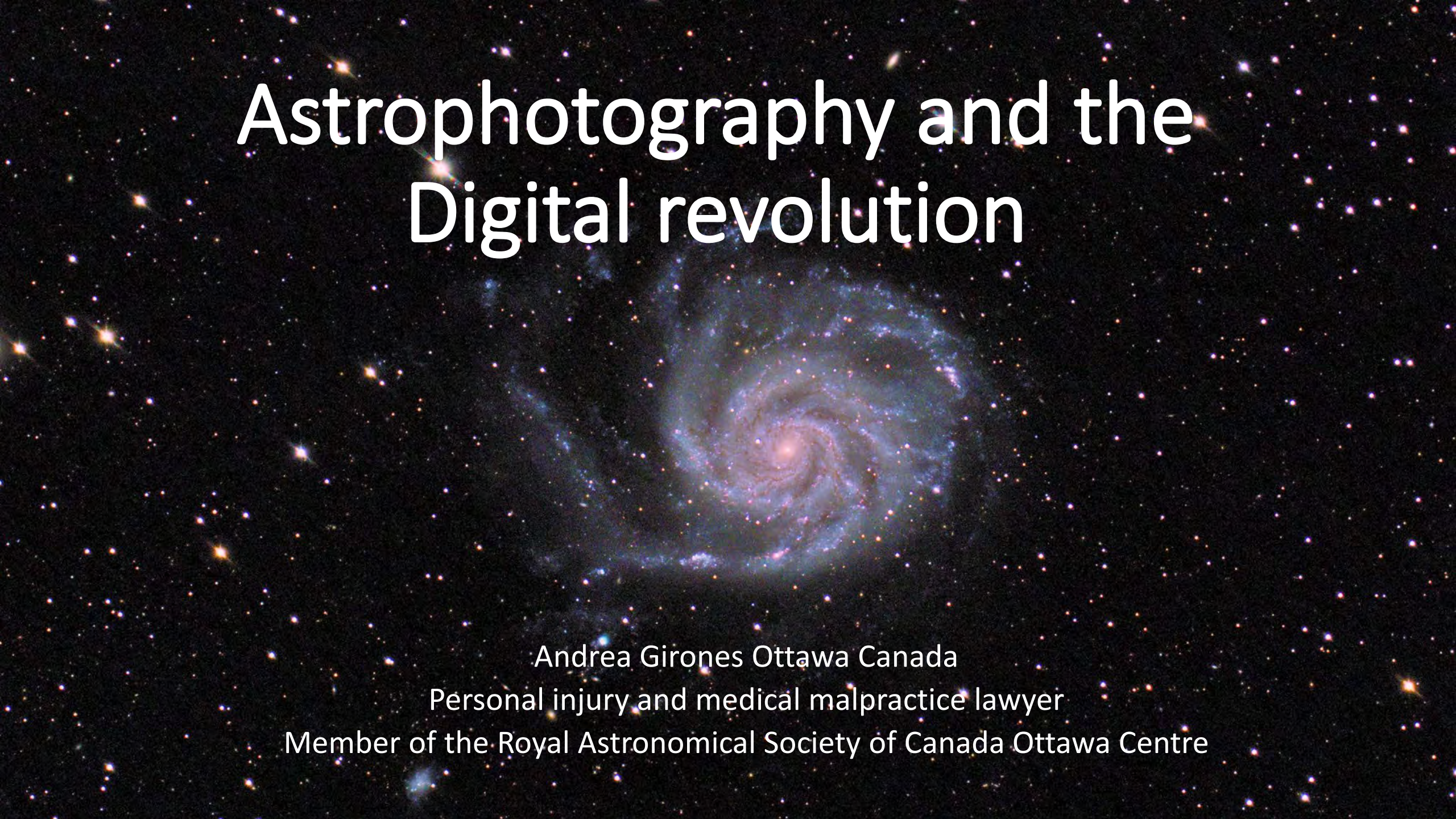
Astrophotography and the Digital revolution



