INTRODUCTION TO ASTRO IMAGING

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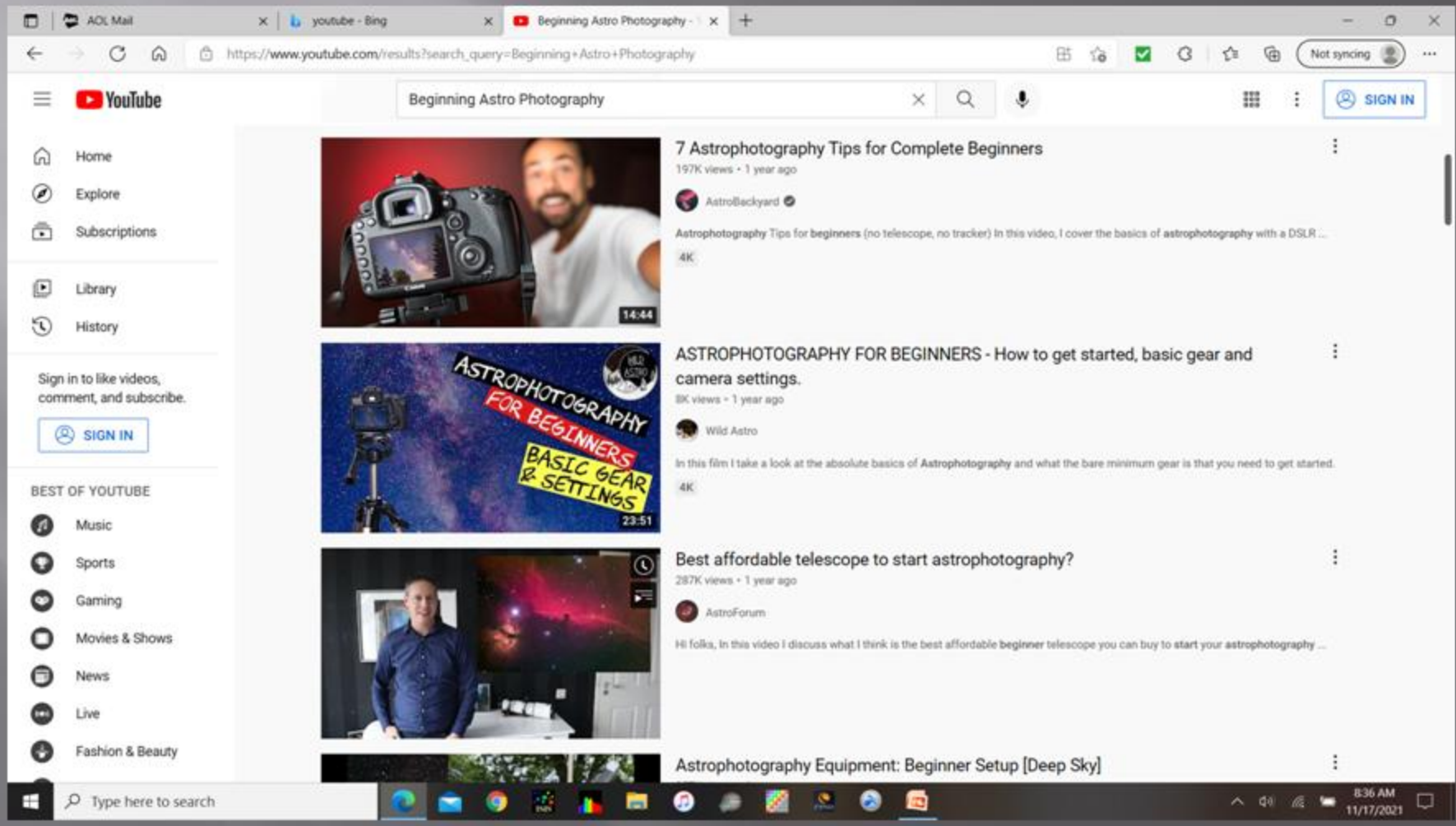
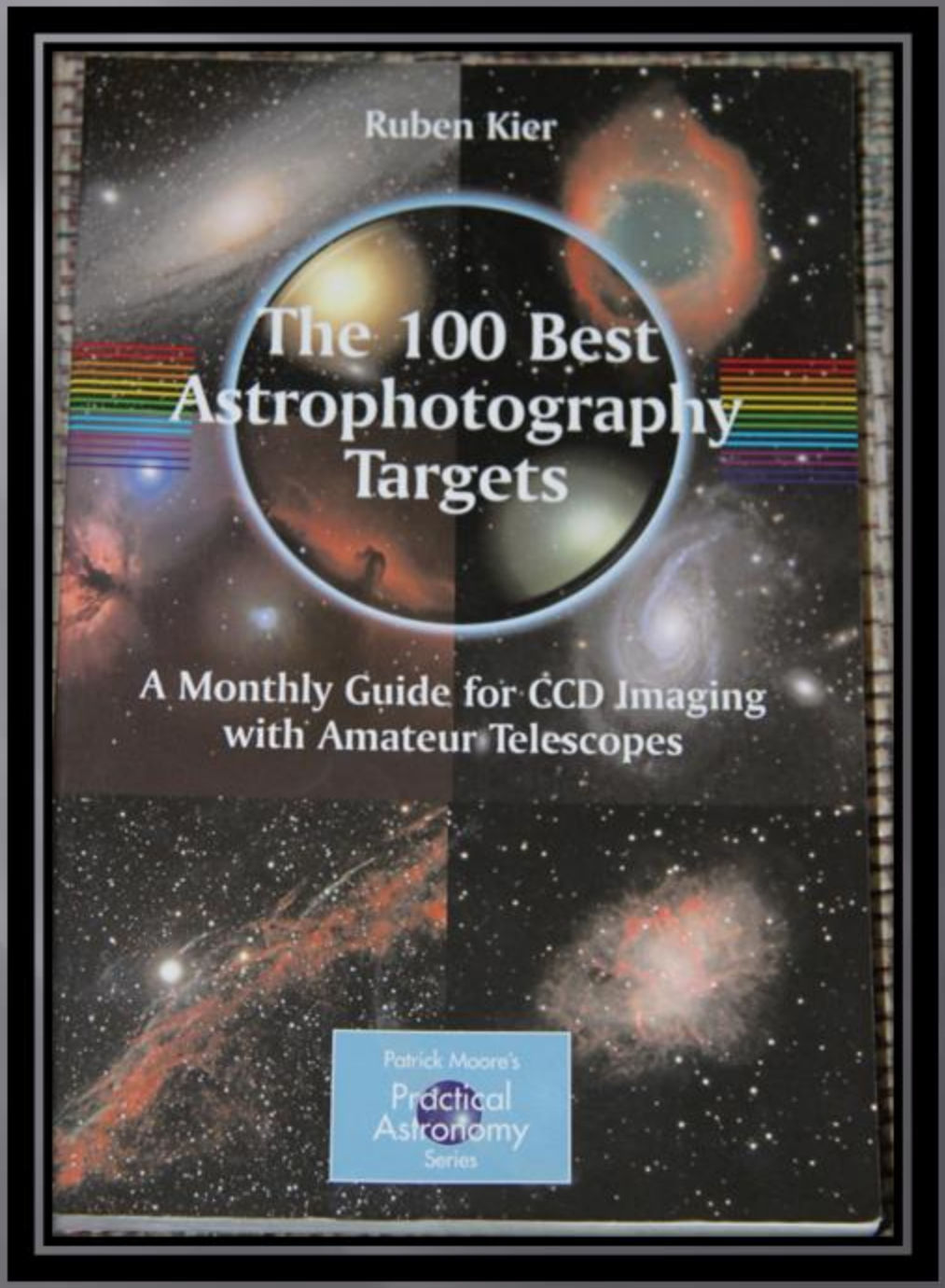
Resources -YouTube




