



Fundamentals of Astrophotography

By Jim Mack

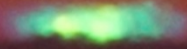
Digital Camera in Hand, Lets Start

- Start with a sunset, You've probably done this
- Be careful so not to damage your eyes or the camera



OK, Break Out The Long Lens

- Then go Hunting for the Elusive Green Flash
 - The Green Flash is an optical phenomena that transiently occurs around the moment of Sunset or Sunrise caused by Earth's atmosphere
 - Oh, there's an Old Wives Tail about seeing the Green Flash



All You Need is a DSLR Camera & Tripod

- Your largest lens used about 50mm, using a longer lens means shorter exposure time
- Use a fast aperture of f2.8 – f4
- Set the White Balance to Daylight or Auto
- Set the Exposure length to 15 – 30 seconds
- Shoot in RAW image format
 - A camera RAW image is an unprocessed photo. It contains the raw image data captured by the camera's sensor and saved in a proprietary file format specific to camera manufacture
 - By default, most digital cameras save as JPEG

All You Need is a DSLR Camera & Tripod

- Set ISO at 1600
- Use a 10 sec delay or a remote to avoid vibration
- Use Manual Focus, center on a bright star, using “Liveview” at high magnification get focus and tape focus ring with blue painters tape
- Local conditions (light pollution) will directly effect the camera settings and outcome of your image
- Always do some test images, Over Exposing is easy

All You Need is a DSLR Camera & Tripod

- Your first image: Now that you're all setup take your first image. Check it, how does it look? Under or over exposed?
- Check the histogram, adjust your ISO and aperture. The maximum level should be around 1/3 to center

View the image
you just shot



Histogram of
the image you
just shot



- Take another Shot! Does it look Good? Take more Save them for later for stacking (advanced)

All You Need is a DSLR Camera & Tripod

- Your image may have a brownish sky due to light pollution
- To fix this:
 - You can create a Custom White Balance or....
 - You can image in the Camera RAW format and correct the white Balance during post processing using the Camera's software
 - Actually you can always image in both RAW & jpg
 - Just an FYI, a RAW image could be 5 to 10x larger than a JPG image of the same

Something Different and Easier

- The Belt of Venus, the rosy arch visible in the opposite sky above the horizon after sunset or before sunrise hovering above Earth's shadow on the atmosphere



