



Astrophotography Under City Lights

Tips for targets, locations, equipment, & processing

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<http://BadAstroPhotos.com>

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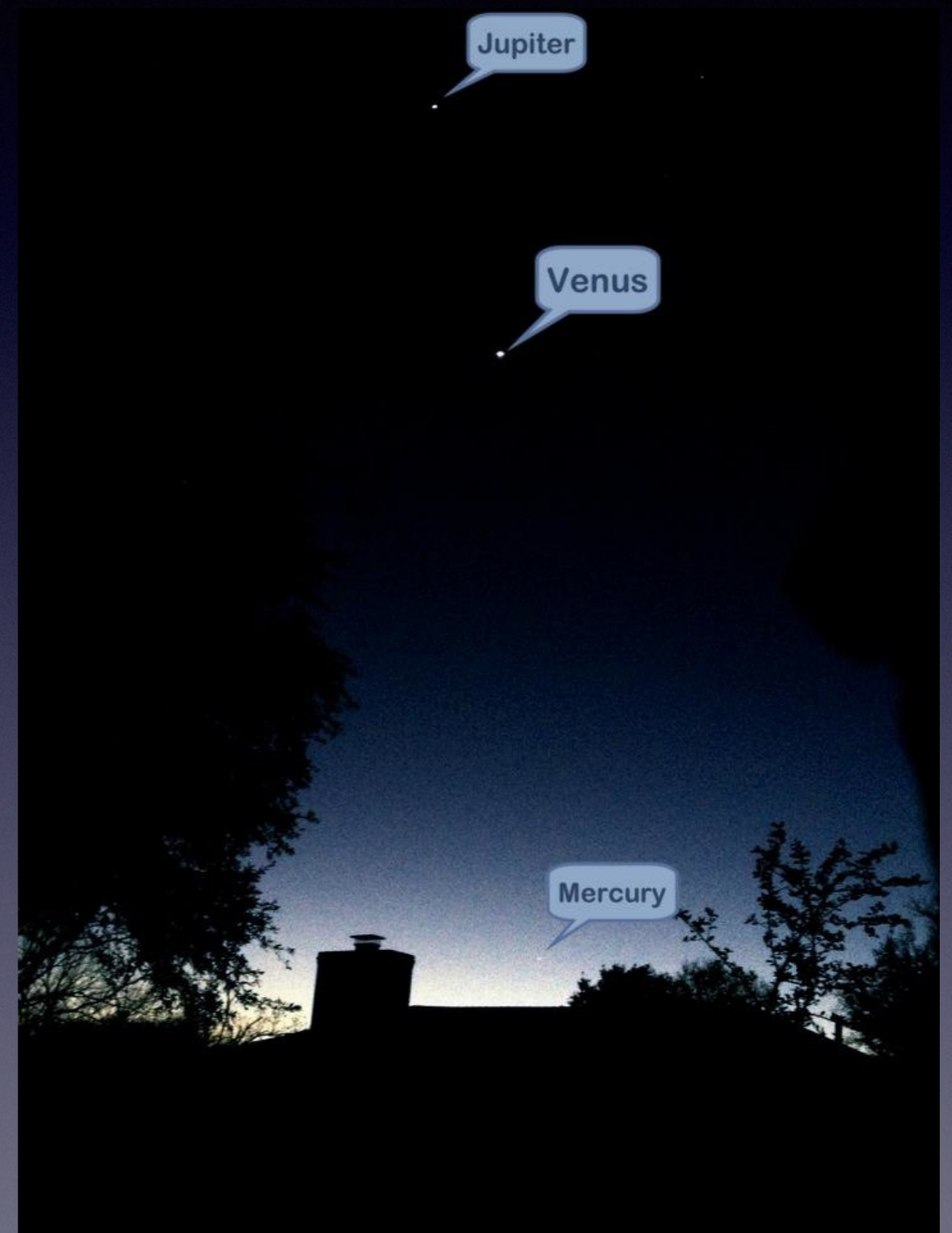


Background:

<http://BadAstroPhotos.com/gettingStarted.html>
<http://BadAstroPhotos.com/withoutTelescope.html>