Ruben Kier
The 100 Best Astrophotography Targets
A Monthly Guide for CCD Imaging with Amateur Telescopes
Patrick Moore's
Practical Astronomy
Series

Zoom Meeting #2

- Mounts
- Computers
- Techniques for Astro Photography

Part One: The Mount

- Types of Mounts
  1. Stationary tripods
  2. Camera tracking mounts
  3. Equatorial Mounts

Camera Trackers

Attach camera to tracker

Polar align the tracker

Has a built-in motor.
Supports 5 to 10lbs.
Long exposures possible.
No more star trails!
Cost $350 - $650

Attach to tripod

The 500 Rule or "How to prevent star trails" with a DSLR.

As the earth turns, so goes the heavens.

When exposed too long, you get long trails instead of nice round stars.

Shutter speed = 500 ÷ (lens fl * cropping factor)

The typical DSLR has an APSC sized sensor. Cropping factor = 1.6

If you use a 50mm lens

Shutter speed = 500 ÷ (1.6 * 50) = 6.25 seconds.

If you keep your exposures ~ 6 seconds, you'll have round stars.

Try increasing the ISO to record more detail.

Portable Astrophoto Observatory

Milky Way at the Grand Canyon

Cheap to Expensive

$15

$75

>$150

Just a camera on a tripod

A camera remote is handy

The difference between a good mount and a poor one.

A good mount is a sturdy mount!

DSLR Camera with barlow on Dobsonian Scope

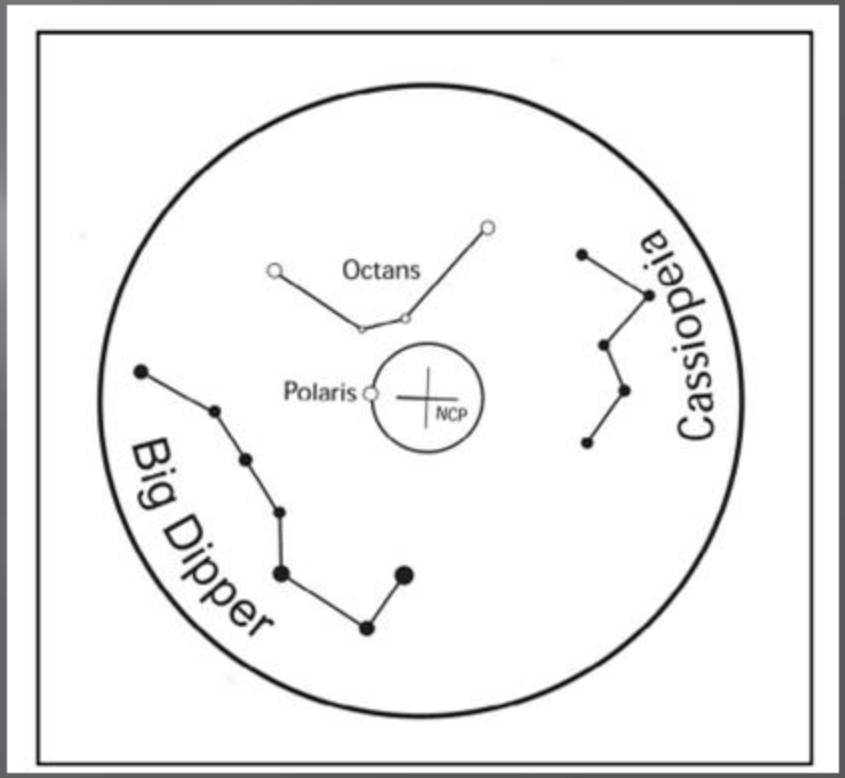
Alt-Azimuth Telescope Mounts

Not usable for Deep Sky because they cannot be polar aligned.

Polar Alignment with Software

Many GoTo mounts have polar alignment software built into the hand controller.

Polar Alignment Scope



Equatorial Telescope Mounts

This can be polar aligned

Angle corresponds to your latitude.

As the earth turns, the scope turns with it.

Camera on telescope with motorized mount

Globular Cluster M22 in Sagittarius Sept 2016

Galaxies M51 & M52· In Ursa Major

This is how you get to the really neat deep-sky photos.

Super Wedges

Turns an Alt-Azimuth mount into an equatorial mount

but

Celestron Wedge for Nexstar Evolution and SE 6/8

The difference between good and bad focus.

Part Three: Techniques

- Focus
- How long an exposure?
- How high the gain?
- "Dark frames"
- "Flat frames"
- Guiding….

Mac Book

This is a great product; but, there is limited astro software to capture and process the image.

PC Specs:

- Plenty of memory (> 8 Gig)
- Plenty of CPU speed.(>= iCore 3)

You don't need lots of memory and speed to capture the image.

BUT

You want lots of memory/speed to stack and process images.

Part Two: Computers

Laptops are preferred because they are portable.

You will want to take it outside.

How to get a good focus?

- With a DSLR, you can "eyeball" it on the camera's viewing screen. (try enlarging a star and focus)

My DSLR came with software that displays the image on a PC.