All You Need is a DSLR & Tripod

➤ Night Scape, Rocket Launch and Star Trails



All You Need is a DSLR & Tripod

➤ Night Scape, with the Moon, Mercury and Venus



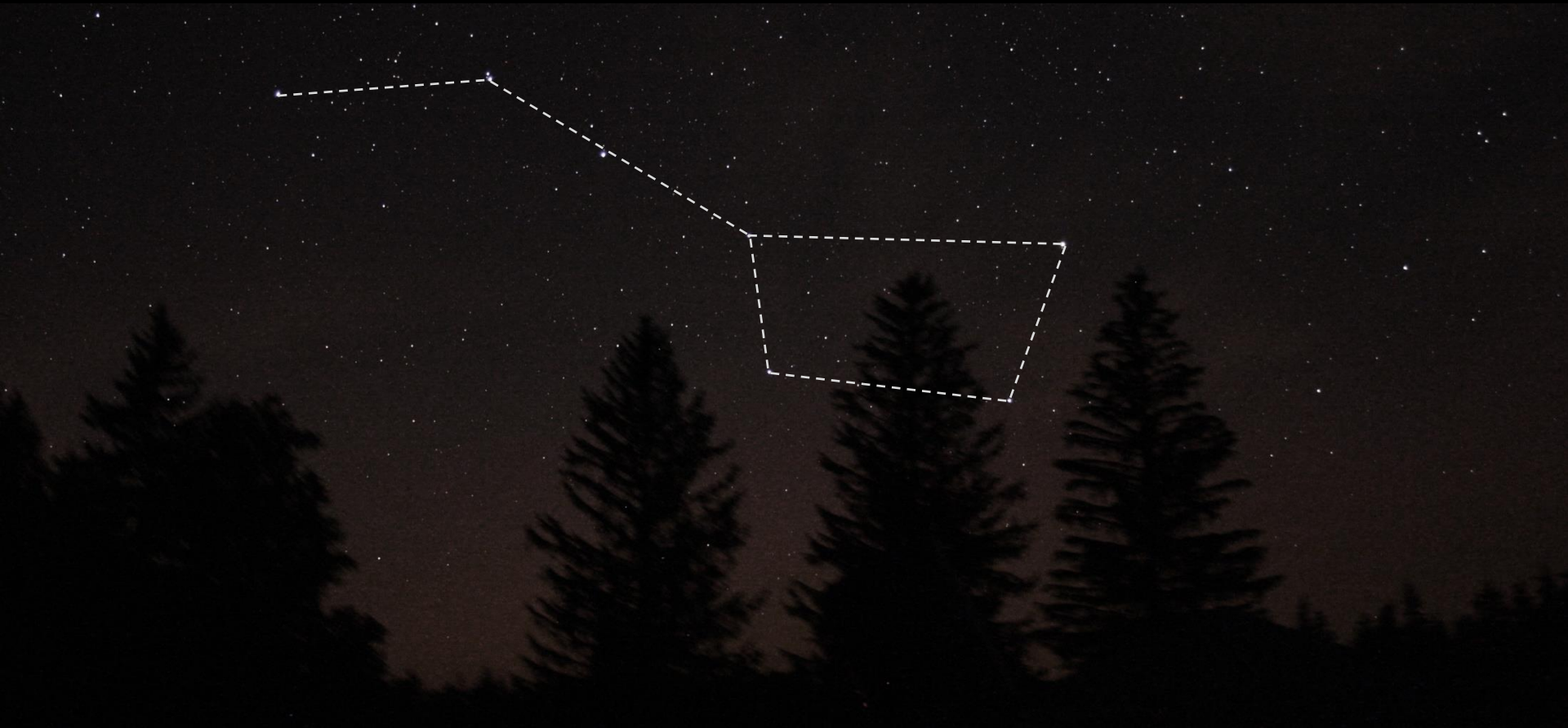
Wide Field Constellation



Image courtesy Dave Deitz

Nightscape, Constellations, Asterisms

➤ Ursa Major and The Big Dipper



Look, That Looks Like ... Asterisms

- Asterisms, a Group of Stars that form a recognizable pattern or shape



Night Scape with the Moon and Venus



Our Moon is a Great Object to Image

➤ 1.4 Day old Moon and Mercury



← Mercury

Our Moon is a Great Object to Image

➤ 28 Day old Moon



Keep Looking Up

- Plan ahead, for information on What's Up this month check Astronomy Magazine, The Bishop or the "Local Group of Deep Sky Observers" (LGDSO)
- Above all have some fun, who can write backwards



You Want More, Get a Camera Tracker!

- A Small Equatorial Camera Tracking Mount
- Ranging in price from \$250 to \$500
- Payload capacity 6 to 10 pounds
- Allowing you to take longer exposures up to 5+ min



Now That You have a Tracker

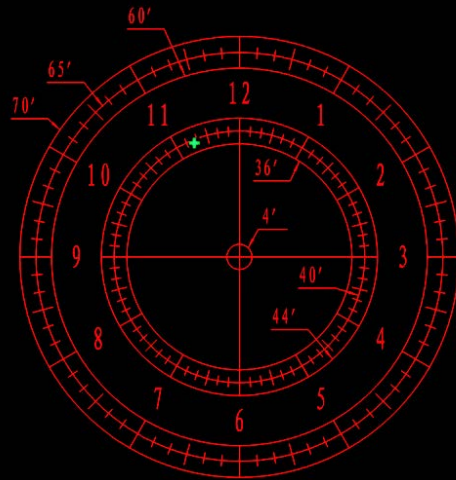
- Setup Tracker as instructed, Level, Balance & Polar Alignment are Very Important
- You Should Use an Intervalometer allowing more control when imaging
- Mirror Lock up will stop some vibrations
- Your maximum exposure will Depend on the Sky
- Your largest lens about 200mm or what the Tracker can hold
- Make sure you have good focus, using "Liveview" zoom in to view the image
- Use Blue Painter's Tape to hold the focus ring
- Over Exposing is easy, Always do some test images



Polar Align Your Camera Tracker!

- With your Camera and Tracker mounted onto a Sturdy Tripod
- Setup and Polar Align, Polar Align, Polar Align!
- Good Polar Alignment means Better images & point stars

Smart Phone App
Makes it Easier.
(Ioptron)



