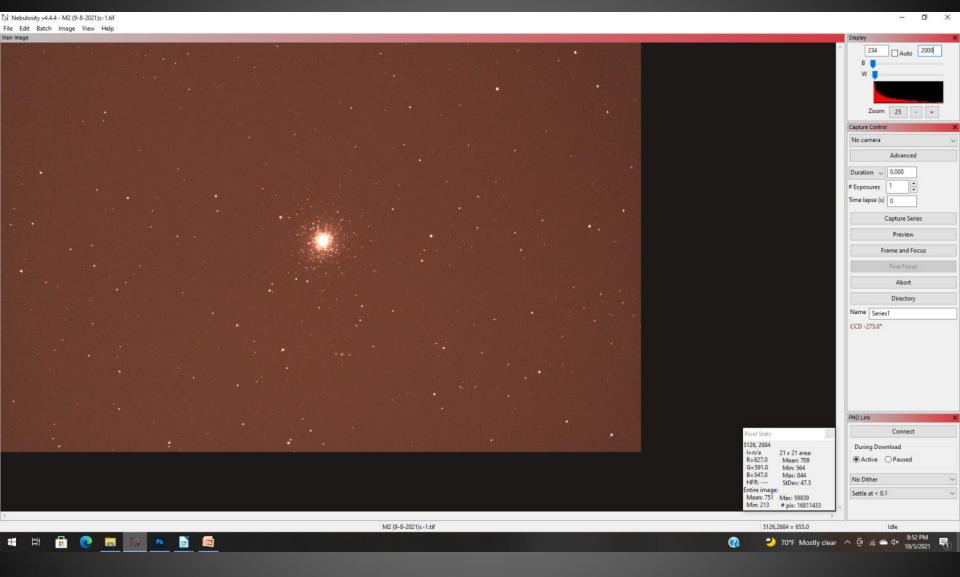From my first night out with the LX90

Basic Processing in Nebulosity

Brightened to show the cluster a little better… scaled 25% to show the entire frame.
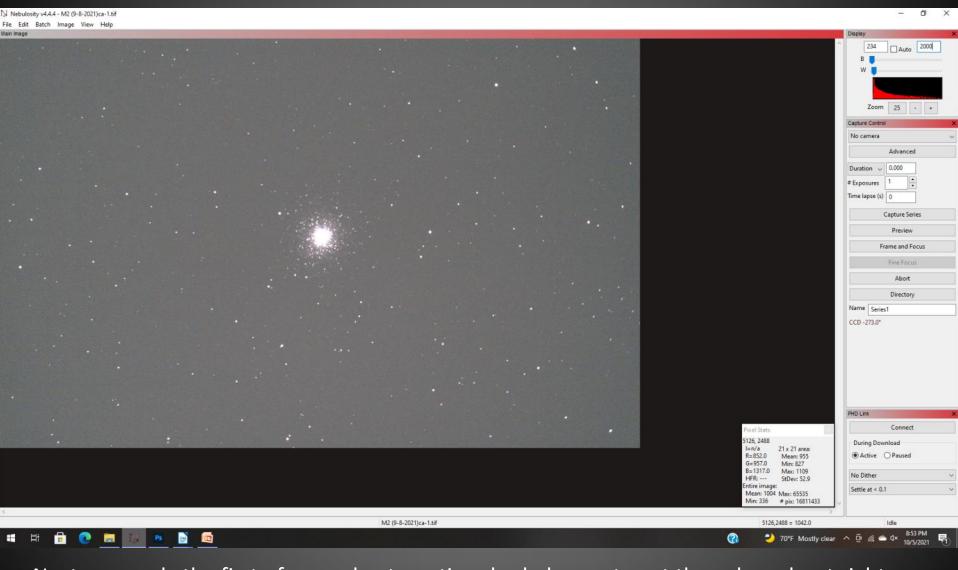
Basic Processing in Nebulosity

