

# INTRODUCTION TO ASTRO IMAGING

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# Resources - YouTube

The screenshot shows a web browser window with the YouTube search results for "Beginning Astro Photography". The browser's address bar shows the URL: [https://www.youtube.com/results?search\\_query=Beginning+Astro+Photography](https://www.youtube.com/results?search_query=Beginning+Astro+Photography). The YouTube interface includes a search bar with the query "Beginning Astro Photography" and a "SIGN IN" button. The left sidebar contains navigation options: Home, Explore, Subscriptions, Library, and History. Below the sidebar, there is a "SIGN IN" button and a "BEST OF YOUTUBE" section with categories like Music, Sports, Gaming, Movies & Shows, News, Live, and Fashion & Beauty.

The search results list the following videos:

- 7 Astrophotography Tips for Complete Beginners**  
197K views · 1 year ago  
AstroBackyard  
Astrophotography Tips for beginners (no telescope, no tracker) In this video, I cover the basics of astrophotography with a DSLR ...  
4K
- ASTROPHOTOGRAPHY FOR BEGINNERS - How to get started, basic gear and camera settings.**  
8K views · 1 year ago  
Wild Astro  
In this film I take a look at the absolute basics of Astrophotography and what the bare minimum gear is that you need to get started.  
4K
- Best affordable telescope to start astrophotography?**  
287K views · 1 year ago  
AstroForum  
Hi folks, In this video I discuss what I think is the best affordable beginner telescope you can buy to start your astrophotography ...
- Astrophotography Equipment: Beginner Setup [Deep Sky]**

The Windows taskbar at the bottom shows the search bar with "Type here to search", several application icons, and the system tray with the date and time: 8:36 AM 11/17/2021.

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 =  $500 \div (\text{lens fl} * \text{cropping factor})$

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

If you use a 50mm lens

Shutter speed =  $500 \div (1.6 * 50) = 6.25$  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



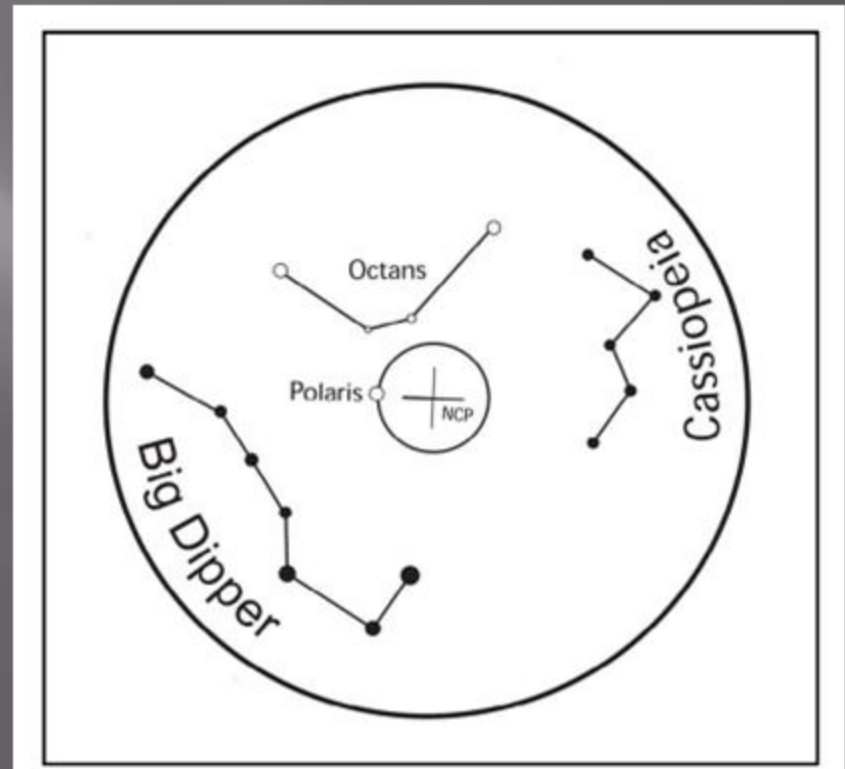
Not usable for Deep Sky because they cannot be polar aligned.

# 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



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.(  $\geq$  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.