Night Scape Venus, Jupiter & Mars



Night Scape Mars, Pleiades & Hyades

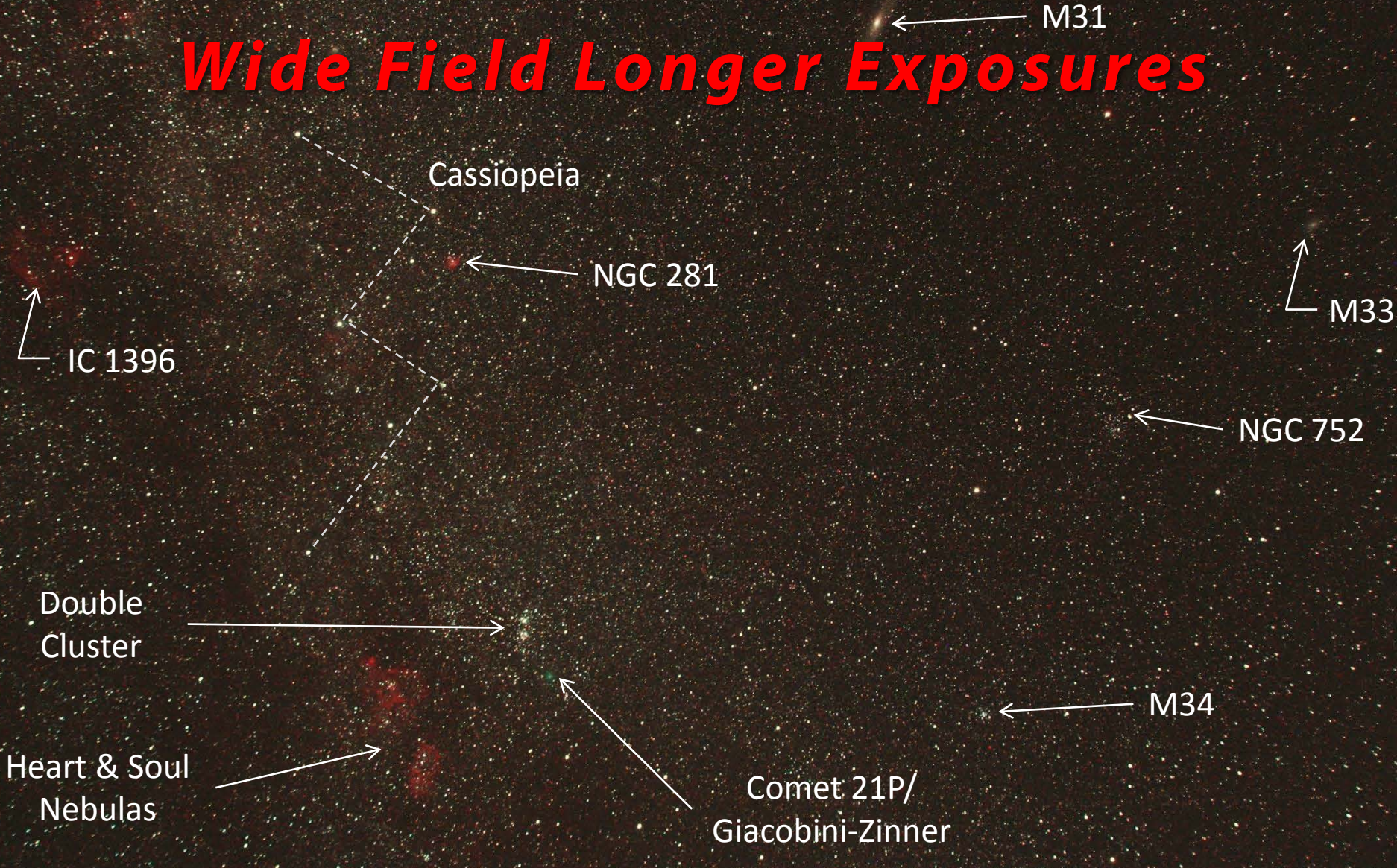


Wide field Sky Scape Long Exposures

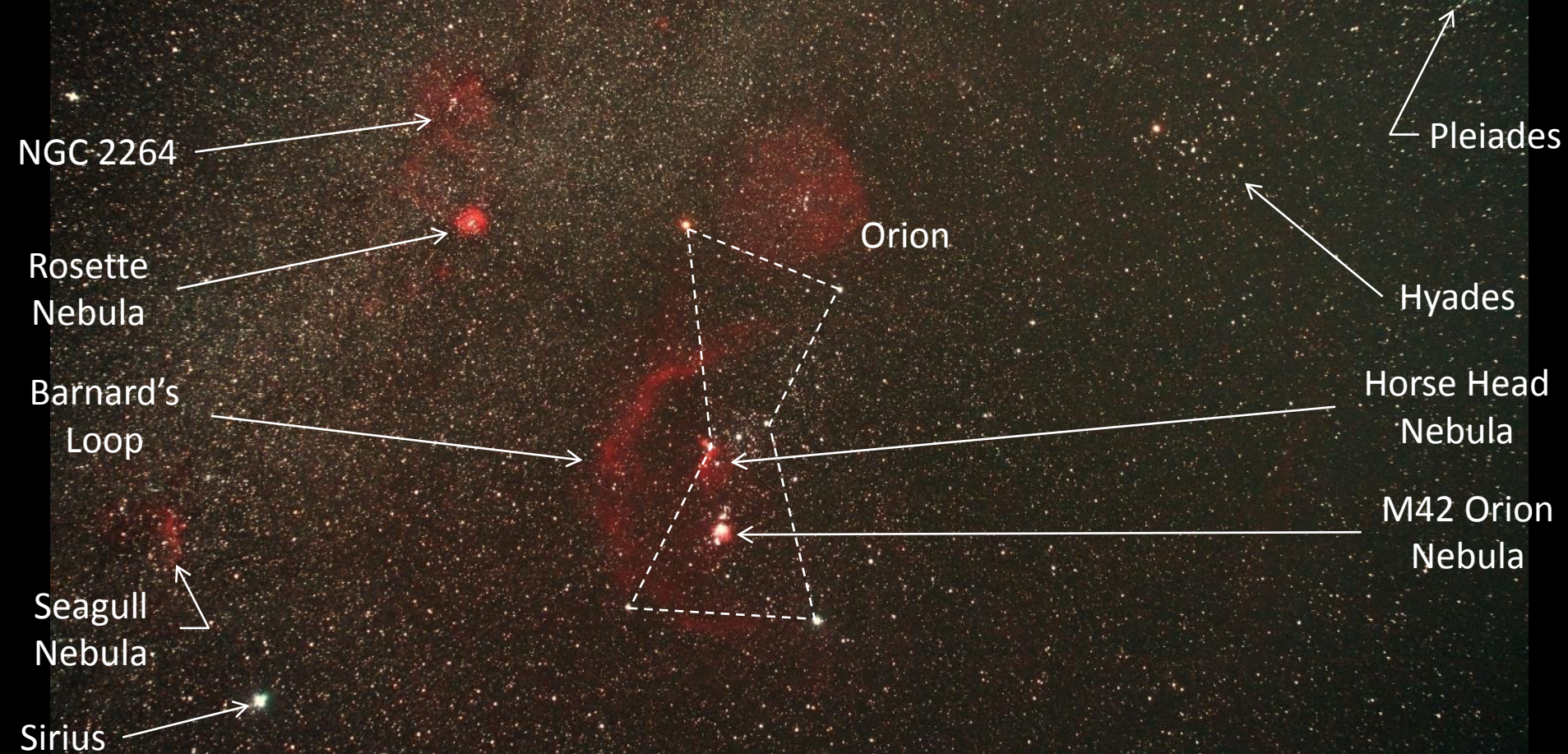
➤ Lake & Sky Scape, 2min Exposure



Wide Field Longer Exposures



Wide Field Longer Exposures



Wide Field Many Exposures

- Milky way, 30sec Exposure from Myakka 15mm
- Stacking, the process of taking many images of the same object and combining all the Data into One
- Something for the Advanced Program