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Where to start

- A basis in earth photography will help
- A camera with interchangeable lenses can get you started a DSLR or mirrorless camera
- Fast lens or a wide angle fast telescope
- COMPUTER KNOWLEDGE WILL HELP YOU
  - Find your Astro targets (Stellarium.com)
  - Plan your imaging run (Telescopius.com)
  - Acquire the images with acquisition software
  - Stack and Process the digital images
  - Search the internet, watch YouTube and join Facebook groups and forums to learn more

Types of astrophotography

- Milky way (wide angle)
- Moon rising and setting
- Nightscape with moon, planets
- High resolution planetary (whole other ball game need a BIG telescope and video Astro camera and probably filters)
- Deep sky objects
  - Nebula, big bright, easy to image with small wide angle telescope
  - Galaxies small, hard to image and need bigger scope narrow field of view

Deep Sky objects- Nebulas

- Large areas of interstellar and intergalactic dust
- Usually star forming regions
- Young stars are very hot and very bright and illuminate the area and dust that surround them
- Tend to appear red and pink in photos where a lot of hydrogen exists.
- Can be blue and rarely yellow (Rho Ophiuchi region)
- Can be supernova remnant as well
- Are big and bright

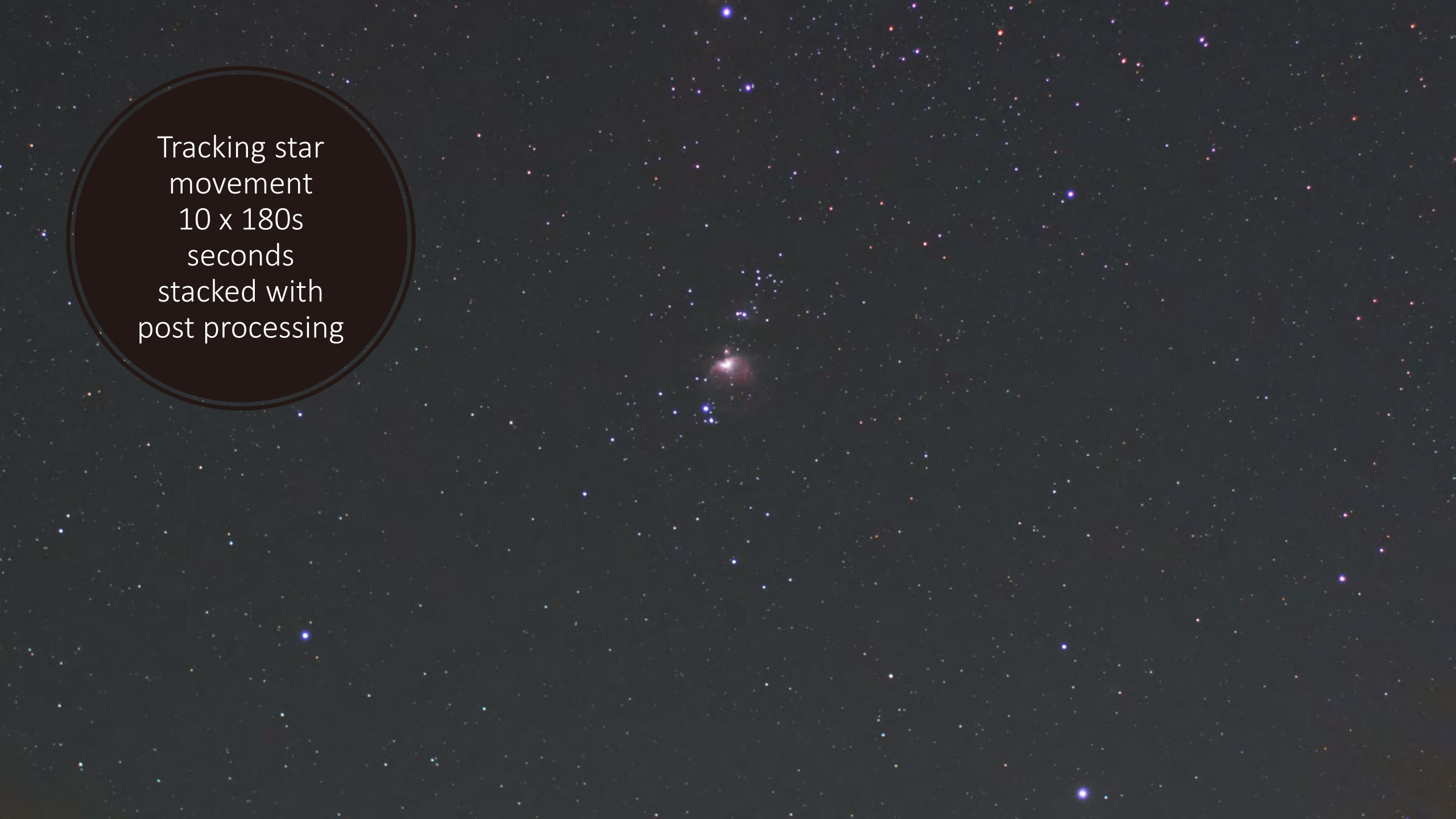
Seeing beautiful deep sky images around the Internet?