Urban Challenges

- Skyglow
- Range of Light
- Heat Islands
- Mobility
- People

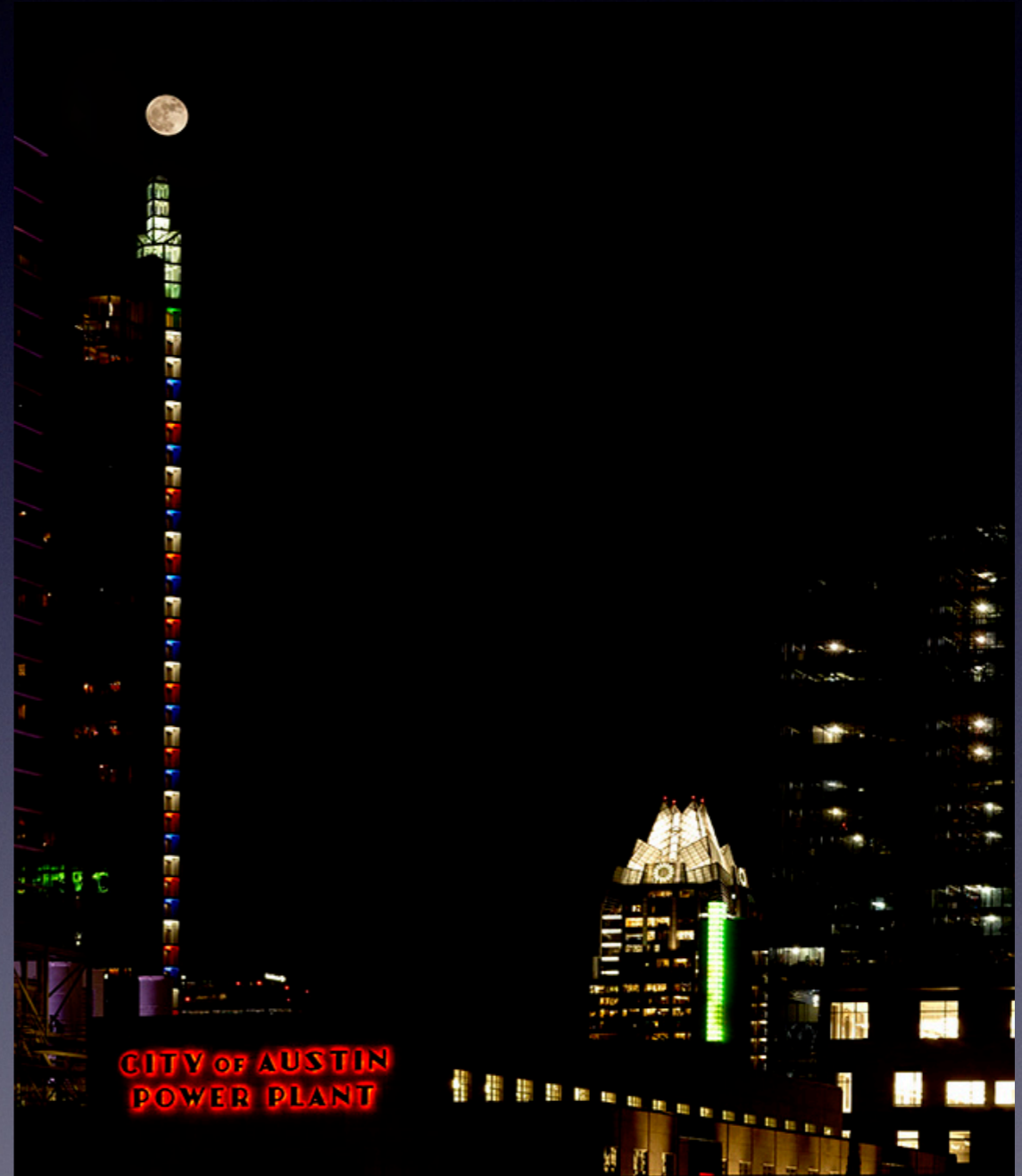


Skyglow

- Minimize by imaging during
 - low dust and humidity
 - after midnight
- Remove skyglow gradient
 - Gradient removal introduces noise
 - Requires more photons to keep noise low
 - Stack for noise reduction
 - Removal gradient in post processing

Range of Light

- City lights are bright
 - our eye sees a range of 1,000,000:1
 - a screen shows 1:000:1, a print sometimes only 100:1
- Stack exposures to extend dynamic range
- HDR compositing