One 30sec Exposure



Thirty 30sec Exposures Stacked



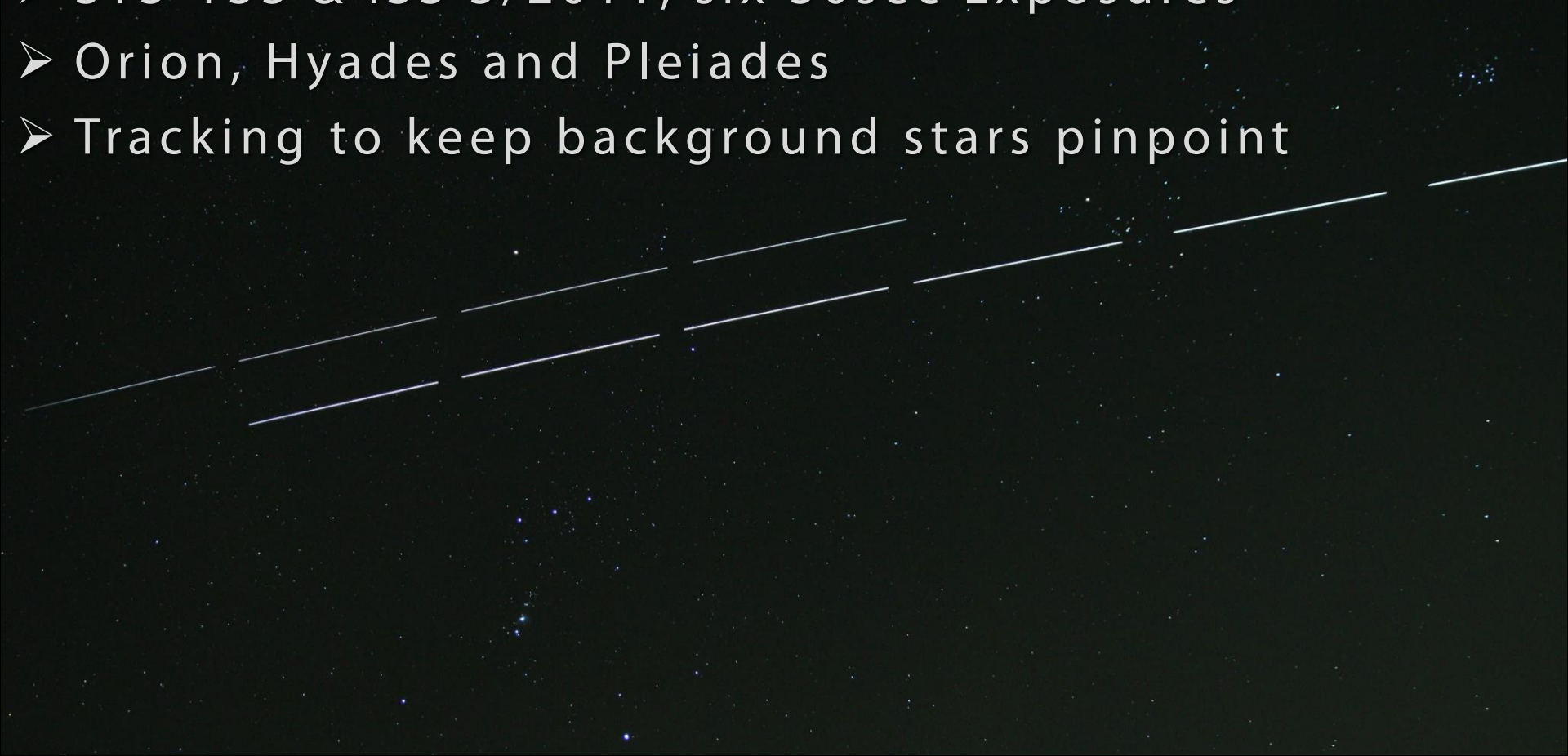
Night Scape Summer Milky Way



Image courtesy Andy Harrell

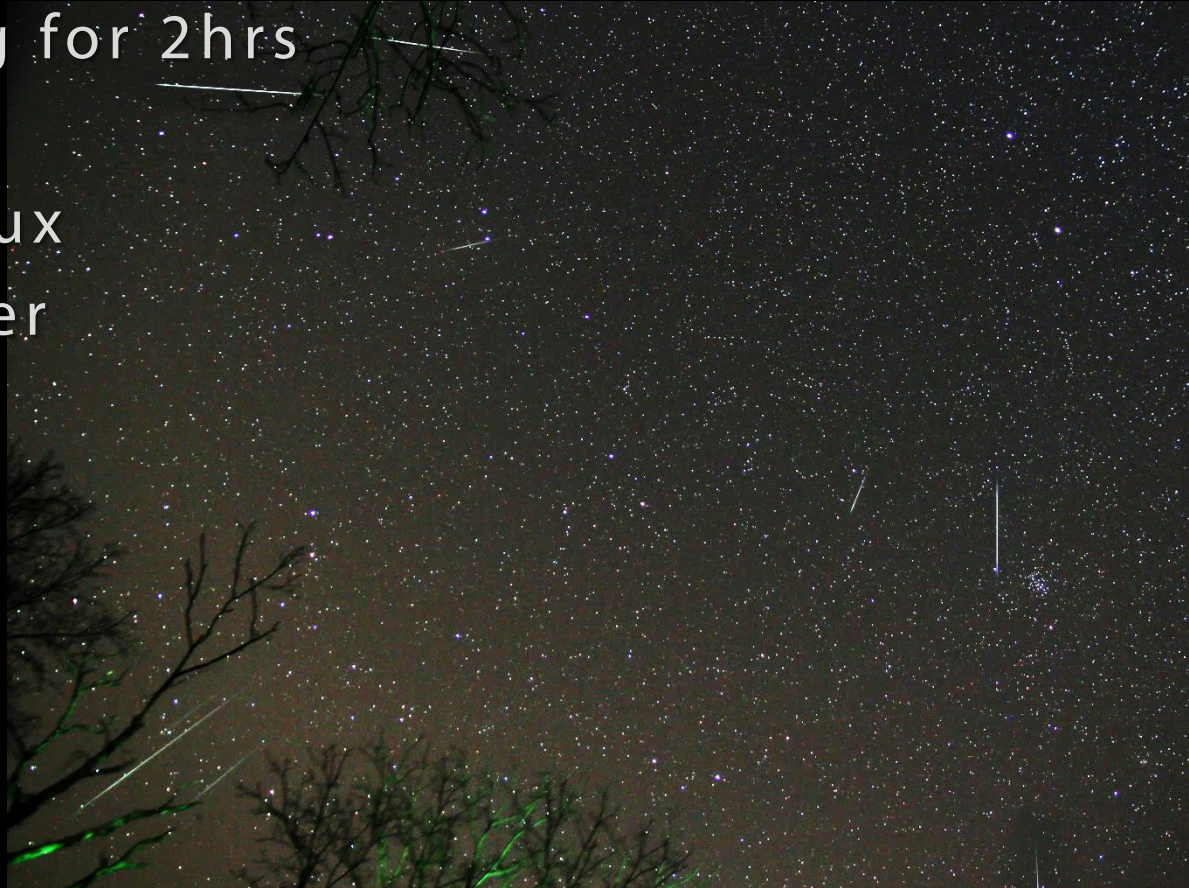
Imaging an Event Many Exposures

- STS-133 & ISS 3/2011, six 30sec Exposures
- Orion, Hyades and Pleiades
- Tracking to keep background stars pinpoint



Long Event Many Short Exposures

- Geminids Meteor Shower, Many 1min Exposures
- Tracking & imaging for 2hrs
- Nine Meteors
- Stars Castor & Pollux
- M44 Beehive Cluster
- Photoshop is Great



On The Fly Many Exposures Sky Scape

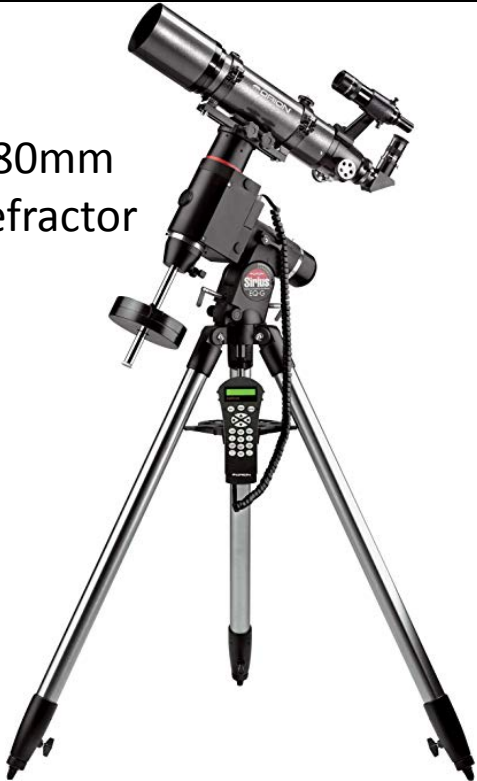
- Multiple 1 min exps, Aurora Borealis spans 100+ deg
- You Never Know When Something Might Happen
- Stitched six images, Photoshop is my friend!



Its Time to Get Real, Close Ups!

- Now you Want a Telescope and Equatorial Mount
- What can you do with that telescope?

80mm
refractor



7" reflector



8" Schmidt-
Cassegrain



Think of a Telescope as a Camera Lens

- Think of your Telescope as a large Camera Lens

80mm refractor 80mm f6.8 = **544mm** focal length

7.5" reflector 190mm f5.3 = **1007mm** focal length

8" Schmidt 203mm f10 = **2030mm** focal length

Cassegrain

- All Types of Telescopes will work But
- You will need these, Intervalometer
2" adapter with T-ring and 2x Barlow
with T-ring plus More



What You Can Image with a Telescope

- Lunar, Planetary and Deepsky
- All Types of Telescopes will work But.....



