

A long-exposure photograph of a night sky showing numerous concentric star trails in shades of blue and white. The trails are centered around a point in the sky, likely the North Star. In the foreground, the dark silhouettes of hills and trees are visible. A small, brightly lit building is nestled among the trees on the left side of the frame. A faint red light trail is visible in the lower-left corner.

BEGINNER DIGITAL ASTROPHOTOGRAPHY

Mike Weasner
<http://www.weasner.com/co>

Cassiopeia Observatory
email: mweasner@mac.com

WORKSHOP OUTLINE

- What is Astrophotography?
- What do you need to do Astrophotography?
- Some useful optional items and techniques
- Using software to improve your images
- Some resources
- Door Prizes!! (must be present to win)
- “Play Time” after sunset using your cameras

(Unless otherwise credited, all astrophotos by Mike Weasner)

WHAT IS ASTROPHOTOGRAPHY?

- It is photography of astronomical objects (Moon, planets, stars, nebulae, galaxies, etc)
- Development began in the mid-1800s using telescopes and metal photographic plates
- Glass plates used in the 1900s, roll film used by amateur astronomers mid-1900s
- Special (expensive) CCD imagers began being used in the 1970s at professional observatories
- As the price of CCD imagers dropped, amateur astronomers started using them in the 1990s
- Digital cameras began being used by amateur astronomers in the mid-1990s

WHAT IS ASTROPHOTOGRAPHY?

(CONTINUED)

- This early astrophotograph was taken in 1880 by Henry Draper and shows the Orion Nebula



WHAT IS ASTROPHOTOGRAPHY? (CONTINUED)

- I began doing simple astrophotography in the early 1960s using a 3" reflector telescope and a small "box" film camera



WHAT IS ASTROPHOTOGRAPHY? (CONTINUED)

- I continued using various film cameras for my astrophotography through the late 1990s
- I began the switch to digital cameras in the mid-1990s with a Casio QV-10 digital camera and my ETX 90mm telescope



WHAT IS ASTROPHOTOGRAPHY? (CONTINUED)

- By the early 2000s I had made the switch totally to digital cameras
- Currently I use a Nikon D7200 Digital Single Lens Reflex (DSLR) camera and an Apple iPhone 6s Plus for my astrophotography



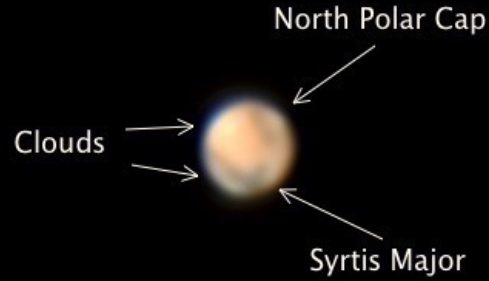
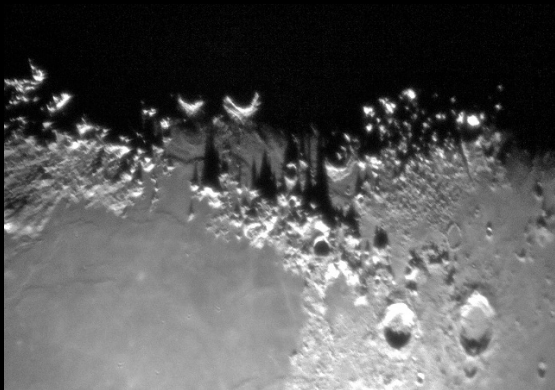
WHAT IS ASTROPHOTOGRAPHY? (CONTINUED)

- Nikon D7200 DSLR



WHAT IS ASTROPHOTOGRAPHY? (CONTINUED)

- iPhone

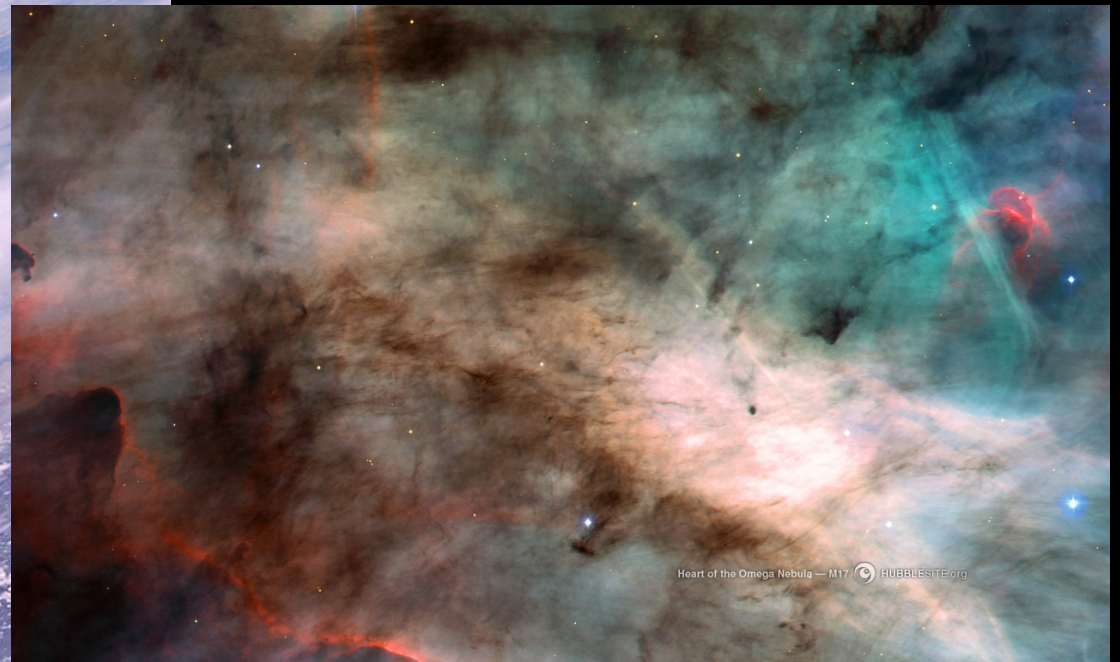
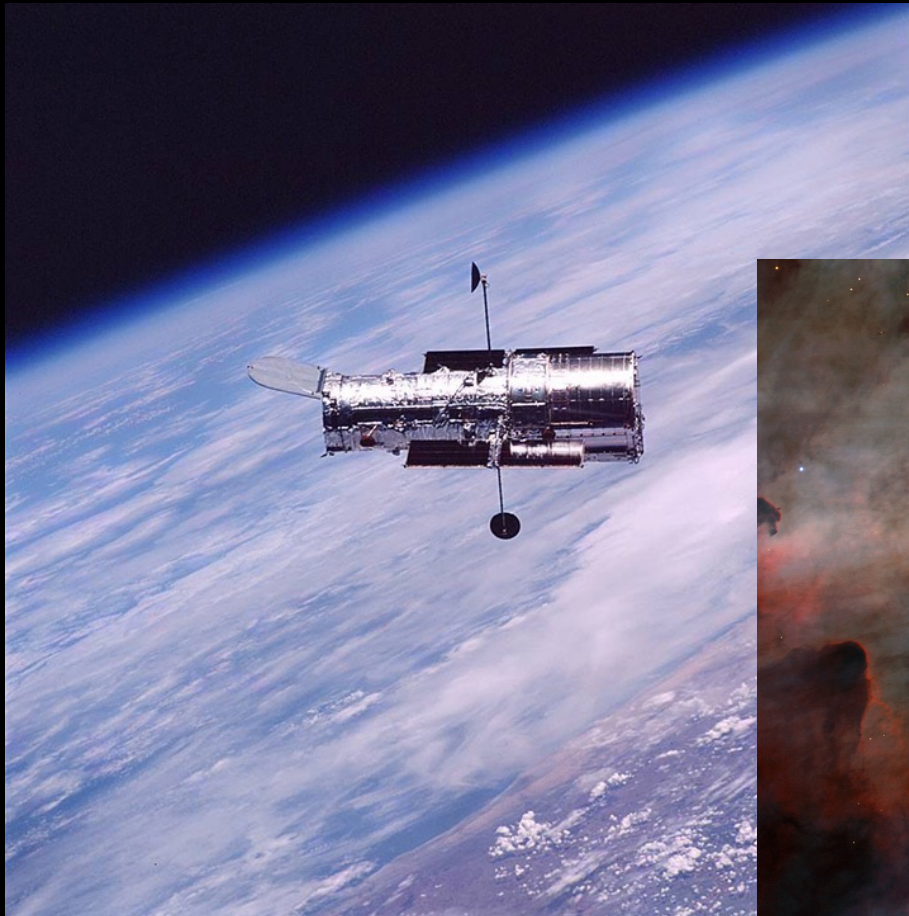


WHAT DO YOU NEED TO DO ASTROPHOTOGRAPHY?

- Depends...
- Lets look at some examples using astrophotographs of the Swan Nebula (Messier Catalog #17)

FOR JUST \$2,000,000,000 (NOT
INCLUDING OPERATING EXPENSES)

- Hubble Space Telescope



FOR JUST A FEW HUNDREDS OF MILLIONS OF DOLLARS

- European Southern Observatory 3.58m New Technology Telescope at the La Silla Observatory



FOR ONLY MILLIONS OF DOLLARS

- WIYN 0.9m Telescope at Kitt Peak



ABOUT \$10,000

- Astro-Physics EDF 152mm Refractor Telescope with CCD imager (image credit Brad Wallis and Robert Provin)



FOR HUNDREDS TO THOUSANDS OF DOLLARS

- My D7200 DSLR on my former 8" telescope (now 12")



FOR EVEN LESS COST (MAYBE)

- iPhone on my former 8" telescope (now 12")



OK, SO WHAT DO YOU REALLY NEED?

- Depends on what you already have and what you want to photograph
- In fact, you may already have what you need to get started
- Digital cameras and even smartphones can make you an ASTROPHOTOGRAPHER!!!