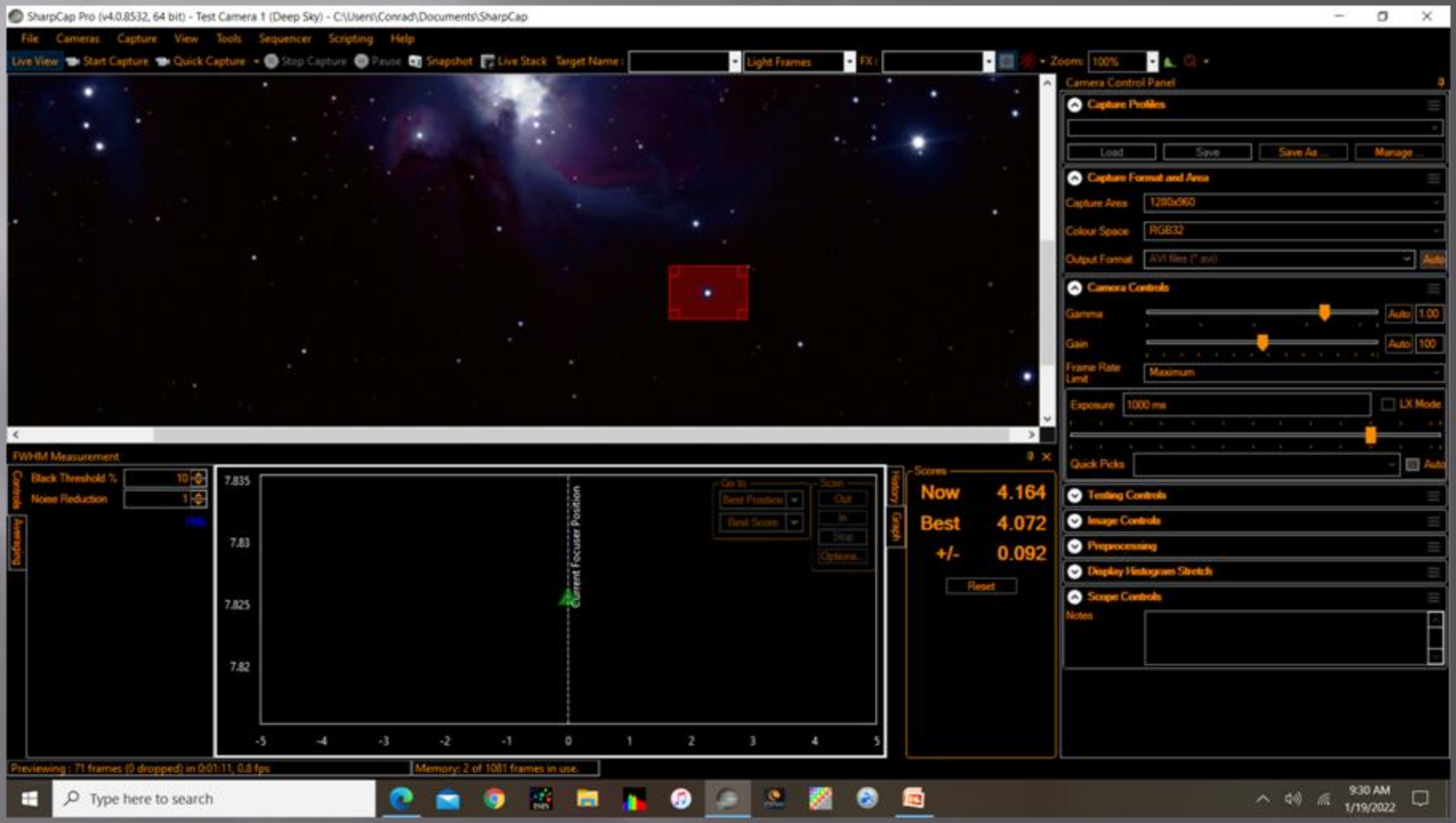
Which is better: one long exposure or many short ones?

- Take many short exposures.
  - The processing can stack these images.
    - twenty 30 sec exposures stacked = one 10 minute exposure.
- You will have to experiment.
  - Planets: short exposures 1 to 2 sec.
  - Galaxies: exposures = 30 sec
  - There is no simple formula for it.