Micro heat islands

- Sources

- streets and driveways
- parking lots
- roofs
- trees
- air conditioners

- Solutions

- lawns
- lakes
- late night after cool down



Locations

- Planetary/Long focal length
 - Location doesn't matter, keep out of bright lights that cause internal reflections
 - your yard
 - neighborhood park
- Nightscapes - add the city landscape to your images
 - Location is everything
 - Scout foreground, Photographers' Ephemeris, Google Earth, maps

Rob Pettengill's not so bad AstroPhotography & Astronomy

Images | Blog | Tools | Questar | How to | Observing | Events | More | About | Contact | Print Store

Observing

- Austin Astronomical Forecasts
- Dark Skies Austin
- Spot the ISS over Austin
- ▼ Austin Urban Observing Sites
 - Urban Observing
 - Booty's Road Park Georgetown
 - Central Park
 - City Park Road Turkey Creek trail head
 - Fountainwood Observatory Southwestern University
 - Mansfield Park Drive
 - Mexican American Cultural Center
 - New Sweden
 - Northwest Balcones / Talleyran Park
 - Pfluger Pedestrian Bridge**
 - Spicewood Club Drive
 - UT Austin Observatories
 - ▼ Texas Observing Sites
 - Texas Observing
 - Texas State Parks Stargazing Areas
 - Texas Local Parks and Rest Areas
 - 3 Rivers Foundation
 - Comanche Springs Astronomy Campus
 - Aransas National Wildlife Refuge
 - Balmorhea State Park
 - Big Bend Region
 - Brazos Bend State Park
 - Buescher State Park
 - Cedar Brakes Park
 - Caprock Canyons State Park
 - Colorado Bend State Park
 - Cooper Lake State Park
 - Copper Breaks State Park
 - Davis Mountains State Park
 - Devils River State Natural Area
 - Devil's Sinkhole State Natural Area
 - Eagle Eye Observatory (closed)
 - Enchanted Rock State Park
 - Fort Griffin State Historic Site
 - Guadalupe Mountains National Park
 - Guadalupe River State Park
 - Hueco Tanks State Park
 - Inks Lake State Park
 - Kikapoo Cavern State Park
 - Lost Maples State Natural Area
 - Marathon Motel & RV Park
 - Marfa Lights Viewing Station
 - Martin Dies, Jr. State Park
 - McDonald Observatory / Davis Mountains
 - Medina County Texas 173 Rest Stop between Bandera and Hondo

Pfluger Pedestrian Bridge

Sky darkness (Bortle class 1 is best): 8+



image courtesy of Apple Maps

The Pfluger Pedestrian Bridge crosses Lady Bird Lake just east of Lamar Blvd. Accessible from the hike and bike trail, the most convenient parking is the short block of West 2nd St. between Seaholm Dr. and Lamar Blvd. The bridge too brightly lit for many targets, but provides great downtown backdrops for nightscape photography. It is also an excellent location for urban outreach sidewalk astronomy. There is a parade of people open to good views of the sky and conversation about astronomy and photography.

Magnetic compass telescope polar alignments are not reliable, because of the ferrous metal reinforcements in the bridge structure. The center span of the bridge runs about 35 degrees east of north.

More information:

- [Pfluger Pedestrian Bridge](#)



Austin Clear Sky Chart

2018-10-11	Th	Friday	Saturday
Local Time	22	11111111112222	1111111111
UT -5.5h	23012345678901	23456789012301234567890123012345678901	23456789012345678