TYPES OF ASTROPHOTOGRAPHY

- Simple Night Sky Astrophotography
- Tracked (or Piggyback) Astrophotography
- Prime Focus Astrophotography
- Afocal Astrophotography
- Eyepiece Projection Astrophotography

SIMPLE NIGHT SKY ASTROPHOTOGRAPHY

- What you need:
 - Telescope: none
 - Camera: shutter speed 30 seconds or "Bulb", ISO ~800 or higher; smartphone with special apps
 - Mount: tripod, GorillaPod (\$20), or "bean bag"; handheld sometimes works



SIMPLE NIGHT SKY ASTROPHOTOGRAPHY (CONTINUED)

- What you can photograph
 - Moon and brighter planets
 - Comets
 - Constellations (stars)
 - Star trails
 - Meteor Showers
 - Aurora (when visible)
 - Zodiacal Light (when visible)
 - Satellite passes
 - Milky Way

SIMPLE NIGHT SKY ASTROPHOTOGRAPHY (CONTINUED)

- What you do to take the photographs
 - Mount camera on tripod (preferred)
 - Focus camera lens to infinity (turn off Auto-Focus if possible)
 - Set camera lens to wide open f/ stop
(stop down one or two stops to sharpen lens)
 - Set to high ISO setting
 - Point the camera at your target in the sky
 - Adjust camera lens focal length as desired
 - Start the exposure, typically several seconds or minutes
 - Check image and adjust settings and focal length as needed

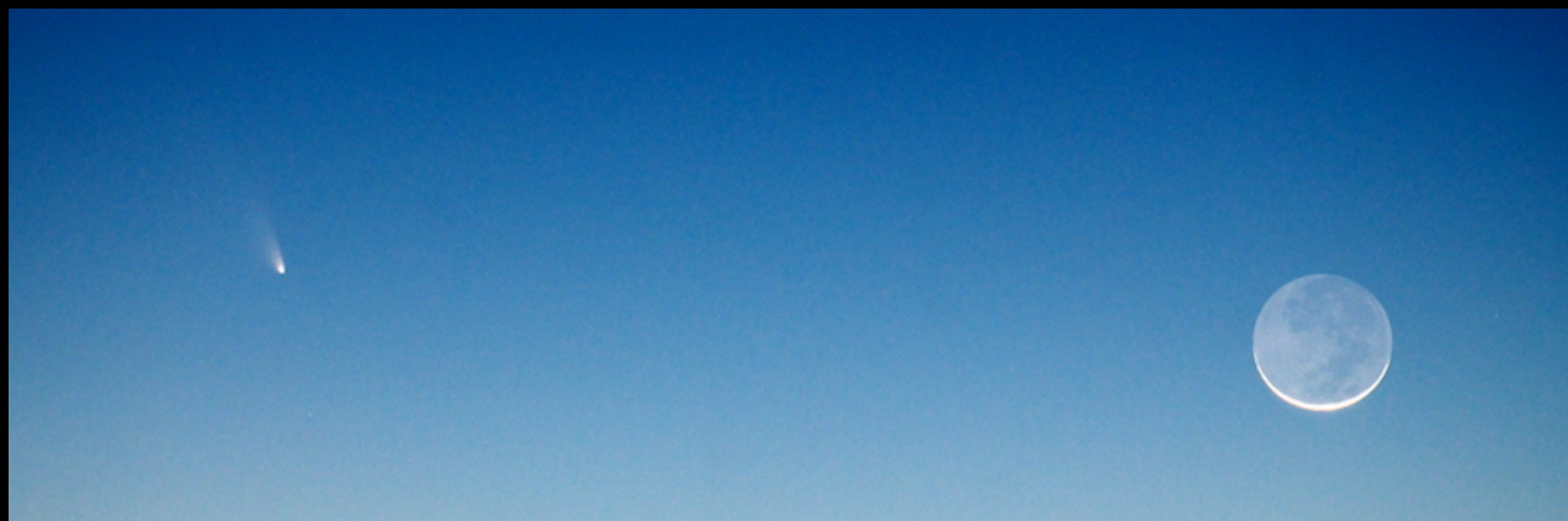
SIMPLE NIGHT SKY ASTROPHOTOGRAPHY EXAMPLES

- Moon, Venus, and Jupiter in evening sky taken with D70 DSLR (1/5sec, ISO 640, 29mm lens)



SIMPLE NIGHT SKY ASTROPHOTOGRAPHY EXAMPLES (CONTINUED)

- Comet C/2011 L4 PanSTARRS and the Moon, D7000 DSLR (1 second, ISO 400, 220mm lens)



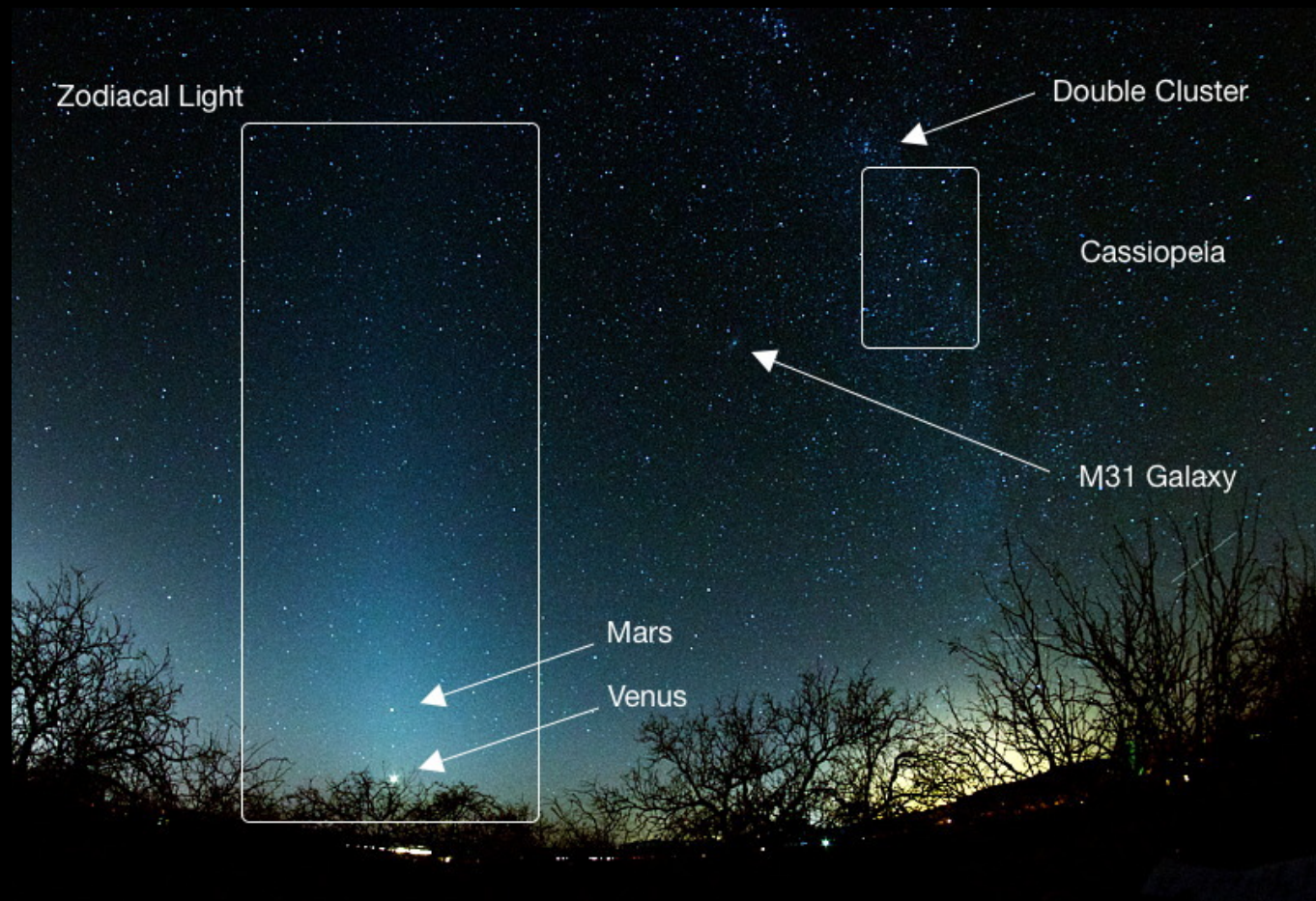
SIMPLE NIGHT SKY ASTROPHOTOGRAPHY EXAMPLES (CONTINUED)

- Orion with D7000 DSLR
(25 seconds, ISO 500,
18mm lens)



SIMPLE NIGHT SKY ASTROPHOTOGRAPHY EXAMPLES (CONTINUED)

- Zodiacal Light, and other, D7000 DSLR (30 seconds, ISO 1600, 8mm fisheye lens)



SIMPLE NIGHT SKY ASTROPHOTOGRAPHY EXAMPLES (CONTINUED)

- International Space Station (ISS), Dragon cargo ship, airplanes, D7000 DSLR (89 seconds, ISO 800, 18mm lens)