- TRACKING / STACKING is likely involved.
- A star tracker/ computerized equatorial mount will track the motion of the sky and allow you to take longer exposures
- Free stacking software also likely involved
- Use camera equipment you already have (a DSLR or Mirrorless camera and camera lenses)

Why track the Stars?

- Photos require pin point stars.
- Astrophotography requires long exposures to gather more light and more data.
- After about 20-30s, the stars in your image will move, creating star trails


180s untracked


Tracking star
movement
10 x 180s
seconds
stacked with
post processing

Enter the star tracker

Skywatcher Star adventurer
iOptron Sky Guider
Move Shoot Move

See Andrea’s presentation from Astronomy day Ottawa 2021

Computerized Go To mounts

- Celestron CGEM Mount and 11”inch Schmidt Cassegrain telescope
- Using the hand controller you can align the scope using a 3 star alignment routine. After an initial alignment routine the mount can take you directly to your target and continue to track the target throughout the night.
- Using the ASCOM protocol you can also connect your mount directly to a computer thereby accessing additional features with acquisition software on your computer.
- Your computer program can control the goto mount and direct it to the location in the sky .
- Using your camera, the computer software can take a picture of the sky and plate solve the astronomical coordinates.

Plate Solving

- Taking a picture and solving for the astronomical coordinates.
  Several useful applications in astrophotography
- Google “Dylan O'Donnell plate solving” for this video

Connecting the Computer to the Mount

- Different scopes connect in different ways however once connected they usually operate the same way
- SharpCap – to polar align
- Stellarium to select targets and plate solve to centre target
- NINA acquisition software to plan an set of images and control the camera and possibly filters
- PHD software to “guide” the mount during long exposures
- All in one solution the ASIAIR mini computer

Polar Alignment and finding your target

Sharpcap has a popular polar alignment routine in its software.