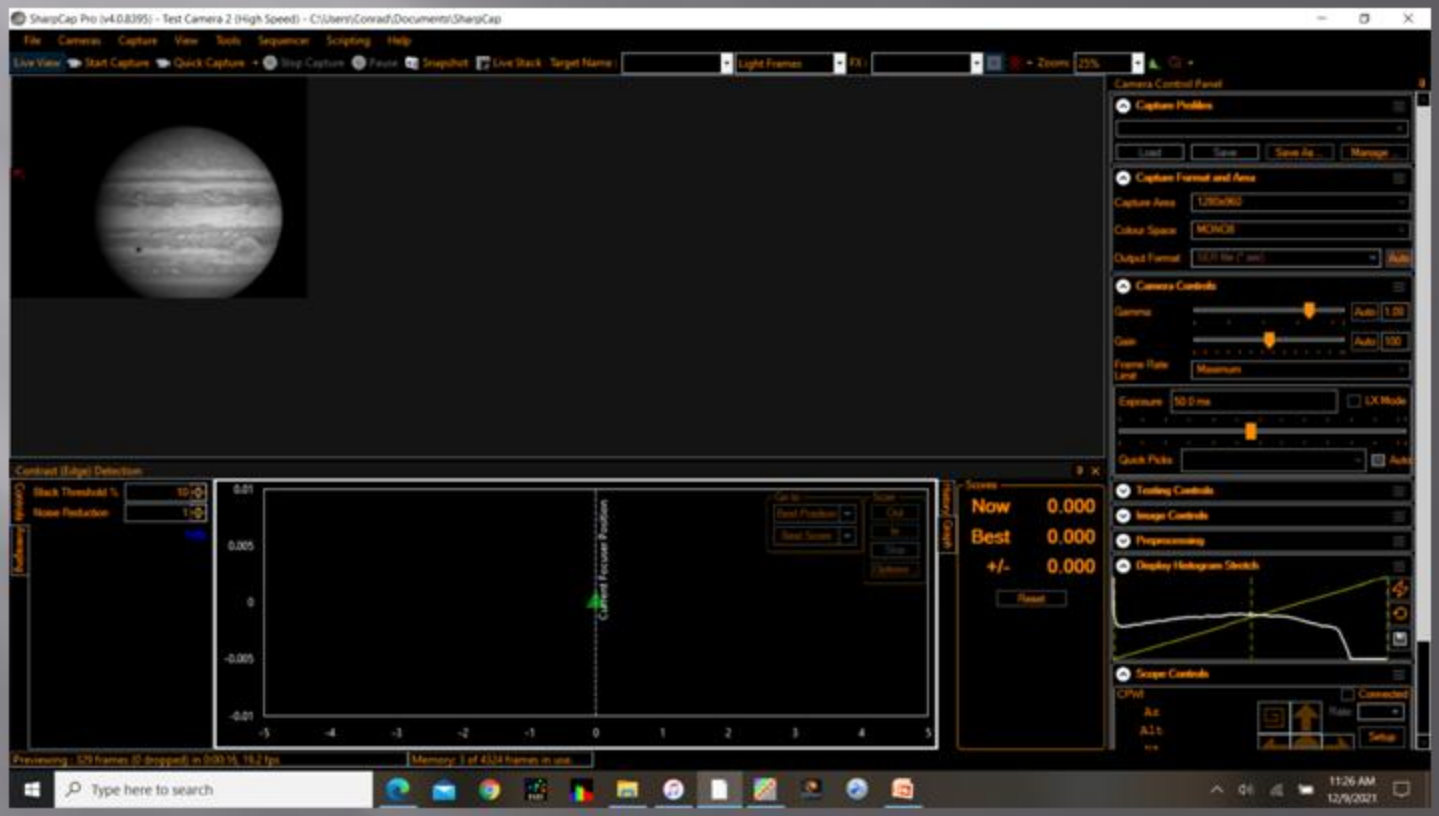
Which is better: one long exposure or many short ones?

- Longer exposures are harder. (> 1 minutes)
  - If polar alignment isn't good, you get blobs instead of stars
  - Lines may appear from planes.