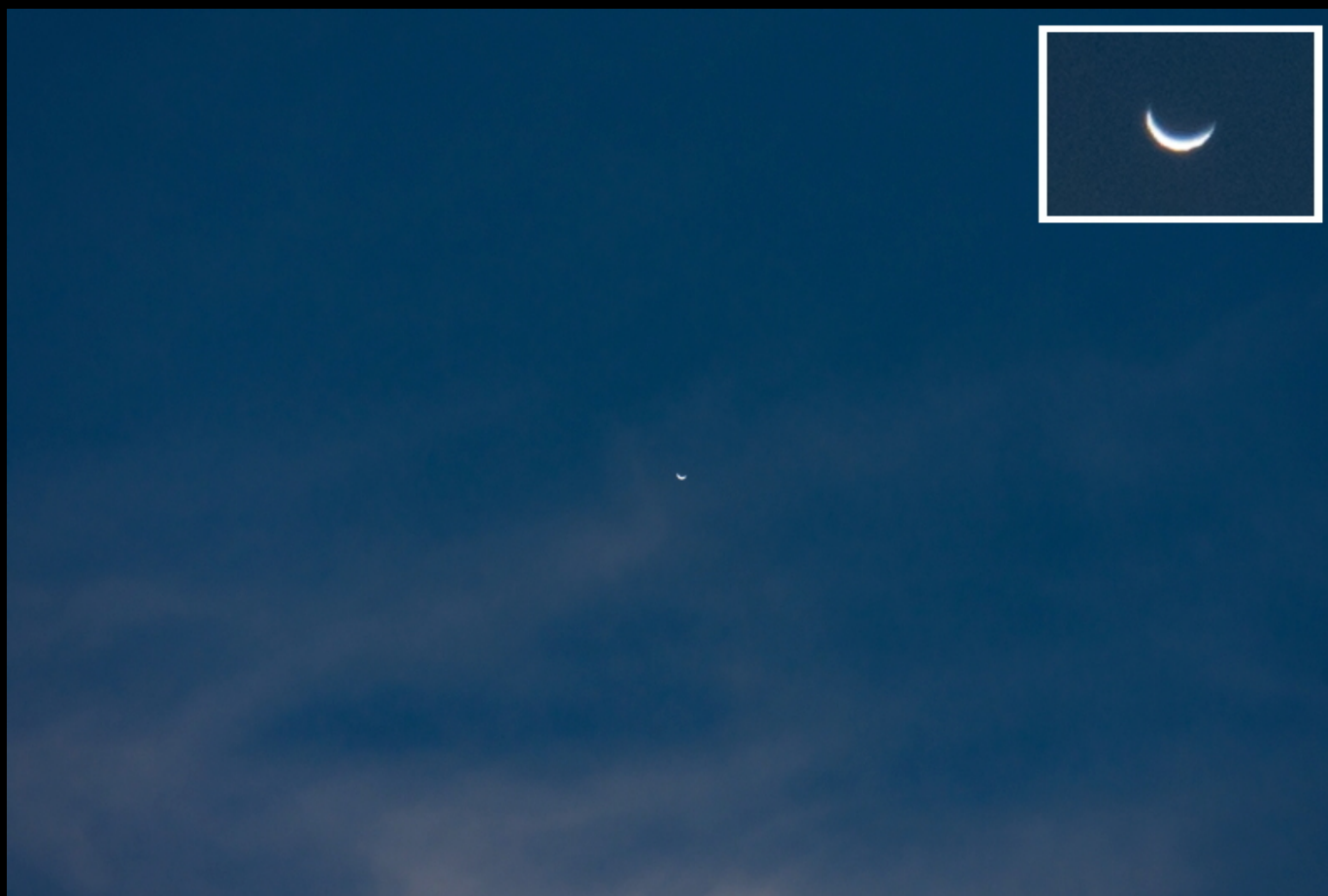
SIMPLE NIGHT SKY ASTROPHOTOGRAPHY EXAMPLES (CONTINUED)

- Milky Way, D7000 DSLR (60 seconds, ISO 5000, 8mm fisheye lens)



SIMPLE NIGHT SKY ASTROPHOTOGRAPHY EXAMPLES (CONTINUED)

- Venus crescent phase, D7200 DSLR (1/1000sec, ISO 400, 600mm lens)



SIMPLE NIGHT SKY ASTROPHOTOGRAPHY EXAMPLES (CONTINUED)

- Constellations, iPhone 6s Plus (NightCap Pro app, 30 seconds)



SIMPLE NIGHT SKY ASTROPHOTOGRAPHY EXAMPLES (CONTINUED)

- Star trails, satellites, airplanes, iPhone 5s (NightCap Pro, 1 hour)



TRACKED ASTROPHOTOGRAPHY

- What you need:

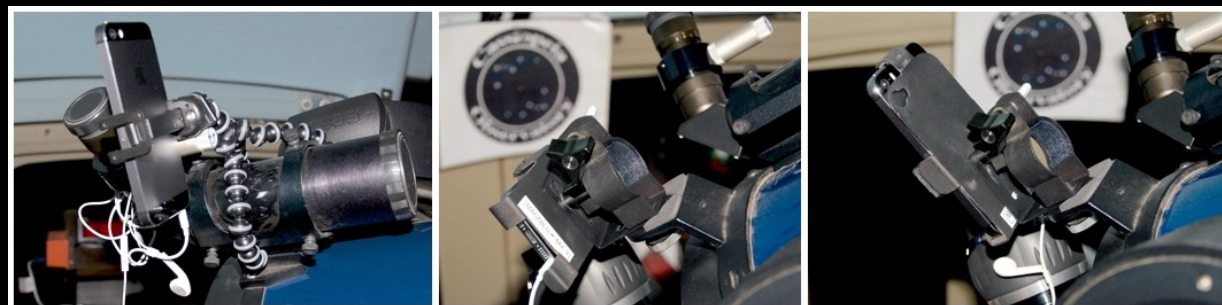
- Telescope: equatorial tracking mount (manual or motor driven) or tripod-mounted star tracker (Vixen, iOptron, others \$300-700)



- Camera: shutter speed 30 seconds or "Bulb", ISO ~800 or higher; smartphone with special apps



- Mount: piggyback adapter (\$30-up, Levenhuk, GorillaPod (\$20)



TRACKED ASTROPHOTOGRAPHY (CONTINUED)

- What you can photograph
 - Comets
 - Constellations (stars)
 - Milky Way (wide angle lens)
 - Some Deep Sky Objects (DSOs) (telephoto lens)

TRACKED ASTROPHOTOGRAPHY (CONTINUED)

- What you do to take the photographs
 - Place camera on mount (tracking on or manually guide using star in eyepiece)
 - Focus camera lens to infinity (turn off Auto-Focus if possible)
 - Set camera lens to wide open f/ stop
(stop down one or two stops to sharpen lens)
 - Set to high ISO setting
 - Point the telescope & camera at your target in the sky
 - Adjust camera lens focal length as desired
 - Start the exposure, typically minutes
 - Check image and adjust settings and focal length as needed

TRACKED ASTROPHOTOGRAPHY EXAMPLES (CONTINUED)

- Pleiades & Comet C/2014 Q2 Lovejoy, D7000 DSLR (piggybacked on telescope, 5 minutes, ISO 6400, 58mm lens)



TRACKED ASTROPHOTOGRAPHY EXAMPLES

- Orion and some DSOs, D7200 DSLR (iOptron SkyTracker Pro, 5 minutes, ISO 3200, 35mm lens)



TRACKED ASTROPHOTOGRAPHY EXAMPLES (CONTINUED)

- Milky Way, D7000 DSLR (telescope, 5 minutes, ISO 500, 18mm lens)



TRACKED ASTROPHOTOGRAPHY EXAMPLES (CONTINUED)

- M31 Andromeda Galaxy, D7200 DSLR (SkyTracker Pro, 30 seconds, ISO 12800, 300mm lens)



TRACKED ASTROPHOTOGRAPHY EXAMPLES (CONTINUED)

- More iOptron SkyTracker Pro images
- Winter Milky Way (D7200 DSLR, 10 minutes, ISO 1600, 8mm fisheye lens)



TRACKED ASTROPHOTOGRAPHY EXAMPLES (CONTINUED)

- More iOptron SkyTracker Pro images
- Double Cluster (D7200 DSLR, 30 seconds, ISO 1600, 300mm lens)



TRACKED ASTROPHOTOGRAPHY EXAMPLES (CONTINUED)

- More iOptron SkyTracker Pro images
- Orion Nebula (D7200 DSLR, 30 seconds, ISO 4000, 300mm lens)



TRACKED ASTROPHOTOGRAPHY EXAMPLES (CONTINUED)

- More iOptron SkyTracker Pro images
- Pleiades Star Cluster (D7200 DSLR, 2 minutes, ISO 6400, 300mm lens)



TRACKED ASTROPHOTOGRAPHY EXAMPLES (CONTINUED)

- More iOptron SkyTracker Pro images
- Flame & Horsehead Nebulae (D7200 DSLR, 1 minute, ISO 12800, 300mm lens)



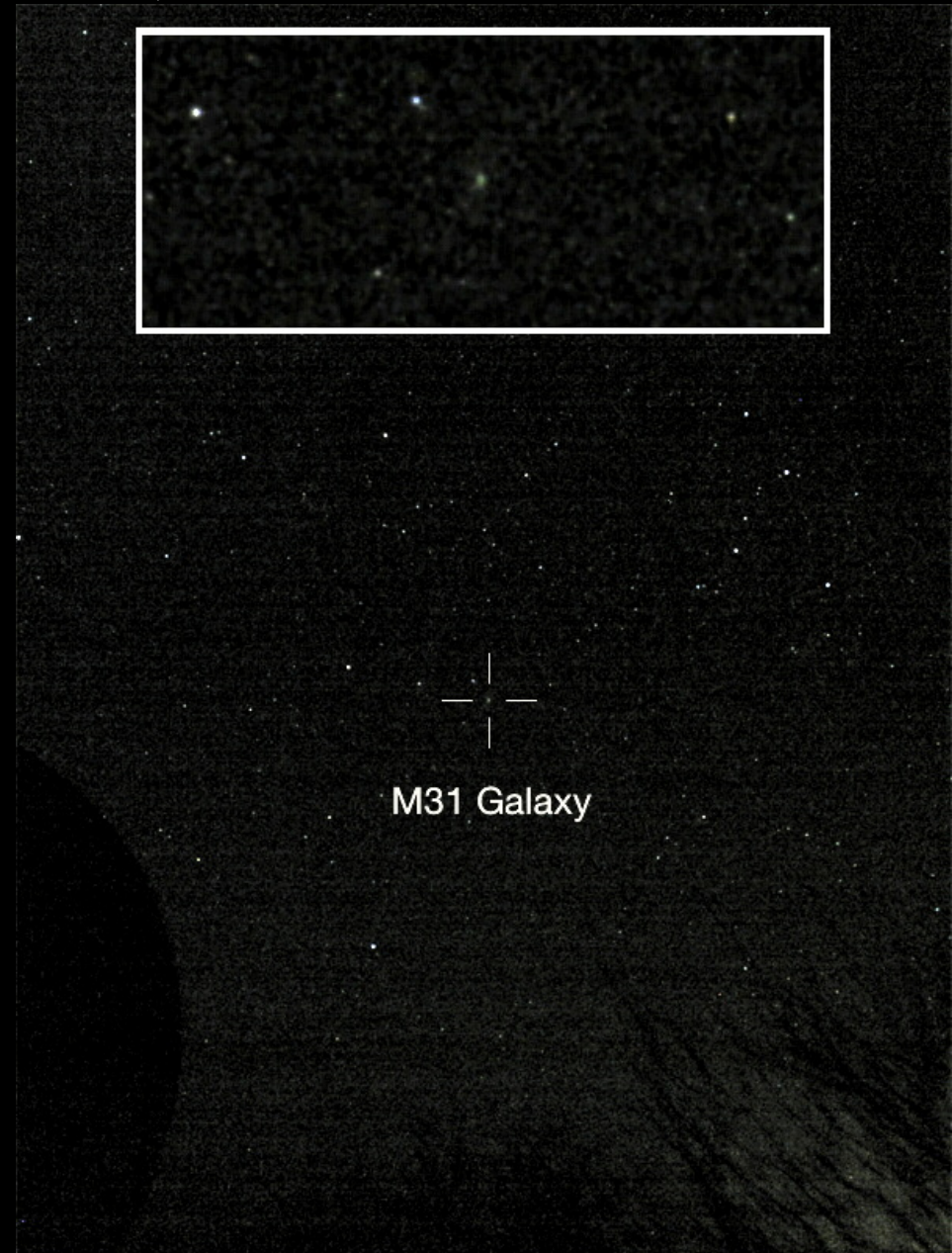
TRACKED ASTROPHOTOGRAPHY EXAMPLES (CONTINUED)