Acquisition Software

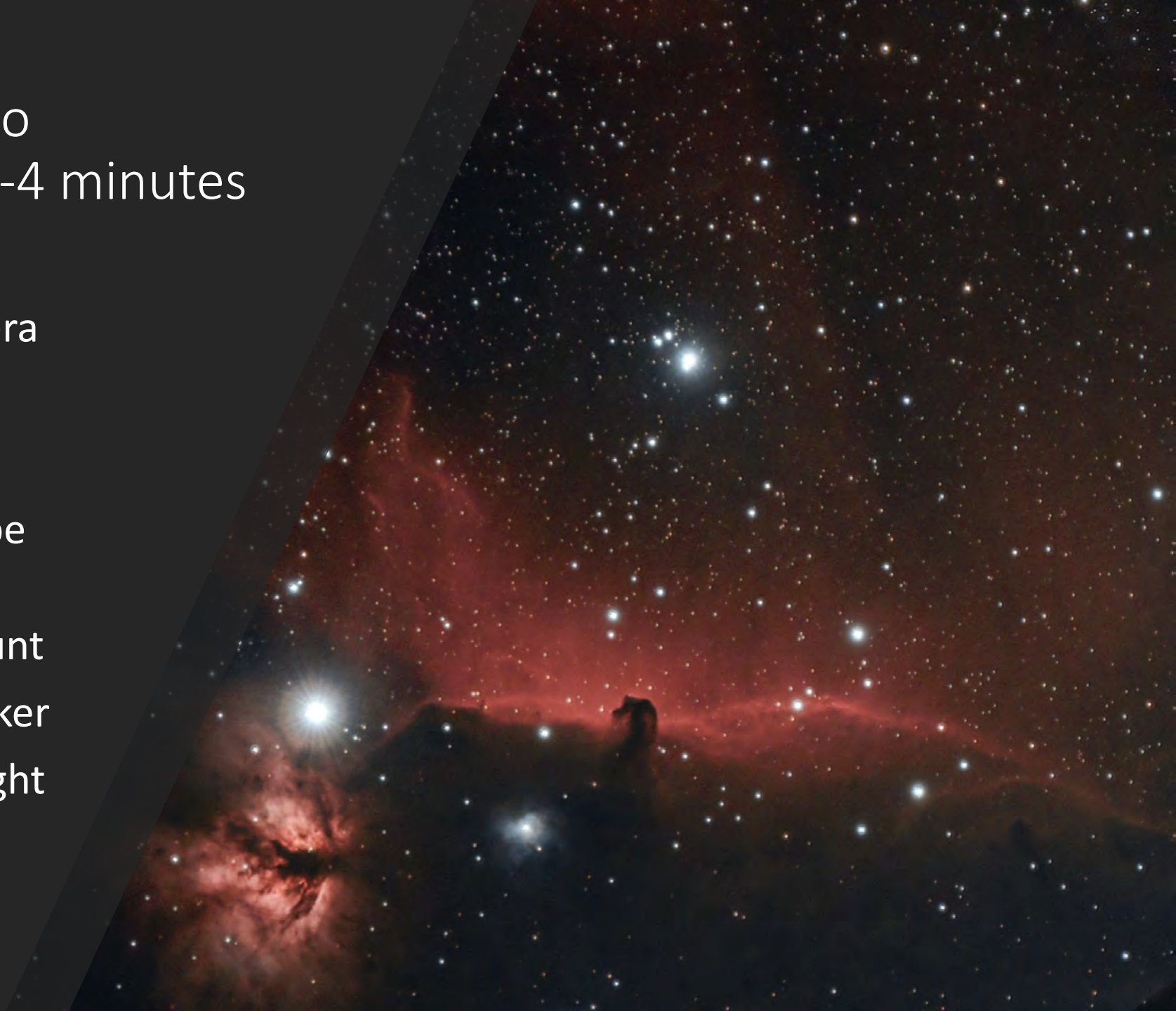
- DSLR Astro camera- specific software
- The software control the camera
- Run a sequence of long exposures images
- Controls gain and temperature
- Change filters
- Control auto focusers
- Can also plate solve

Excellent guiding and tracking is key

- A solid equatorial mount is required.
- The bigger the scope the bigger the mount required.
- Most images use an autoguiding system
- The best software is called PHD – “press here dummy”
- The guidescope tracks a specific star and sends pulses to the telescope mount to keep the image on track.

You want to be able to accurately track for 3-4 minutes

- Zwo ASI533 Cooled camera
- 250mm Telescope
- 47 x 300s tracked
- Guided with a guide scope and camera
- Using the Equatorial mount
- Stacked in Deep Sky Stacker
- Post processed in Pixinsight and Photoshop



Deep sky imaging gear

- Small refractor telescope
- Guide scope and camera on top
- Astro camera (although you can use a DSLR as well)
- ASIAIR mini computer- controls the camera and the guiding and later the telescope itself
- Much wider field of view than larger scopes
- Easier to guide and have good stars

ASIAIR

- Contains all the software you might need to get started in a “simplified” version
  - Polar alignment, focusing, plate solving guiding, acquisition, live stacking
- Is controlled though the ASIAIR APP on your phone or tablet.
- New version is supposed to have a wider range for built in WiFI it can join your home network so you can monitor everything from inside.
- Good beginner setup and is PORTABLE.
- Replaces a laptop and uses far less power in the field.