Focusing with SharpCap

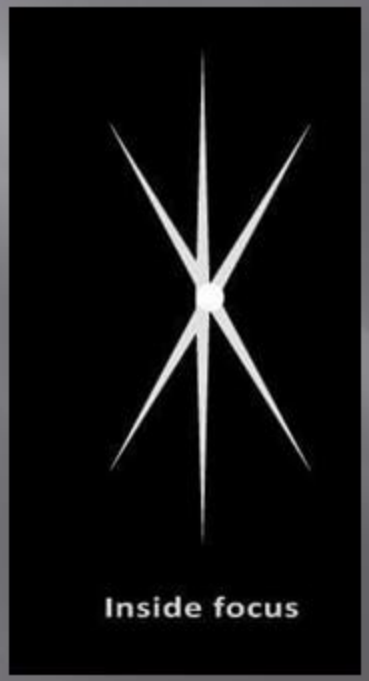


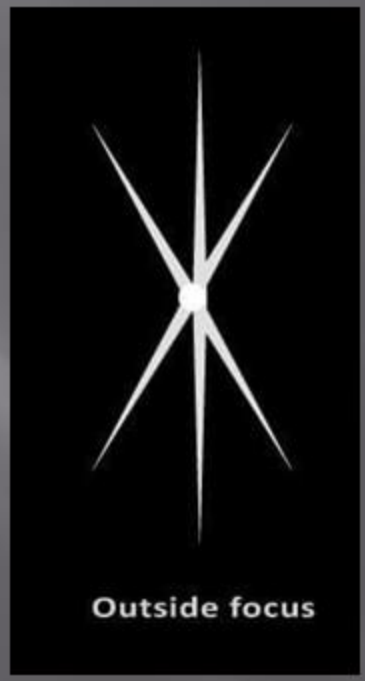
Focusing with Software Dedicated Astro Cameras



Capture software has a **live view** to help you focus on stars or planets.

Bahtinov mask





The mask goes on the front of your telescope.

The spikes and the star shifts position during focusing.

What is "gain"?

- "Gain" is a measure the sensor's sensitivity.
  - With a DSLR, it is the ISO number.
  - With astro cameras, capture software controls it.
    - It can be a number from zero to 1000.
- High gain = high sensitivity
  - it makes the image "grainy".
- Pick a number in the middle.
  - Experiment with this.

Some People Use Guide Scopes

There are **two** telescopes and **two** cameras on this mount.

Both cameras are connected to the computer.

"Guiding" software on the computer sends signals to the mount correcting its position.

This is more complicated.
- More cameras
- Mount needs port
- More software

I don't recommend this for the beginner.

No Special Guiding was done for this

I have 94 thirty second exposures

The image processing software corrected for any imperfections in guiding.

Guiding – Should You?

If you want to take photos like these, you need:

1. A motorized equatorial mount
2. Polar aligned

Image Calibration – Flat Frame

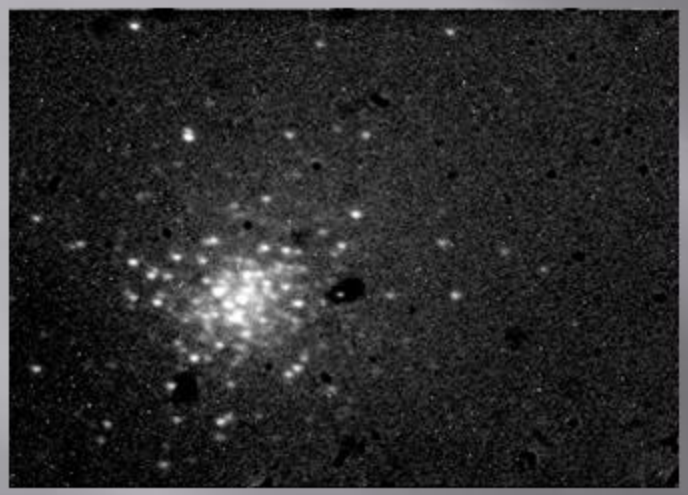


image minus dark

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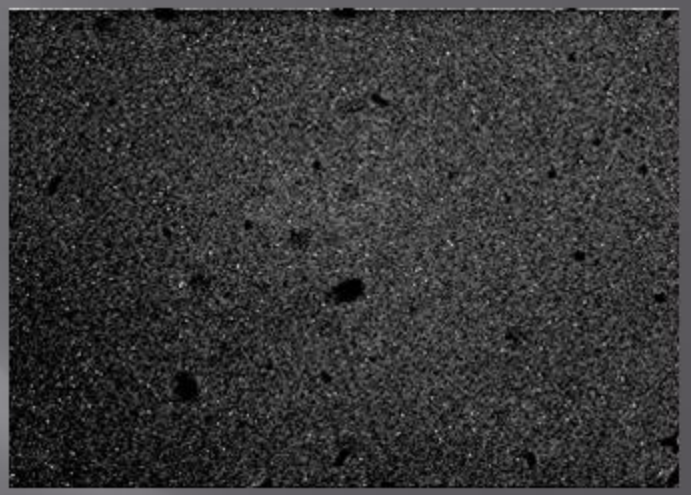
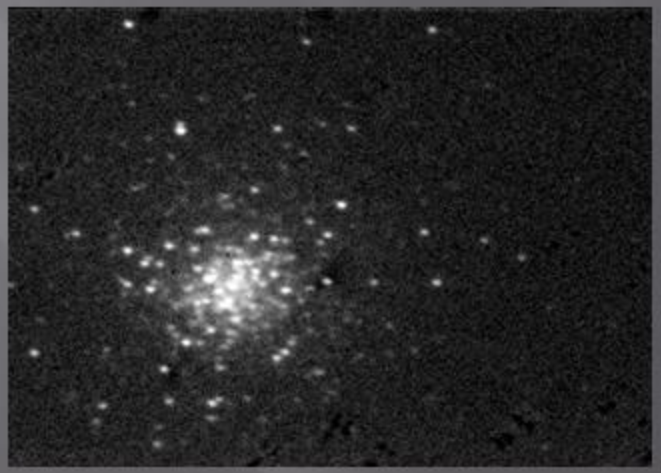
divide

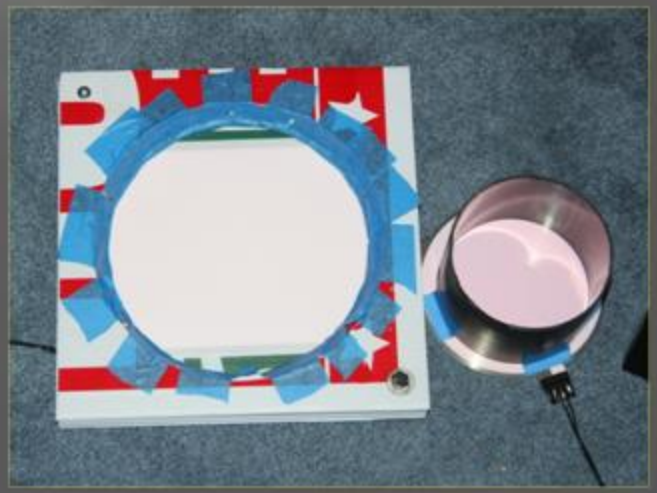


"Flat" frame from camera



Taking a flat frame

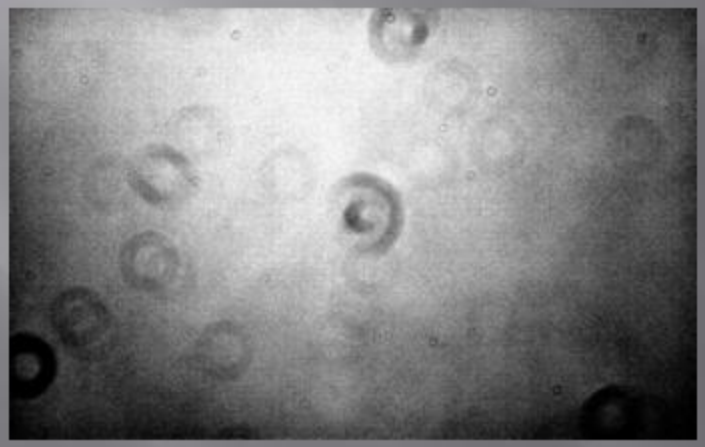
- During the day, cover your scope with a white cloth(away from the sun)
- Take an exposure. (capture software can help)
  - This is your "flat" frame
  - During image processing, your software divides the image by the "flat" frame.



What is a "Flat" Frame?

It is an image of:

- light distribution across the chip.
  - Vignetting
- sensitivity of each pixel.
- dust on the sensor.



This is an image of the daytime sky with a tee-shirt covering the front of my scope.

The camera sensor is not uniformly lit!

Dust particles on the sensor shows up as "donuts".

Image Calibration – Dark Frame

Raw image from camera subtract "Dark" frame from camera

What is a "dark" frame?

- The camera's sensor is sensitive, even in total darkness.
- When you take an image, you take an additional image with the scope covered.
  - This new image records the "dark" current.
    - This is your "dark" frame
  - During image processing, your software subtracts the "dark frame" from the regular image.
- For example: twenty 30sec exposures of M51
  - Take five 30sec exposures with scope covered