- More iOptron SkyTracker Pro images
- Flame & Horsehead Nebulae (D7200 DSLR, 2 minutes, ISO 12800, 600mm lens)



TRACKED ASTROPHOTOGRAPHY EXAMPLES (CONTINUED)

- M31 Andromeda Galaxy, iPhone 5s (telescope, NightCap Pro, 5 minutes)



PRIME FOCUS ASTROPHOTOGRAPHY

- What you need:
 - Telescope: equatorial tracking mount (preferred) without eyepiece (essentially becomes a long telephoto lens)
 - Camera: removable lens, shutter speed 1/200sec to many seconds or "Bulb", ISO 100 or higher
 - Mount: prime focus adapter (\$20-\$40; camera specific T-Ring \$20)



PRIME FOCUS ASTROPHOTOGRAPHY (CONTINUED)

- What you can photograph
 - Sun (with proper filter), Moon, planets, asteroids
 - Comets
 - ISS (with some telescopes)
 - Deep Sky Objects (DSOs; star clusters, nebulae, galaxies)

PRIME FOCUS ASTROPHOTOGRAPHY (CONTINUED)

- What you do to take the photographs
 - Mount camera (without lens) on telescope (tracking on)
 - Focus object in camera viewfinder or on "live view" screen; use a bright star or the Moon
 - Set camera shutter to 1/200sec, ISO 400 (Moon, depending on phase); 1 second, ISO 800 (or higher) for brighter planets (adjust as needed); 30 seconds or "bulb", ISO 1600-up for stars and DSOs
 - Point the telescope at your target in the sky
 - Start the exposure, typically minutes for DSOs
 - Check image and adjust settings as needed
 - Add a "Barlow Lens" (telenegative lens) to increase magnification (\$50-\$300); add a "focal reducer" (telecompressor lens) to reduce magnification (\$100-400)

PRIME FOCUS ASTROPHOTOGRAPHY EXAMPLES

- Sun, D7000 DSLR (1/1000sec, ISO 200)
[important: use proper solar filter to prevent eye and equipment damage]



PRIME FOCUS ASTROPHOTOGRAPHY EXAMPLES (CONTINUED)

- Full Moon, D7000 DSLR (1/500sec, ISO 100)



PRIME FOCUS ASTROPHOTOGRAPHY EXAMPLES (CONTINUED)

- First Quarter Moon, D7200 DSLR (1/250sec, ISO 400)



PRIME FOCUS ASTROPHOTOGRAPHY EXAMPLES (CONTINUED)

- Moon, 2X Barlow Lens, D7000 DSLR (1/400, ISO 1600)



PRIME FOCUS ASTROPHOTOGRAPHY EXAMPLES (CONTINUED)

- Jupiter & Galilean Moons, 2X Barlow Lens, D7000 DSLR (1/30sec, ISO 1000)



PRIME FOCUS ASTROPHOTOGRAPHY EXAMPLES (CONTINUED)

- Jupiter, Saturn, 2X Barlow Lens, D7200 DSLR
("stacked"; will discuss later)



PRIME FOCUS ASTROPHOTOGRAPHY EXAMPLES (CONTINUED)

- Dwarf Planet (asteroid) Ceres, 2X Barlow, D7200 DSLR
(10 seconds, ISO 3200; animated 15 minute intervals)



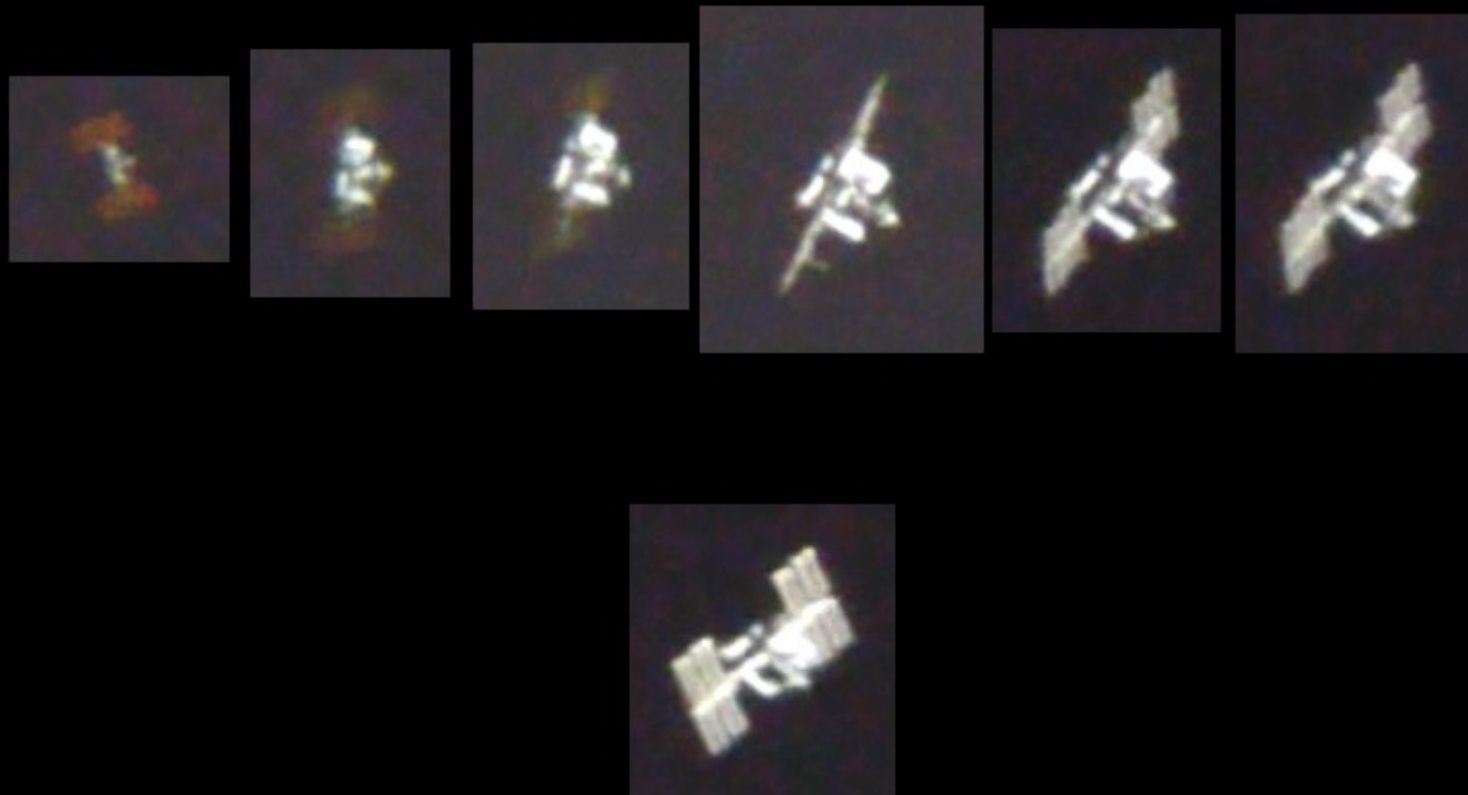
PRIME FOCUS ASTROPHOTOGRAPHY EXAMPLES (CONTINUED)

- Comet C/2014 Q2 Lovejoy, Focal Reducer, D7000 DSLR (5 minutes, ISO 6400)



PRIME FOCUS ASTROPHOTOGRAPHY EXAMPLES (CONTINUED)

- ISS, 2X Barlow Lens, D7000 DSLR (1/1000sec, ISO 4000; frames from video)



PRIME FOCUS ASTROPHOTOGRAPHY EXAMPLES (CONTINUED)

- Omega Centauri (globular cluster), Focal Reducer, D7200 DSLR (1 minute, ISO 3200)



PRIME FOCUS ASTROPHOTOGRAPHY EXAMPLES (CONTINUED)

- Ring Nebula (M57), Focal Reducer, D7200 DSLR (1 minute, ISO 5000)



PRIME FOCUS ASTROPHOTOGRAPHY EXAMPLES (CONTINUED)

- Orion Nebula (M42), D7000 DSLR (3 minutes, ISO 6400)



PRIME FOCUS ASTROPHOTOGRAPHY EXAMPLES (CONTINUED)

- Leo Triplet Galaxies (M65, NGC3628, M66), Focal Reducer, D7200 DSLR (5 minutes, ISO 6400)