What You Can Image with a Telescope

- The 80mm Refractor, easy to use not heavy
 - Good for Moon, and Deepsky objects
 - Not great for Planetary Imaging but can be done
- The 7" Reflector, not as easy to use by design
 - Can image Moon and Deepsky objects w/effort
 - Can image Planetary but not very well w/effort
- The 8" Schmidt-Cassegrain, easy to use a bit heavier
 - Can image most objects in the sky
 - Best for Planetary Imaging
 - **I Think The Refractor and SCT are best for imaging**

Start With The Moon

- The Moon is Big, Bright and looks Different Nightly!
- Moon Phases Before & After Full are better because the shadows bring out the details



Get Closer, look at the detail

➤ Now Go For a Close up, Target Along the Terminator



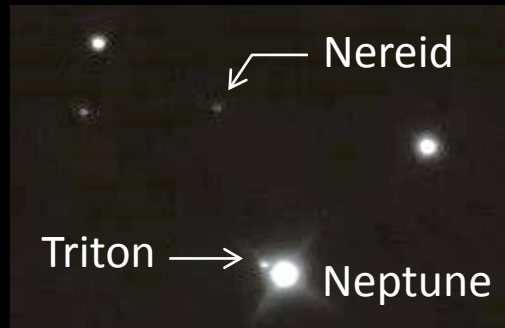
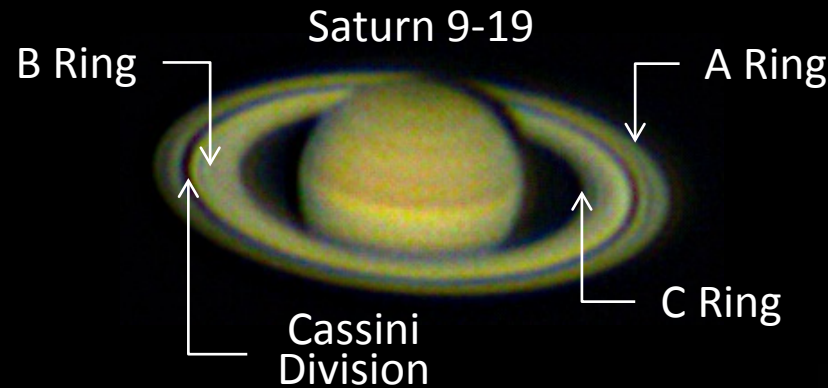
A Different But Interesting Moon

- Imaging The Moon is relatively easy, short exposures
- Some Special events to look for and image
 - Total Lunar Eclipse, or an ISS Transit



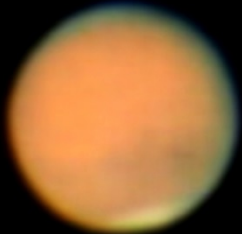
Planetary Imaging - Advanced

- Imaging the Planets Requires more Magnification
- The Planets are Much Smaller and Dimmer



Mars Opposition 2018

Dust Storm



Planetary Imaging Camera Choice

- Imaging Planets with a DSLR is a bit harder than it seems. The planets are small and dim, you need more power and almost perfect seeing
- So the digital CMOS dedicated planetary cameras are your Best Option. But now you need your laptop to power and operate these cameras and software
- And you still need more equipment.....



How About The Sun?

- **NEVER EVER LOOK AT THE SUN THRU A TELESCOPE UNLESS YOU HAVE A PROPER SOLAR FILTER!!!**
- Either Glass or Film They Both Block 99% of the Heat and Light. YES You Can Look at and Image The Sun Safely!!! Any Questions Please Contact LGDSO!



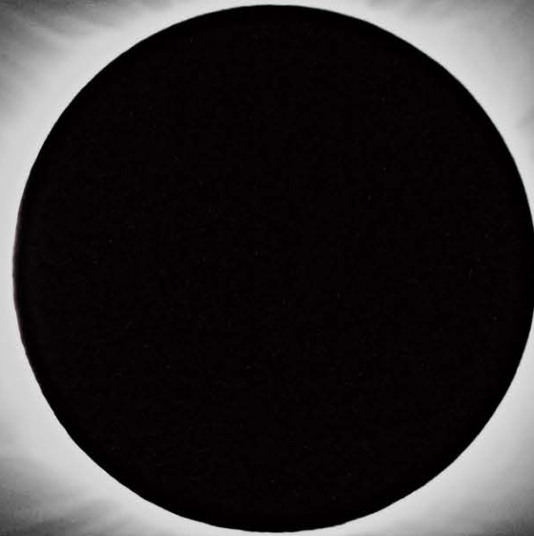
Our Sun in White Light

- **NEVER EVER LOOK AT THE SUN THRU A TELESCOPE!**
- These images were taken thru a refractor with a white light solar filter