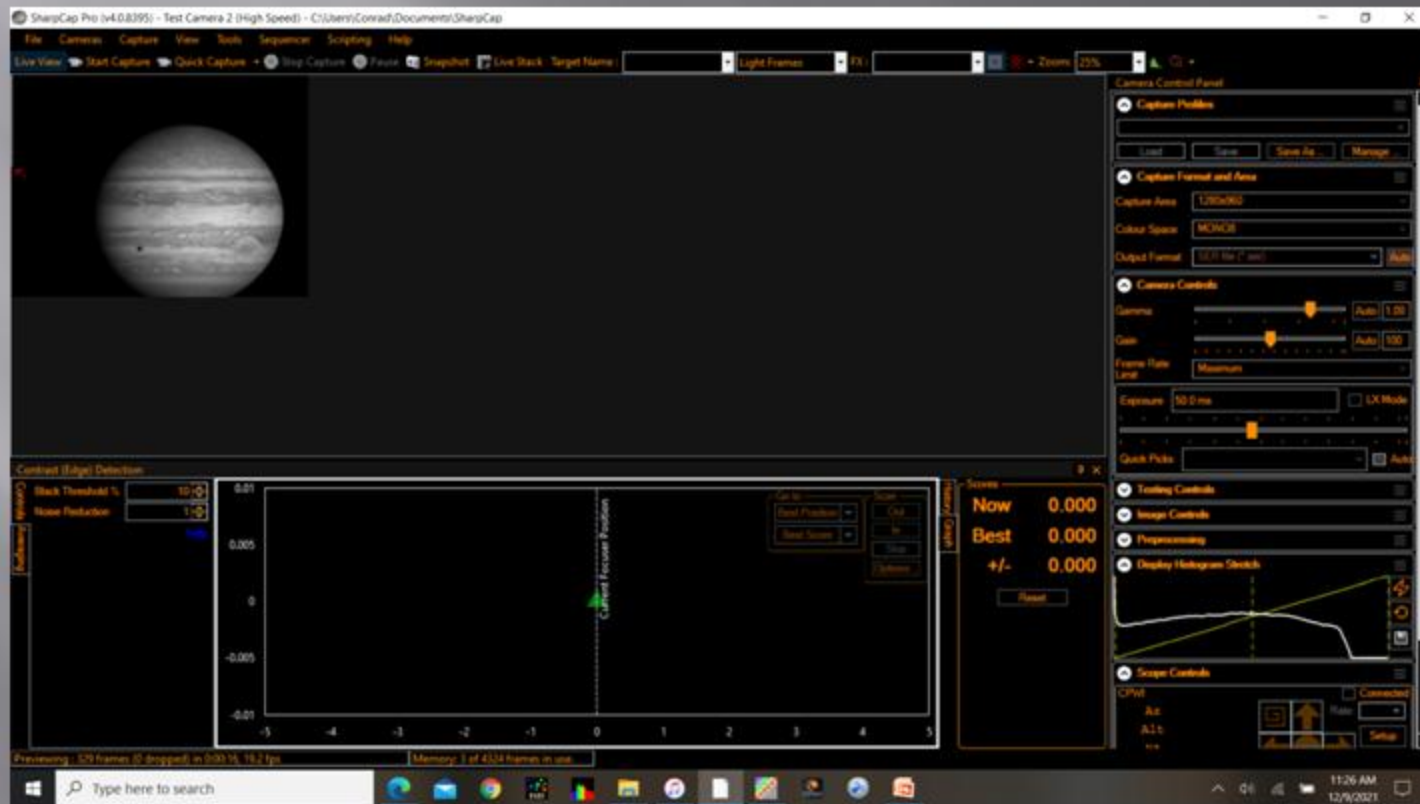
# Focusing with SharpCap

The screenshot displays the SharpCap Pro software interface. The main window shows a live video feed of a star with a red focus box. The interface includes a menu bar (File, Cameras, Capture, View, Tools, Sequencer, Scripting, Help) and a toolbar with buttons for Live View, Start Capture, Quick Capture, Stop Capture, Pause, Snapshot, and Live Stack. The Camera Control Panel on the right contains sections for Capture Profiles, Capture Format and Area (1280x960, RGB32, AVI files), Camera Controls (Gamma, Gain, Frame Rate Limit, Exposure), and Testing Controls. The FWHM Measurement panel at the bottom left shows a graph with a vertical line indicating the current focus position. The Scores panel at the bottom right displays the following data:

Score	Value
Now	4.164
Best	4.072
+/-	0.092

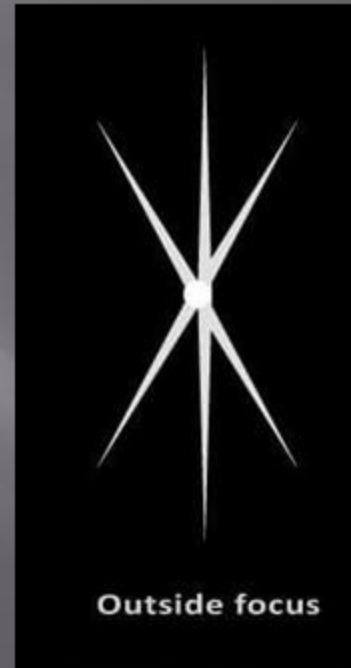
Additional information at the bottom of the interface includes: Previewing: 71 frames (0 dropped) in 0:01:11, 0.8 fps; Memory: 2 of 1081 frames in use; and a Windows taskbar showing the time 9:30 AM on 1/19/2022.

# 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

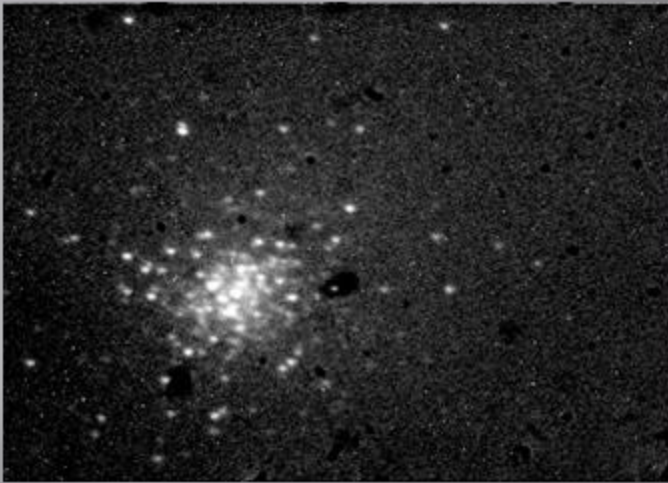
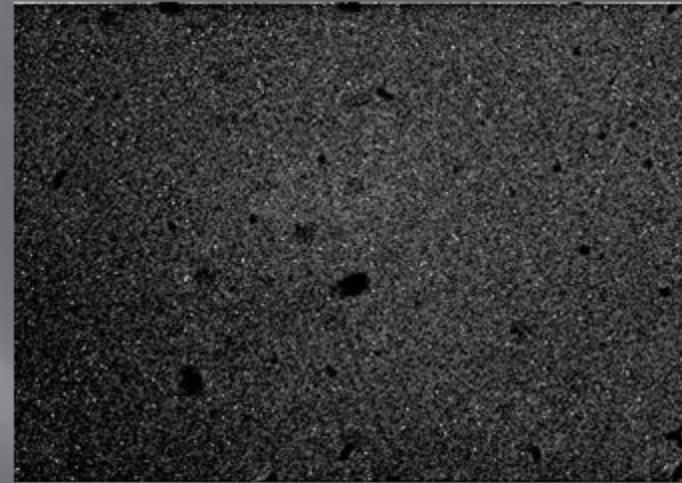


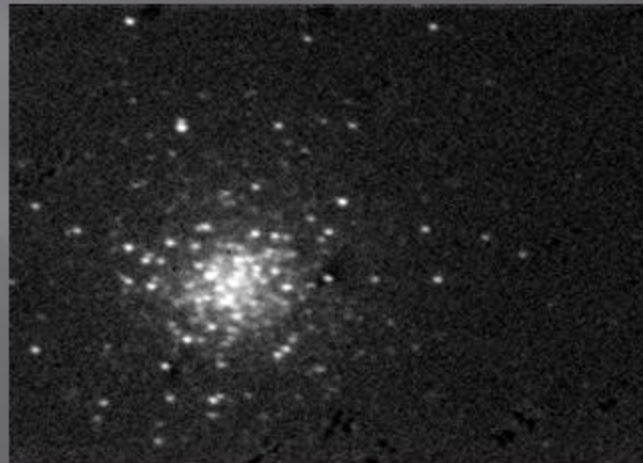
image minus dark



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



"Dark" frame from camera

subtract



# 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