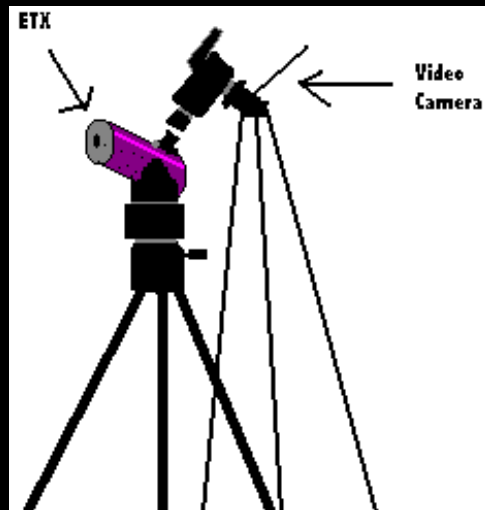
AFOCAL ASTROPHOTOGRAPHY

- What you need:
 - Telescope: equatorial tracking mount (preferred) with eyepiece;
Can also use binoculars and spotting scopes
 - Camera: with lens, shutter speed 1/200sec to many seconds or "Bulb", ISO 100 or higher; smartphone (special apps for DSOs)
 - Mount: afocal camera adapter (~\$30-50)
Can also handhold camera over eyepiece (for bright objects)



AFOCAL ASTROPHOTOGRAPHY (CONTINUED)

- An alternative to an adapter or handholding the camera is to use a camera tripod
- This setup shows a video camera on a photographic tripod with the camera aimed at the eyepiece



(Credit Bill Hardin; 1998)

AFOCAL ASTROPHOTOGRAPHY (CONTINUED)

- What you can photograph
 - Sun (with proper filter), Moon, planets, asteroids
 - Comets
 - ISS (with some telescopes)
 - Deep Sky Objects (DSOs; star clusters, bright nebulae, bright galaxies)

AFOCAL ASTROPHOTOGRAPHY (CONTINUED)

- What you do to take the photographs
 - Mount camera (with lens) on telescope (tracking on, if available)
 - Focus object in camera viewfinder or on "live view" screen; use a bright star or the Moon
 - Set camera shutter to 1/200sec, ISO 800 (Moon, depending on phase); 1 second, ISO 800 (or higher) for brighter planets (adjust as needed); 30 seconds or "bulb", ISO 1600-up for stars and DSOs
 - Point the telescope at your target in the sky
 - Start the exposure, typically minutes for DSOs
 - Check image and adjust settings as needed
 - Add a "Barlow Lens" (telenegative lens) to increase magnification (\$50-\$300); add a "focal reducer" (telecompressor lens) to reduce magnification (\$100-400); can also use different eyepieces

AFOCAL ASTROPHOTOGRAPHY EXAMPLES

- Chinese Space Station transiting the Sun, 77X, iPhone 5s



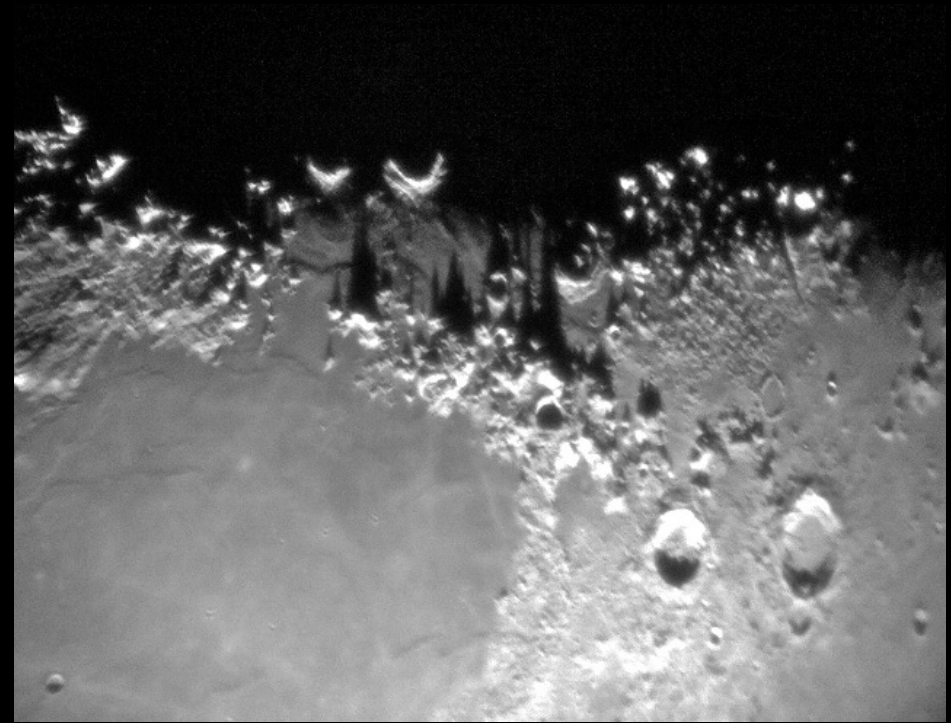
AFOCAL ASTROPHOTOGRAPHY EXAMPLES (CONTINUED)

- First Quarter Moon, 77X, iPhone 4



AFOCAL ASTROPHOTOGRAPHY EXAMPLES (CONTINUED)

- Montes Caucasus shadows,
231X, iPhone 4



- Crater Copernicus,
222X, iPhone 5s



AFOCAL ASTROPHOTOGRAPHY EXAMPLES (CONTINUED)

- Saturn, 444X, iPhone 4



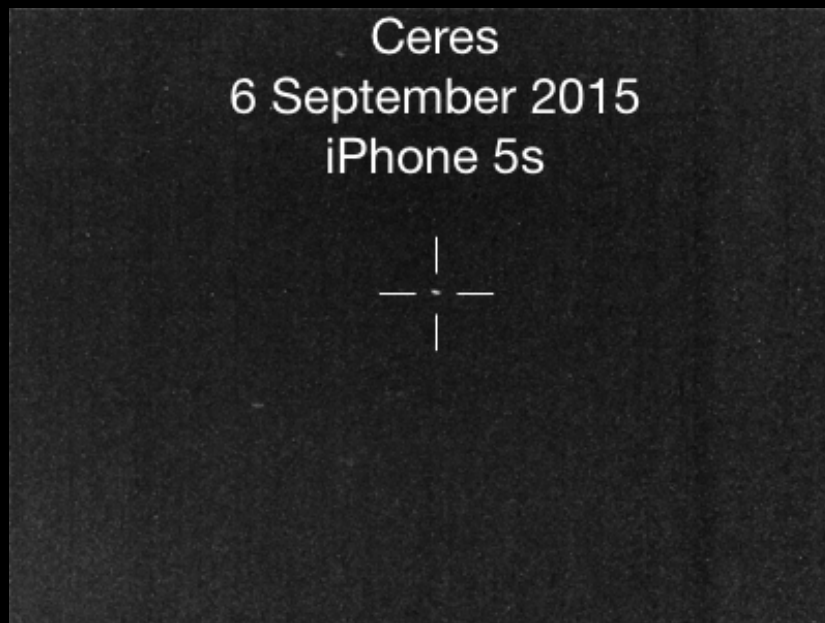
AFOCAL ASTROPHOTOGRAPHY EXAMPLES (CONTINUED)

- Venus, 271X, iPhone 6s Plus (NightCap Pro)



AFOCAL ASTROPHOTOGRAPHY EXAMPLES (CONTINUED)

- Dwarf Planet (asteroid) Ceres, 77X, iPhone 5s
(NightCap Pro app)



AFOCAL ASTROPHOTOGRAPHY EXAMPLES (CONTINUED)

- Comet C/2014 Q2 Lovejoy, 48X, iPhone 5s (NightCap Pro)



AFOCAL ASTROPHOTOGRAPHY EXAMPLES (CONTINUED)

- Globular Cluster (M22), 77X, iPhone 5s (NightCap Pro)



AFOCAL ASTROPHOTOGRAPHY EXAMPLES (CONTINUED)

- Orion Nebula (M42), 77X, iPhone 5s (NightCap Pro; stacked)



AFOCAL ASTROPHOTOGRAPHY EXAMPLES (CONTINUED)

- Whirlpool Galaxy (M51), 77X, iPhone 5s (NightCap Pro)



AFOCAL ASTROPHOTOGRAPHY EXAMPLES (CONTINUED)

- Double Cluster, 49X, iPhone 6s Plus (NightCap Pro)



AFOCAL ASTROPHOTOGRAPHY EXAMPLES (CONTINUED)

- Ring Nebula (M57), 94X, iPhone 6s Plus (NightCap Pro)



AFOCAL ASTROPHOTOGRAPHY EXAMPLES (CONTINUED)

- Picacho Peak, 8X monocular, iPhone 6s Plus (Camera app)



EYEPIECE PROJECTION ASTROPHOTOGRAPHY

- What you need:
 - Telescope: equatorial tracking mount (preferred) with eyepiece;
Can also use some spotting scopes (with swappable eyepieces)
 - Camera: removable lens, shutter speed 1/200sec to many seconds or "Bulb", ISO 800 or higher
 - Mount: camera adapter (~\$20-\$200;
camera specific T-Ring \$20)
Can also hand hold camera over eyepiece (for bright objects)



EYEPIECE PROJECTION ASTROPHOTOGRAPHY (CONTINUED)