Select your target

- Pick a big bright nebula to start. In the summer Milky way there are many big bright objects
- Use websites like Stellarium and Telescopius to plan your image and find out where your target is when it rises, sets….
- Plan for a night with no moon and your target is high in the sky
- Link to telescopius.com

Good Targets for Beginners -Summer

- The Andromeda Galaxy M31
- The North American Nebula NGC7000
- The Lagoon nebula M8
- The Veil Nebula NGC 6990

Good targets for beginners - Winter

- The Orion Nebula M42
- The Horshead Nebula IC434
- The Pleiades M45
- The Heart nebula IC1848

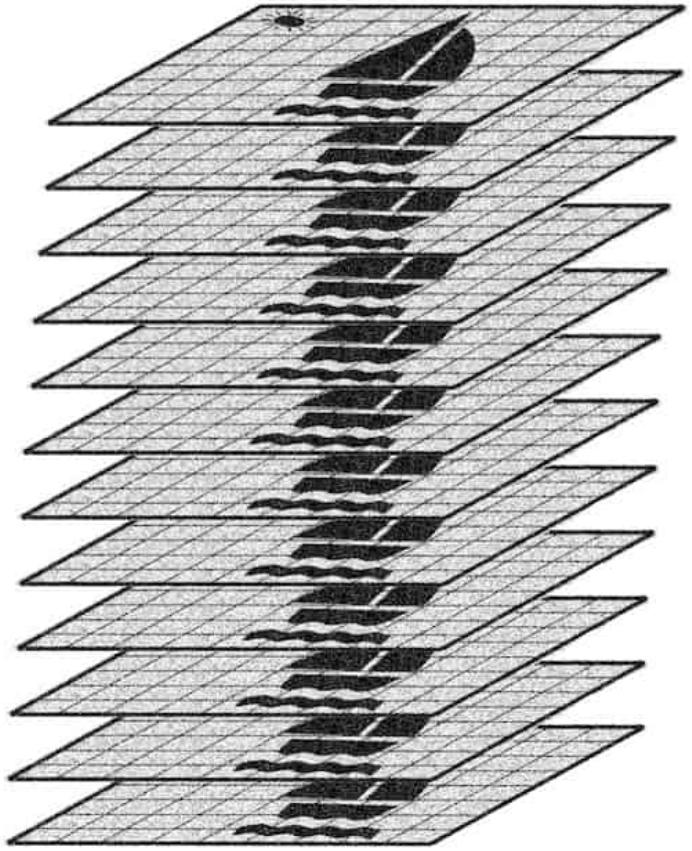
Capturing the images is only the Beginning

- Next you must STACK the images using free software such a Deep Sky Stacker and Sequator
- You must process the images and STRETCH the histogram to reveal details in the darker parts of your image. You can use Lightroom, Photoshop,
- Usually have to adjust COLOUR as most cameras are biased to the green.
- There are MANY image processing tutorials

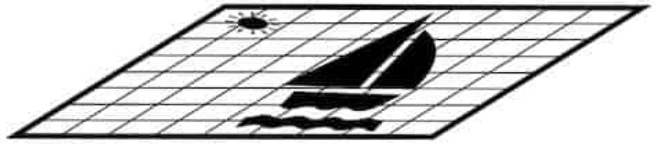
Stacking and Stretching is key

- Stacking increases the signal to noise ratio
- The more images, the more detail you can extract from the background
- Free software to stack images
  - Deep Sky stacker
  - Starry Sky (MAC)
  - Sequator
- Advanced stacking in Pixinsight