Mobility

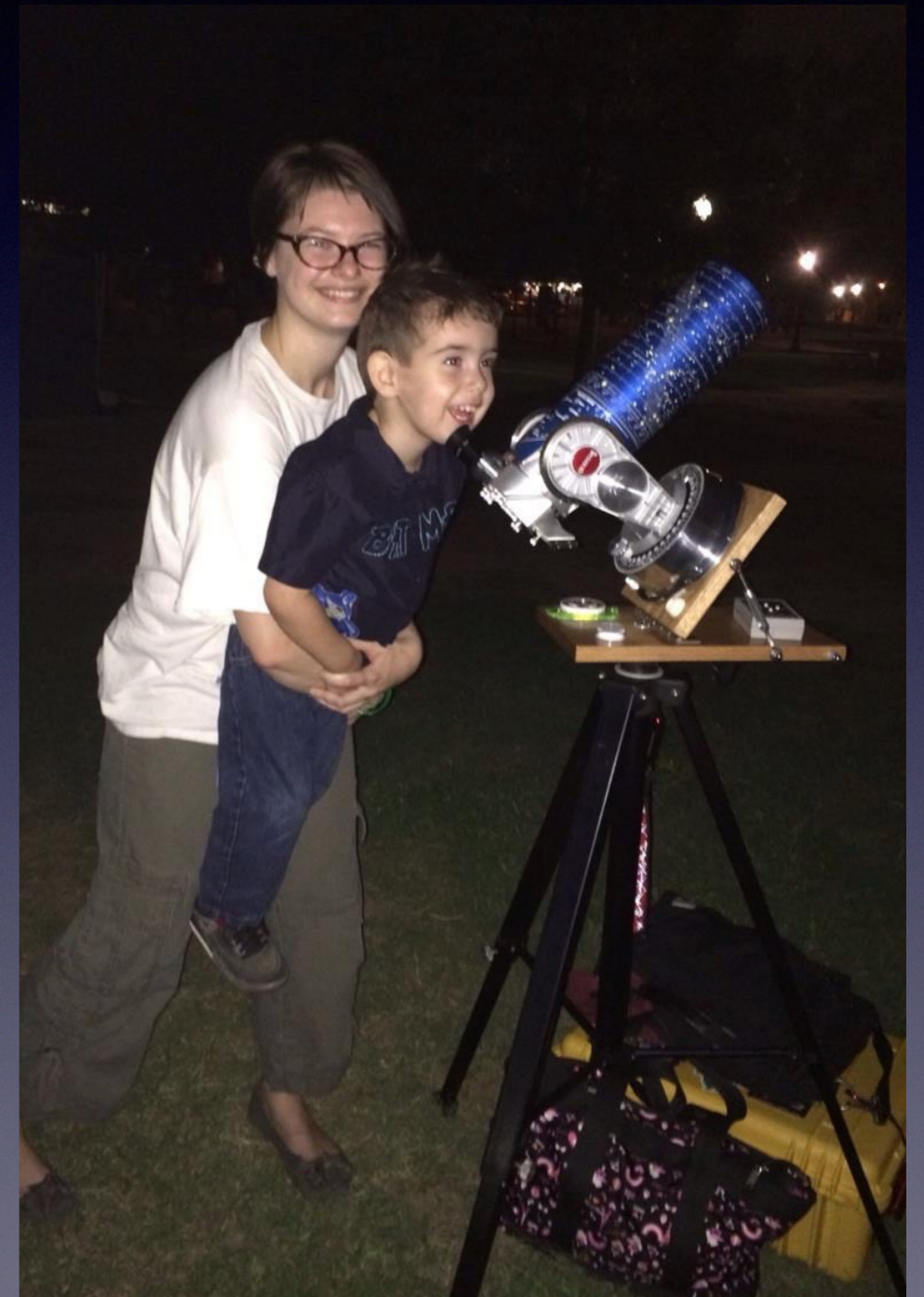
- visibility obstructions
- access and parking
- public transit
- venue restrictions
- Solution - keep light on your feet
 - Light Equipment
 - Backpack
 - Luggage trolley



image @highlinenyc

People

- **safety** (see list)
<http://BadAstroPhotos/urbanObserving.html>
- **outreach**
 - lots of curious people for pop up events
 - use time waiting for urban landscape to cool down



Equipment

- Dobs work great in your driveway, good for outreach, not good for photography
- Compact and lightweight - (every payload # requires another)
 - Camera only setup for shorter focal lengths
 - Small, short refractor or catadioptric telescope or lens
 - Fixed tripod for short focal length nightcaps and the moon
 - Small star tracker (Vixen, SkyWatcher, iOptron)
 - Balance by dovetail position around motor axis rather than counterweight
- Cameras
 - Planetary video cameras require a computer to frame and capture images
 - DSLR/mirrorless cameras are complete with no computer required,
 - Video cropped or 4k - for planetary images
 - No automatic features - automatic features malfunction in low light
 - Mirrorless - lighter, less vibration, better low light focusing, reversible tilt screens
 - Manual prime lenses, zooms have extra glass and less contrast



Mobility Examples



< Questar Mak
Planetary Imaging

Mirrorless Camera >
Nightscape



Mauri Rosenthal — AAA NY
< Elect. Assisted Astro on the High Line

- Borg 55FL astrograph
- ZWO ASI1600MC
- iOptron Cube Pro 8200 mount
- Surface tablet