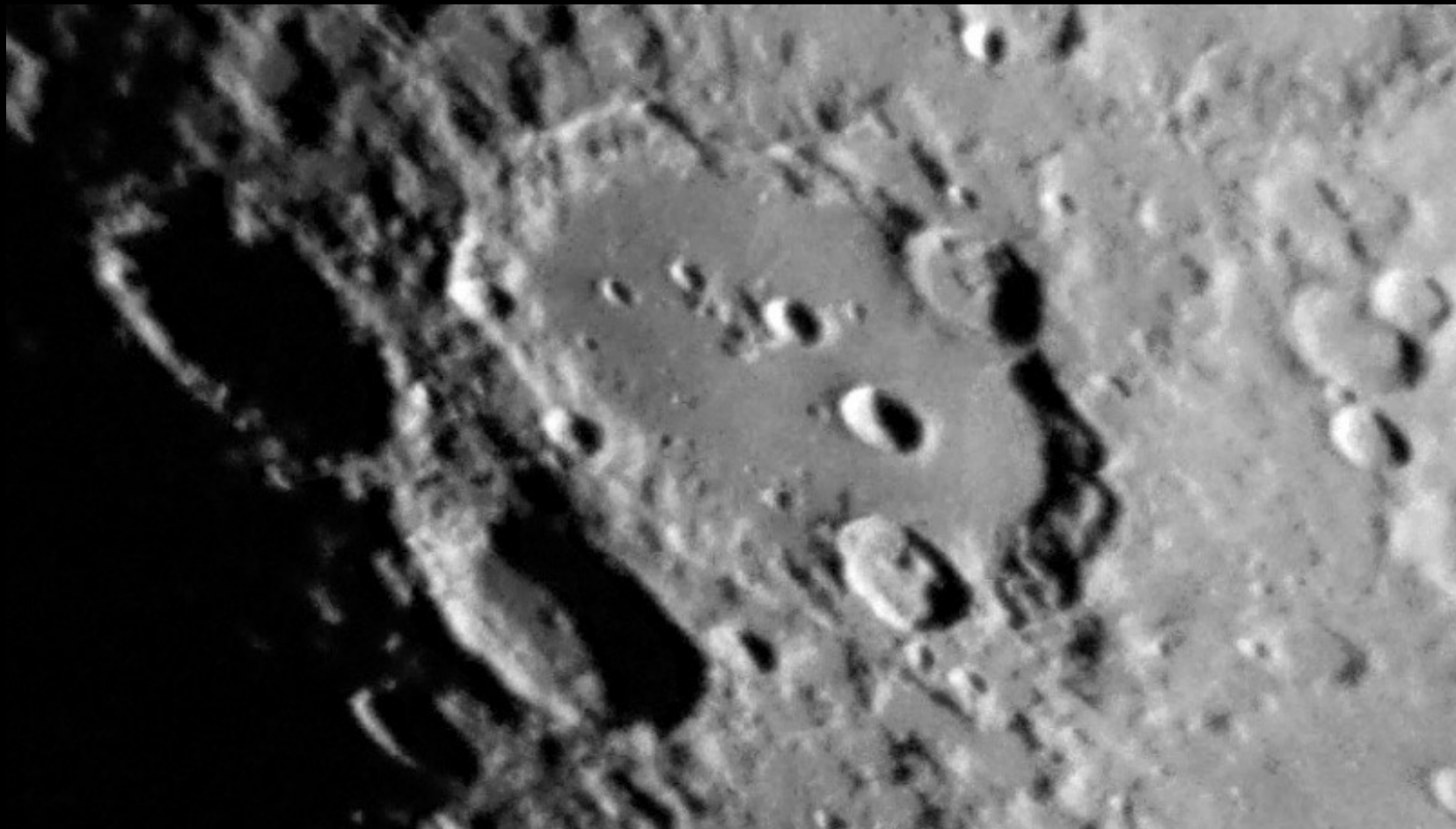
- What you can photograph
 - Sun (with proper filter), Moon, planets, asteroids
 - Deep Sky Objects (DSOs; star clusters, bright nebulae, bright galaxies); but rarely used for this

EYEPIECE PROJECTION ASTROPHOTOGRAPHY (CONTINUED)

- What you do to take the photographs
 - Mount camera (without lens) on telescope (tracking on, if available)
 - Focus object in camera viewfinder or on "live view" screen; use a bright star or the Moon
 - Set camera shutter to 1/200sec, ISO 800 (Moon, depending on phase); 1 second, ISO 800 (or higher) for brighter planets (adjust as needed); 30 seconds or "bulb", ISO 1600-up for stars and DSOs
 - Point the telescope at your target in the sky
 - Start the exposure, typically minutes for DSOs
 - Check image and adjust settings as needed
 - Add a "Barlow Lens" (telenegative lens) to increase magnification (\$50-\$300); add a "focal reducer" (telecompressor lens) to reduce magnification (\$100-400); can also use different eyepieces

EYEPIECE PROJECTION ASTROPHOTOGRAPHY (CONTINUED)

- Crater Clavius, 222X, D7000 DSLR (1/250sec, ISO 3200)



EYEPIECE PROJECTION ASTROPHOTOGRAPHY (CONTINUED)

- Venus, 444X, D7000 DSLR (1/1000sec, ISO 6400; 289 images stacked)



EYEPIECE PROJECTION ASTROPHOTOGRAPHY (CONTINUED)

- Saturn and 5 moons, 160X, D7000 DSLR ("hat trick", ISO 3200)



WHAT'S APPROPRIATE FOR YOU?

- For most beginners, doing sky and afocal astrophotography are the easiest way to get started
- If you have a telescope and a DSLR, doing prime focus astrophotography can also be rewarding
- If you don't have a telescope (or spotting scope, binoculars), night sky photography can be fun and can get you exciting photos
- If you do have a telescope, start your learning using the Moon
 - The Moon is a nice big bright target
 - Once you have the basic techniques down for your telescope and camera, you can move on to imaging fainter objects

USEFUL OPTIONAL ITEMS & TECHNIQUES

- When doing sky astrophotography or astrophotography using a telescope, many times you have to use long exposures
- Mounting the camera on a tripod or adapter helps
- But you can induce vibrations and image blurring when you touch the shutter release
- Use camera's "self-timer" to allow for a delay after pressing the shutter button, which allows time for vibrations to dampen out

USEFUL OPTIONAL ITEMS & TECHNIQUES (CONTINUED)

- Use the “Hat Trick Method” if your camera has a “bulb” shutter setting
- Or better yet, use a “remote shutter release” (hardware or smartphone apps)
- Caution about DSLRs: when you start/stop the exposure, the flip mirror quickly moves, creating vibrations
 - If your camera has a “mirror lockup” capability, use it



USEFUL OPTIONAL ITEMS & TECHNIQUES (CONTINUED)

- If you have an iPhone, use the supplied Earbuds/Mic volume control as a remote shutter release
- If you have one, you can also use the Apple Watch to start/stop exposures

NightCap 23:17



USEFUL OPTIONAL ITEMS & TECHNIQUES (CONTINUED)

- When taking photographs through the telescope of bright objects (like the Moon, Venus, Jupiter) with cameras that use auto-exposure (point-n-shoot digital cameras and smartphones), you may find that the object overexposes in your photographs
- Since you may not be able to control the exposure setting, you can use a filter (typically a "Moon filter" or a "polarizing filter"; \$10-30) to reduce the object brightness



USEFUL OPTIONAL ITEMS & TECHNIQUES (CONTINUED)

- Getting a precise focus can be a challenge, especially when imaging faint objects
- Set camera to manual focus (if possible)
- For sky or afocal astrophotography, set camera lens to infinity (if possible)
- For afocal astrophotography focus the eyepiece for your eye before attaching the camera
- If available, lock the telescope and camera focus to keep the focus from changing

USEFUL OPTIONAL ITEMS & TECHNIQUES (CONTINUED)

- A good focusing tool for DSLR lenses and for telescopes is a “Hartmann” or “Bahtinov” mask (homemade or \$25-\$100)



In focus
Not focused

Not focused In focus



USEFUL OPTIONAL ITEMS & TECHNIQUES (CONTINUED)

- Exposure settings is trial-n-error until you learn your camera + telescope system
- Don't be afraid to play with settings (delete the bad photos!) - Keep records!
- Moon: usually hundredths of a second, ISO 100-1000
Planets: usually seconds, ISO 500-3200
Stars: seconds to minutes, ISO 800-6400
DSOs: minutes, ISO 1600-6400 (or higher)
- Lens focal length and telescope magnification affect exposure length due to Earth's rotation (trailing) and shutter speed & ISO (image brightness)
- Special smartphone apps like NightCap Pro (iPhone) can photograph faint objects and do star trail photos
 - Android alternative: Camera Lite (free) - not as full featured as NightCap Pro
- Experiment, experiment, experiment - Don't get frustrated by initial attempts

USEFUL OPTIONAL ITEMS & TECHNIQUES (CONTINUED)

- Set a red filter on your smartphone (iPhone: see Sky & Telescope web site)
- Last but certainly not the least important item is having a dark sky when you want to photograph stars and faint objects
- Avoid nights and times when the Moon is in your sky
- Oracle State Park, designated as an IDA "International Dark Sky Park" in 2014, and the surrounding area, are good locations for dark skies
- Commercial: Light Pollution is not only undesirable when doing astrophotography, it harms human health, safety/security, wildlife, the environment, and wastes energy/money

ADVANCED TOPIC: USING SOFTWARE TO IMPROVE YOUR ASTROPHOTOS

- Photo editing software can be used to improve how your astrophotos look, and two basic operations are very simple to use
- Normally, you will take one or several photos of an object, keeping only one or two good ones, which you will then edit in software
- A more advanced (and time-consuming) technique is to take several photos (up to 1000s) or a video, then “stack” (merge) the images into a single image using specialized software, which you then edit
(not discussed in this workshop)

ADVANCED TOPIC: USING SOFTWARE TO IMPROVE YOUR ASTROPHOTOS (CONTINUED)

- If you want to make “star trails” photos like this you could just leave the shutter open for hours, or you can use special software that merges short (1 minute) photos taken over several hours into the final photo



ADVANCED TOPIC: USING SOFTWARE TO IMPROVE YOUR ASTROPHOTOS (CONTINUED)

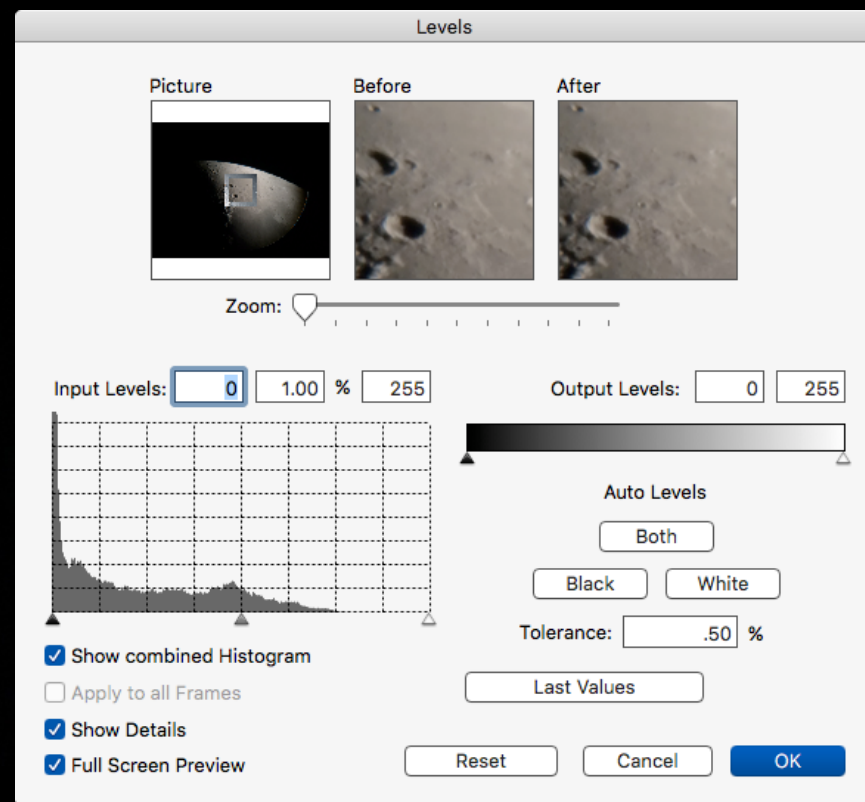
- Once you have your best image selected you can then do two basic and simple editing steps using software on your smartphone, tablet, Mac, or Windows computer
(e.g., Photoshop, GIMP, Lightroom, Photos, GraphicConverter, and many others)
- GraphicConverter (Mac; \$40) used to show “levels” and “sharpening” adjustments
(similar operations in most photo editing software)