Stacking Digital Images

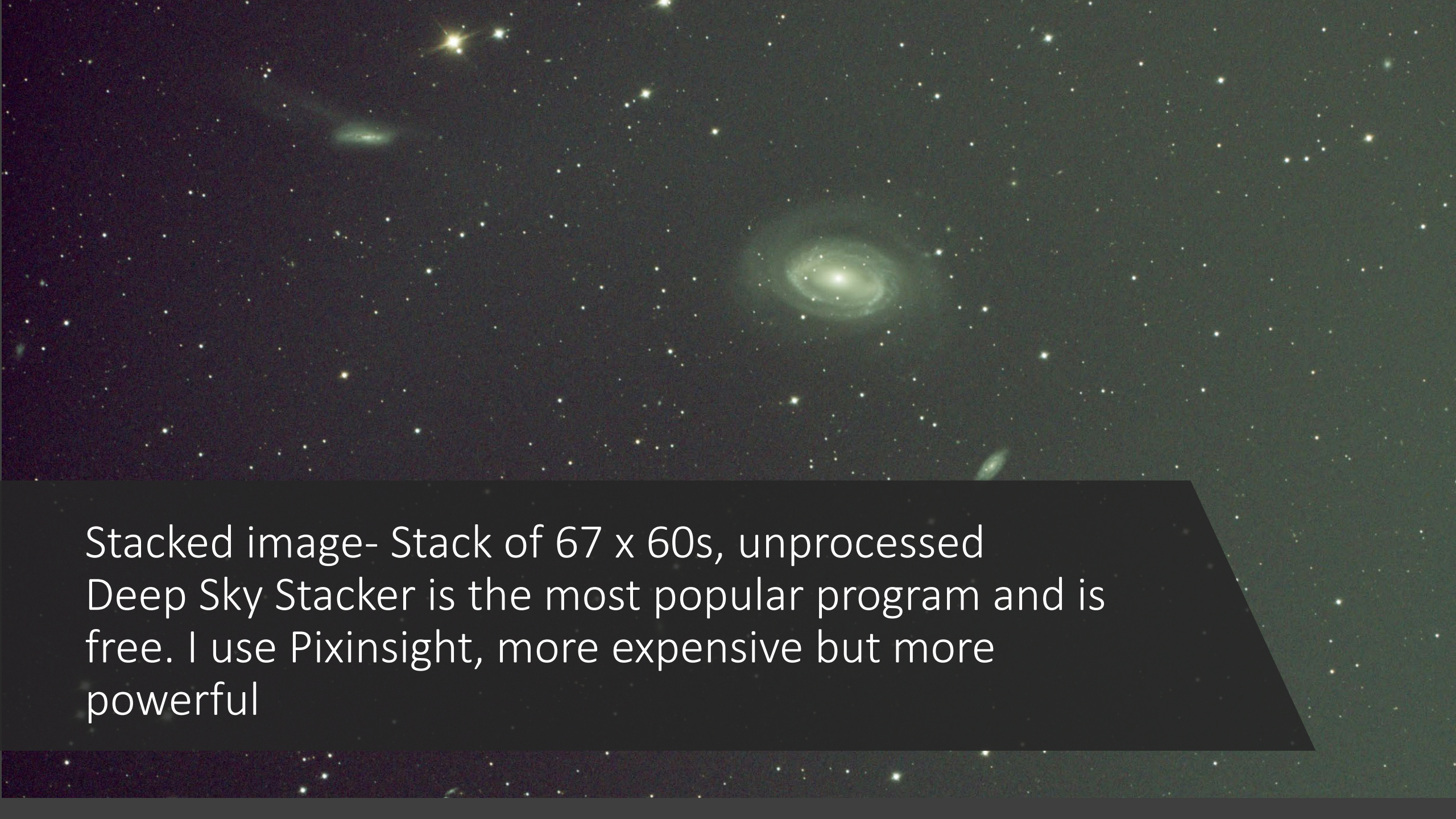


Stack of 12 exposures with random high noise (low signal to noise ratio)