Targets

Three common kinds of astrophotographs:

- Deep Sky Images - faint fuzzys
- Nightscape images
- Solar System - close up images of the Sun, Moon, & planets

These take different:

- Equipment
- Sky conditions
- Processing

Targets - Deep Sky

- Sky glow
 - Star hopping more difficult
 - Sky glow gradient removal requires more data
- Solutions
 - Goto scopes
 - Big scopes, permanent observatory
- For advice from urban DSO astrophotographers see Facebook: Austin Astrophotographers or Yahoo: Austin Dam Astronomers. Jon Talbot does amazing images on the Mississippi Gulf coast between an oil refinery and a casino.

Targets - Nightscape



- urban landscapes give scale and interest to short focal length images
- Using just a camera and lens keeps kit light
- Photographers ephemeris (PhotoPills) apps help you pick your spot
- Moon and conjunctions of bright planets
- HDR composites, take cityscape foreground shots at dusk

Targets - Nightscape



2016-02-04 12:35UT Austin, Texas, Rob Pettengill

Mercury Venus

Moon

Saturn

Antares

Mars

Spica

Jupiter

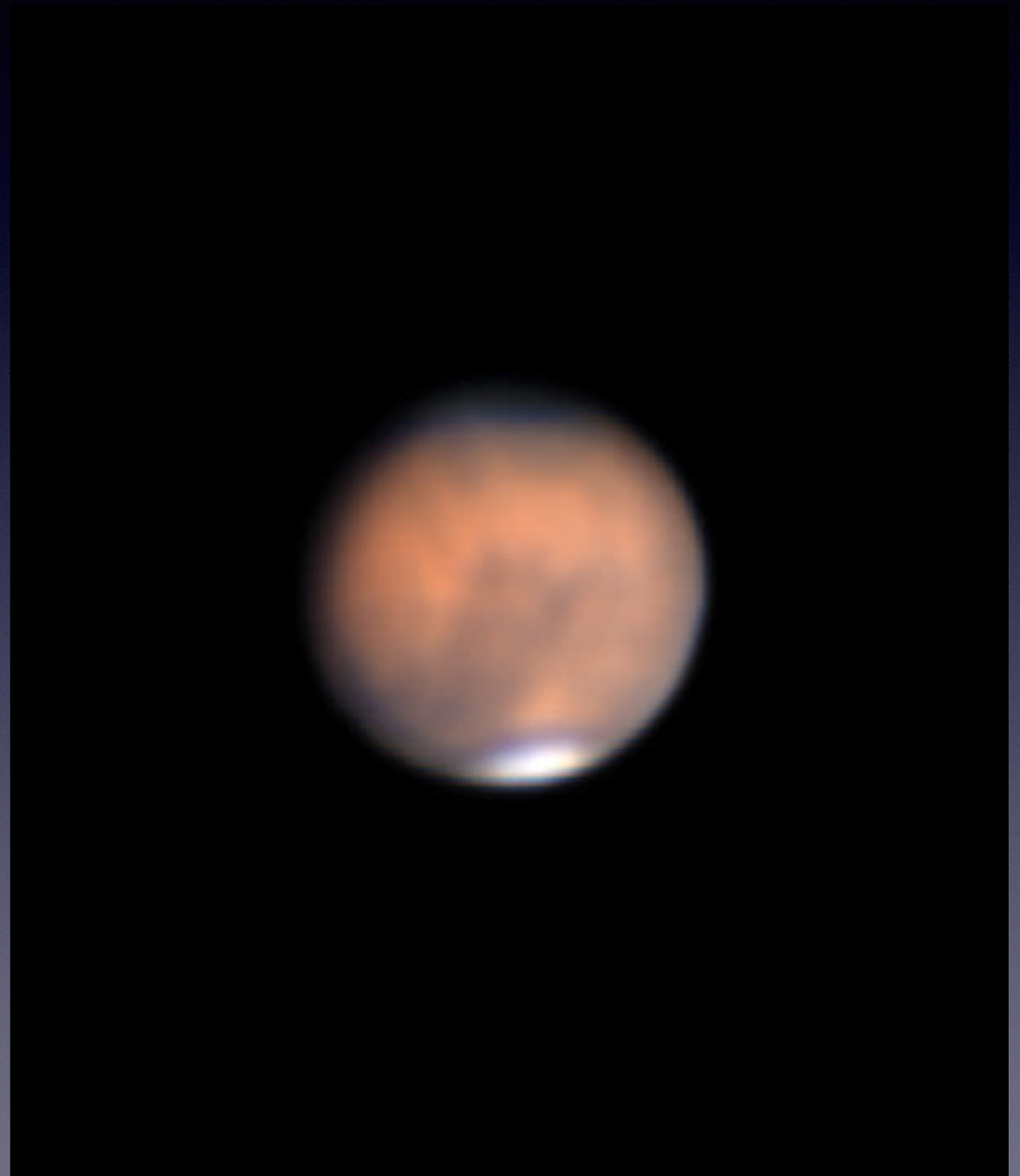


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Targets - Solar System

Sun, Moon, & planets

- dark skies not needed, skyglow isn't a problem
- minimize seeing problems by picking your location and turning off air conditioners