ADVANCED TOPIC: USING SOFTWARE TO IMPROVE YOUR ASTROPHOTOS (CONTINUED)

- “Levels” adjustments are used to enhance the contrast, brightness, bring out shadows (faint) areas, and to darken the sky background
- “Sharpening” adjustments are used to improve the look of details and make the photo look “sharper”

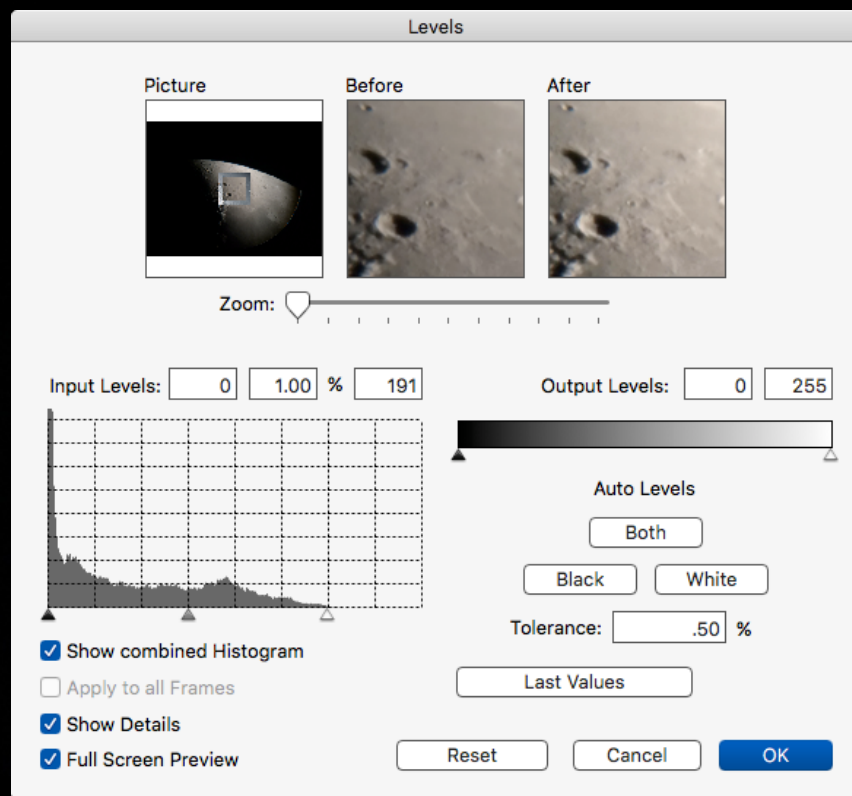
ADVANCED TOPIC: USING SOFTWARE TO IMPROVE YOUR ASTROPHOTOS (CONTINUED)

- Moon, iPhone: original and its “levels”



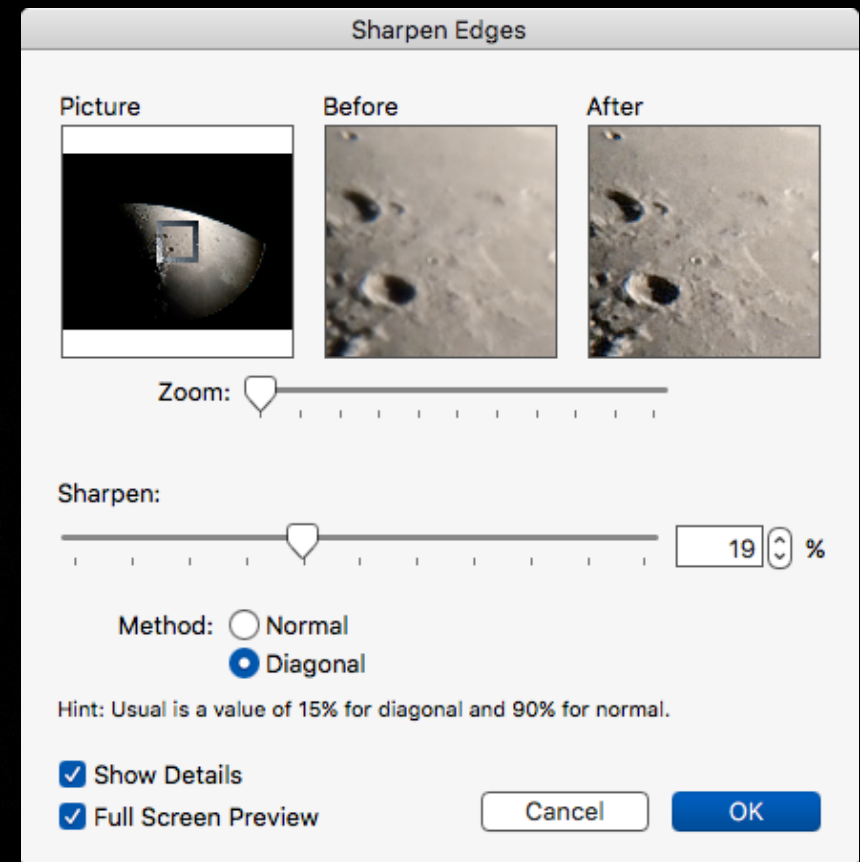
ADVANCED TOPIC: USING SOFTWARE TO IMPROVE YOUR ASTROPHOTOS (CONTINUED)

- Moon, iPhone: adjusted “levels” (moved right triangle to shoulder)



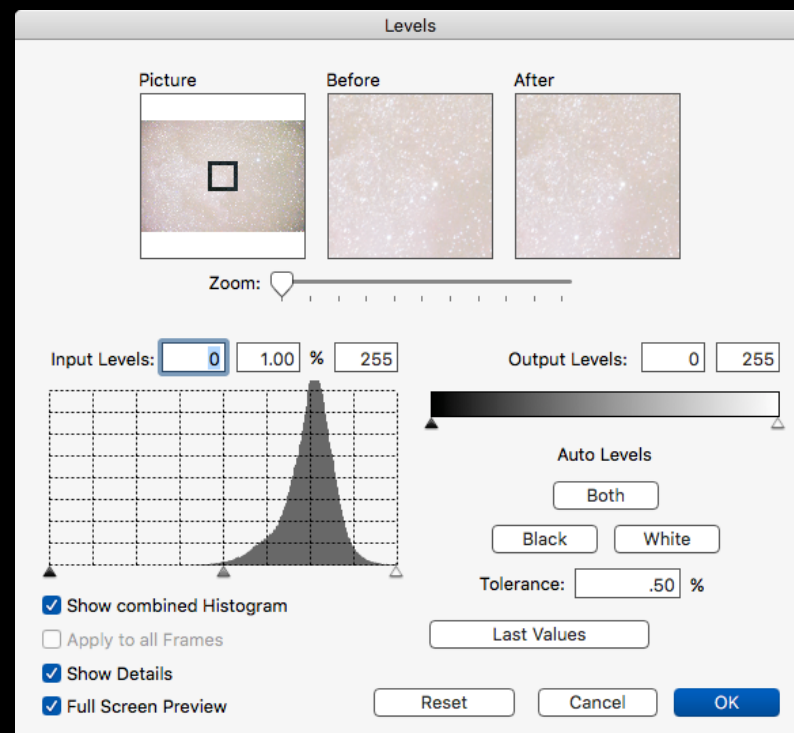
ADVANCED TOPIC: USING SOFTWARE TO IMPROVE YOUR ASTROPHOTOS (CONTINUED)

- Moon, iPhone: sharpened



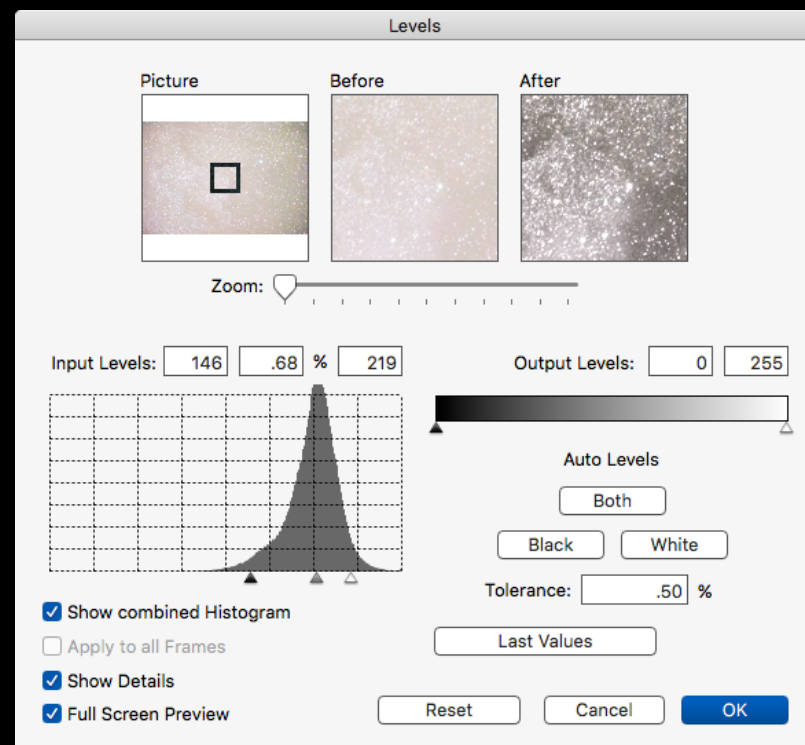
ADVANCED TOPIC: USING SOFTWARE TO IMPROVE YOUR ASTROPHOTOS (CONTINUED)