Brightened to show the edges of the field…
The rough edges are the result of drift and field rotation.
The field looks reasonably smooth with no dust motes.
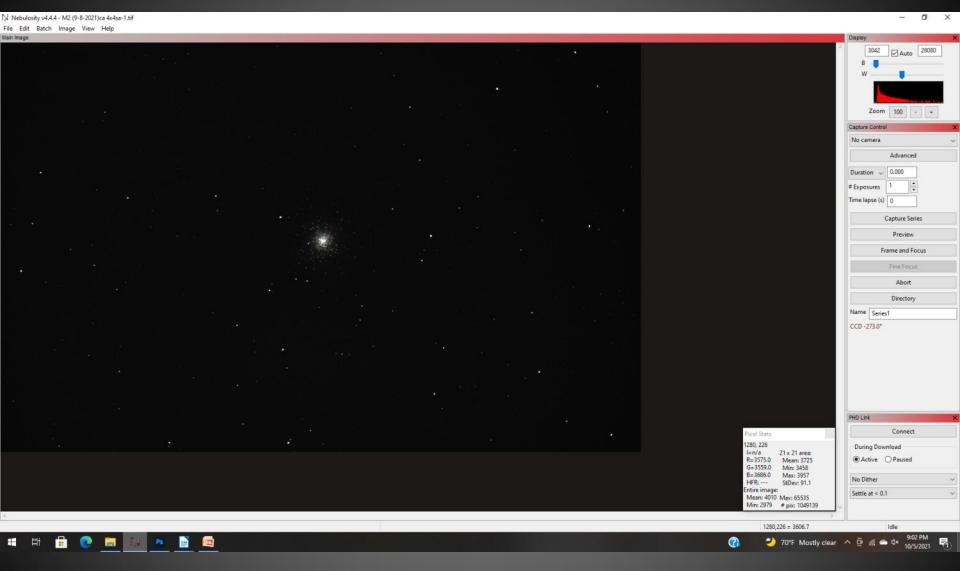
Basic Processing in Nebulosity

The first step is to crop the edges to give us a clean field to work with…

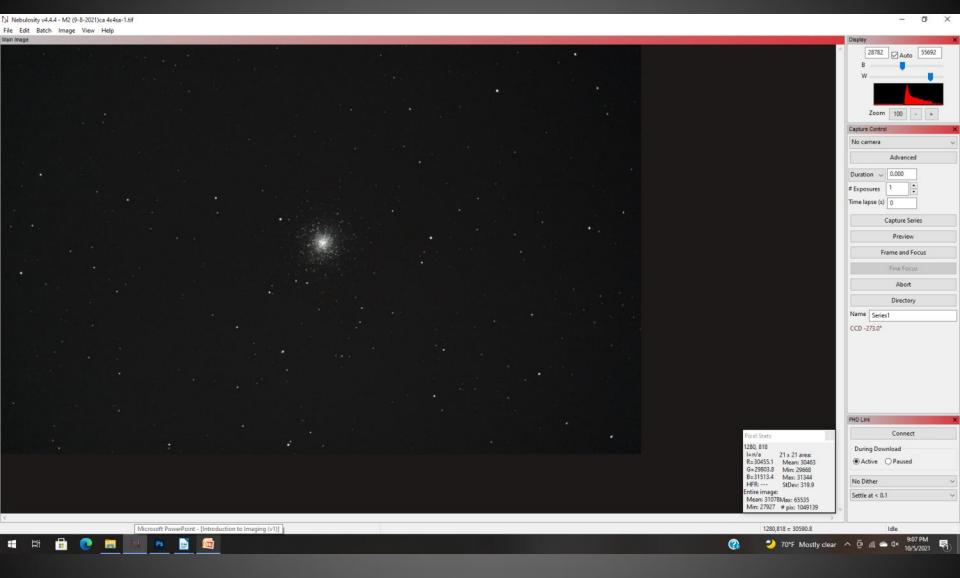# Basic Processing in Nebulosity

Next, we apply the first of several automatic color balances to get the colors about right. The image appears over-exposed because I left the brightness turned up, but this is only on the display, the actual source image is still fairly dark.

Basic Processing in Nebulosity

If you zoom in 100% you see that we are over-sampled and there's a bit of noise in the background. At this level it doesn't look too bad, but it will get worse as we enhance the image. We can take improve all of these issue by binning the image 2x2.

Basic Processing in Nebulosity

Binned 2x2 sum, auto color balance, binned 2x2 average, auto color balance again.
At this point I would ordinarily export the image over the PhotoShop for final processing,
but we can finish this using curves in Nebulosity.

Basic Processing in Nebulosity

Automatic curves and automatic brightness…

Final Image using Nebulosity

Pre-sorted, stacked in Deep Sky Stacker, processed in Nebulosity.
Cropped, color balanced, binned sum, binned average, curves, saved as BMP.

Pre-processed in Nebulosity, finished in Photoshop…

M2, 24x10s, ISO 1600

Closing Thoughts…

You can put together a reasonably good starter system largely from parts that you may already have.

The key is taking the first step and gaining some experience.

That will give you a basis for making decisions on where you go from here.

Experience is the absolute best tool in your toolbox

Also, remember the most important rules…

Rule #1: there are no rules, only guidelines.

Rule #2: see Rule #1.

Never let anyone tell you what you are doing is wrong, there is no One True Way.

Start at the beginning, take it one step at a time, and enjoy the ride!

Questions?

M27, 37x10s, ISO 1600