stacked (averaged) image has low noise and improved signal to noise ratio

Single image 60s of NGC4725



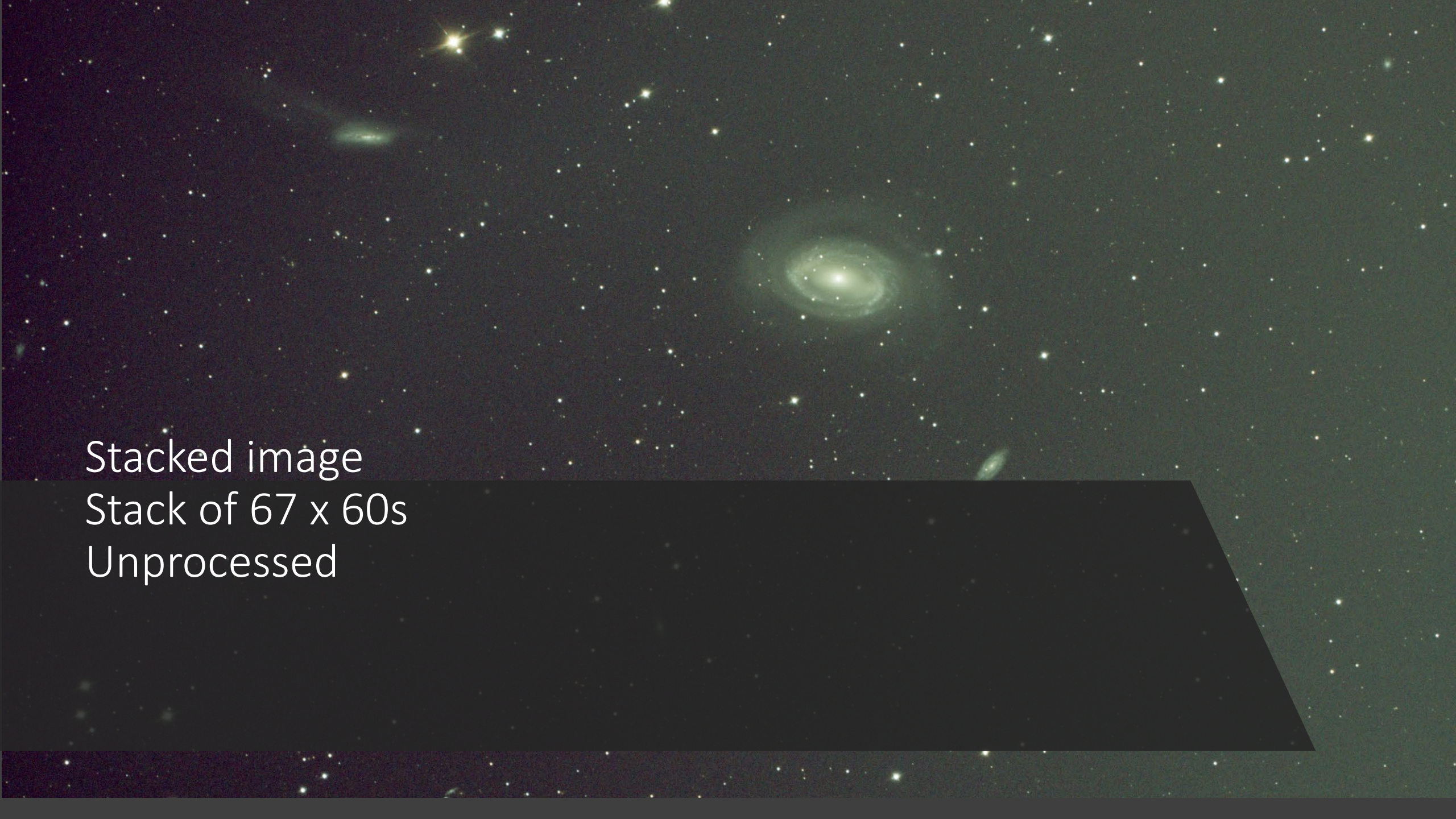
Stacked image- Stack of 67 x 60s, unprocessed
Deep Sky Stacker is the most popular program and is free. I use Pixinsight, more expensive but more powerful

Image processing

- General Photography Software
  - Photoshop
  - Gimp
- Astronomical Software Programs
  - Pixinsight
  - APP Astro Pixel Processor
  - Nebulosity
  - Astronomy tools
- Different price points

Image processing

- Calibrate images with Bias Dark and Flat Fames
- Stack Calibrated images
- Integrated stack is then histogram stretched to bring out the faint faint nebulas
- Gradient removal
- Colour saturation, contrast enhances, sharpening and noise reduction


Stacked image
Stack of 67 x 60s
Unprocessed

Keep it simple to start

- Use what you have
- Learn the sky
- Gather some of the free software.
- Join the RASC
- Find Facebook groups
- Spend way too much time on Youtube

Further resources – Spend LOTS of time on Youtube

- Trevor Jones or “Astrobackyard”
  - Uses his DSLRs with telescopes
  - Urban astronomer
  - Canadian
- Dylan O’Donnell-Image Processing
- Image processing and techniques

Further resources – Spend LOTS of time on Youtube

Peter Zelinka

Cuiv the Lazy Geek

My first image ever using a camera phone at the eyepiece