- North American Nebula (NGC7000), D7200 DSLR (5 minutes, ISO 12800, 140mm lens, tracker): original and its "levels"



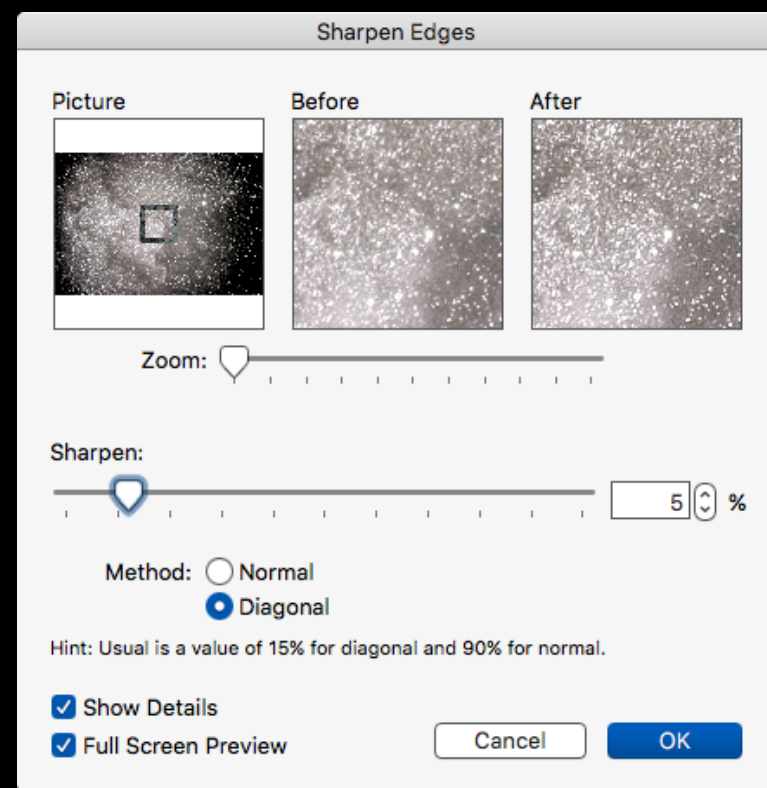
ADVANCED TOPIC: USING SOFTWARE TO IMPROVE YOUR ASTROPHOTOS (CONTINUED)

- North American Nebula (NGC7000), D7200 DSLR: adjusted “levels” (left & right triangles to shoulders, slight center triangle adjustment)



ADVANCED TOPIC: USING SOFTWARE TO IMPROVE YOUR ASTROPHOTOS (CONTINUED)

- North American Nebula (NGC7000), D7200 DSLR: sharpened

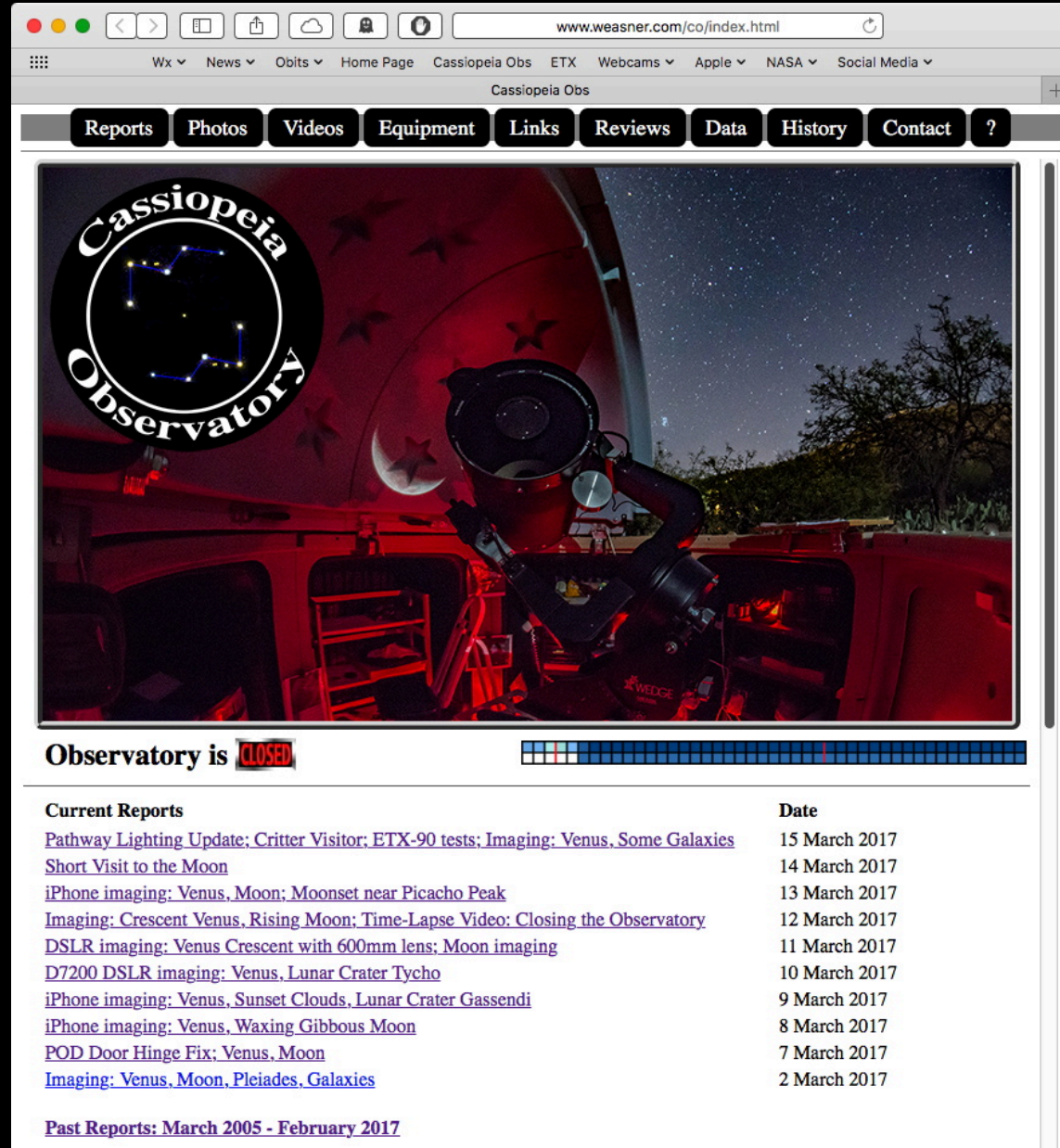


SOME RESOURCES

- Telescope dealers (Starizona, Stellar-Vision, OPT, and many others) for equipment and advice
- Telescope dealers and Amazon for camera adapters
- "Sky and Telescope" Astrophotography Primer (free ebook)
<http://www.skyandtelescope.com>
- Many books and web sites available

SOME RESOURCES (CONTINUED)

- My "Cassiopeia Observatory" web site: <http://www.weasner.com/co>
- When I do astrophotography I usually provide some details on how the images were done in my reports
- Photo Albums that can show you what is possible with a DSLR and iPhone
- How I Do Astrophotography (on the Links page)
- Links and Reviews pages have many useful articles
 - Including this Workshop



The screenshot shows the website for the Cassiopeia Observatory. The header includes navigation links: Reports, Photos, Videos, Equipment, Links, Reviews, Data, History, and Contact. The main image features a telescope mounted on a red structure, with a circular logo for the Cassiopeia Observatory in the upper left corner. Below the image, a status bar indicates "Observatory is CLOSED".

Current Reports

Current Reports	Date
Pathway Lighting Update; Critter Visitor; ETX-90 tests; Imaging: Venus, Some Galaxies	15 March 2017
Short Visit to the Moon	14 March 2017
iPhone imaging: Venus, Moon; Moonset near Picacho Peak	13 March 2017
Imaging: Crescent Venus, Rising Moon; Time-Lapse Video: Closing the Observatory	12 March 2017
DSLR imaging: Venus Crescent with 600mm lens; Moon imaging	11 March 2017
D7200 DSLR imaging: Venus, Lunar Crater Tycho	10 March 2017
iPhone imaging: Venus, Sunset Clouds, Lunar Crater Gassendi	9 March 2017
iPhone imaging: Venus, Waxing Gibbous Moon	8 March 2017
POD Door Hinge Fix; Venus, Moon	7 March 2017
Imaging: Venus, Moon, Pleiades, Galaxies	2 March 2017

Past Reports: March 2005 - February 2017

ASTROPHOTOGRAPHY HAS NEVER BEEN AS EASY OR AS FUN AS IT IS TODAY

- Back in the glass plate and film days (or rather nights), astrophotographers would take a handful of images each night, which they would then process, hoping they got one or two good images
- Today, with CCD imagers and digital cameras, astrophotographers take many images each night, still throwing out the bad ones, but getting many good ones
- Latest models of smartphones have amazing cameras and some camera apps really extend the low-light capabilities
- While not required, today's photo editing software can easily improve your astrophotos
- Since you have attended this workshop, you probably have what you need to get started taking amazing photos of the night sky
- So, start photographing what the night sky has to offer, and have fun!

QUESTIONS?

DOOR PRIZES !!

PLAY TIME!!!

(after dark on the Kannally Ranch House patio)

A long-exposure photograph of a night sky showing numerous concentric star trails in shades of blue and white. The trails are centered around a point in the sky, likely the North Star. In the foreground, the dark silhouettes of hills and trees are visible, with a small, brightly lit building nestled among the trees. A faint red light trail is visible on the left side of the image.

BEGINNER DIGITAL ASTROPHOTOGRAPHY

Mike Weasner
<http://www.weasner.com/co>

Cassiopeia Observatory
email: mweasner@mac.com