Total Eclipse of The Sun 2017

↖
Regulus a Double Star in Leo



Total Solar Eclipse The Diamond Ring

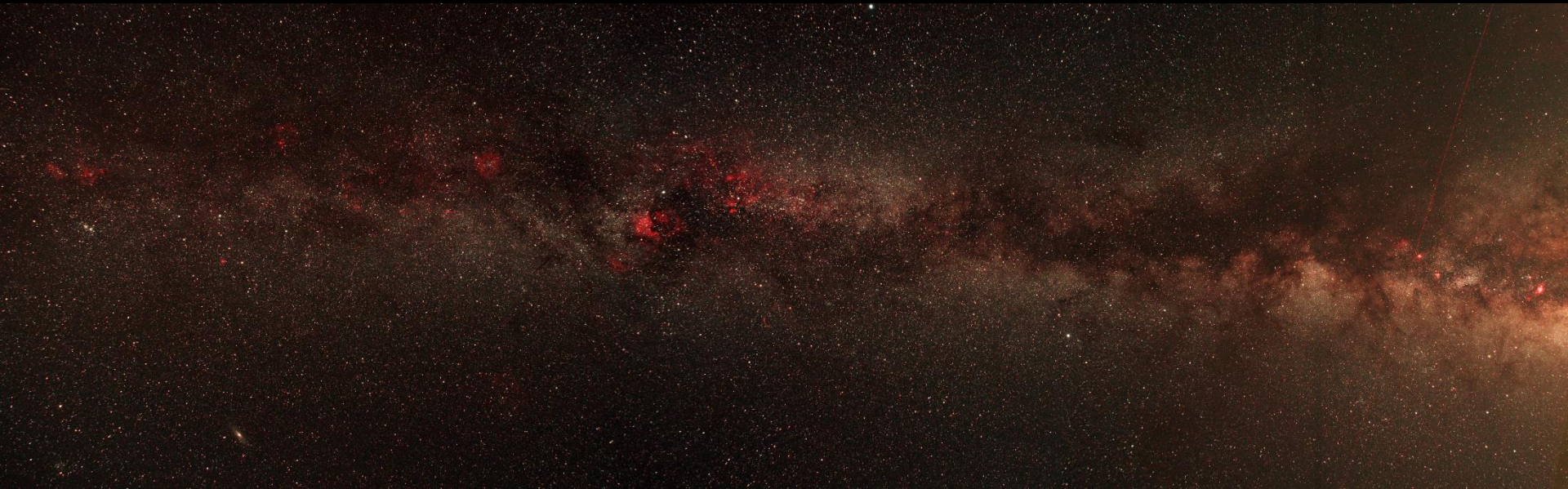


Mercury Transit of The Sun 11-11-19

- This image of third contact was taken thru a refractor with a 0.2 angstrom Hydrogen alpha solar filter



***Advanced Deepsky Imaging
Are You Ready
To Get Down With The Sickness***





Clear Skies

***A pdf copy of this presentation is available
on the LGDSO web site***

Links

Imaging Support

- <https://astrobackyard.com/7-astrophotography-tips/>
- http://www.astropix.com/html/i_astrop/quick.html
- <https://www.skyatnightmagazine.com/astrophotography/a-beginners-guide-to-astrophotography/>
- <https://www.skyandtelescope.com/astronomy-blogs/imaging-foundations-richard-wright/choose-iso-astrophotography/>
- <https://www.skyandtelescope.com/astronomy-resources/astrophotography-tips/astrophotography-stacking-signal/>
- <https://www.skyandtelescope.com/astronomy-blogs/imaging-foundations-richard-wright/astrophotography-gentle-introduction-noise/>
- <https://www.skyandtelescope.com/astronomy-blogs/imaging-foundations-richard-wright/astrophotography-understanding-iso/>
- https://m.youtube.com/channel/UCn3npsPixgoi_xLdCg9J-LQ

Links

Good Information

- <http://lgdso.com/index.html>
- <http://www.cleardarksky.com/c/HRHObFLkey.html?1>
- <https://www.spaceweather.com>
- <https://apod.nasa.gov/apod/archivepix.html>
- <http://www.skymaps.com/downloads.html>
- <http://deepskystacke.free.fr/english/index.html>
- <https://sites.google.com/site/sequatorglobal/>
- http://xjubier.free.fr/en/site_pages/solar_eclipses/TSE_2024_GoogleMapFull.html

Links

Vendors

- <https://www.highpointscientific.com>
- <https://www.telescope.com/mobile/home.jsp>
- <https://www.meade.com/>
- <https://www.skywatcherusa.com>
- <https://www.celestron.com/portal/>
- <https://www.cloudynights.com>