- medium to longer focal lengths lenses and telescopes



Targets: Solar System, Venus & Jupiter Conjunction

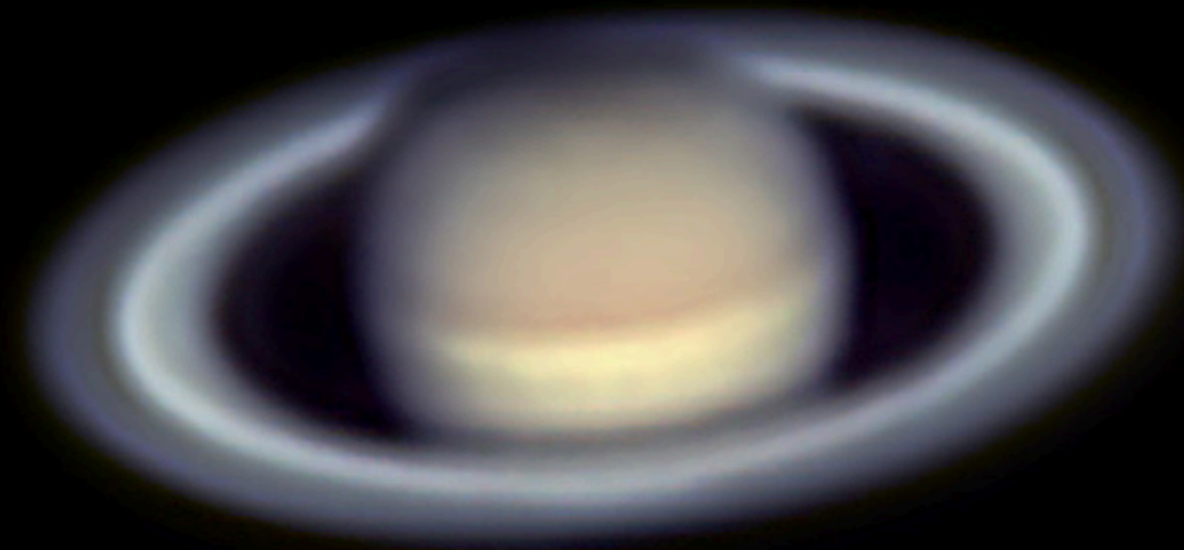
3 exposures convening 9.5 stops, 33 images in HDR stack



Targets: Solar System, Jupiter



Targets: Solar System, Saturn



Capturing data



- Capture Raw or throw away most of your data, 12 vrs 8 bits is 4096 vrs 256:1
- Don't overexpose
- Natural light painting from city lights and traffic, multiple exposures for HDR
- Take foreground image at twilight, wait for darkness to capture stackable images of target
- keep shots aligned between foreground and sky images

Post Processing

- Stack for more photons and less noise
- Small equipment benefits from sharpening to reverse diffraction
 - Fool the eye - unsharp mask and cousins
 - Real resolution - LR
Deconvolution, Wavelets



Post Processing

- Essential features:
 - Support for 16 bit images
 - Support for masked processing
 - Extensible platform with processing plugins (e.g. Photoshop, PixInsight, ...)
- Control processing with masks to maximize benefits and minimize artifacts with masks for:
 - Background stars and small moons
 - Planetary limb
 - Terminator (Moon)
 - Planetary disk without limb - with gradient as needed for side illumination

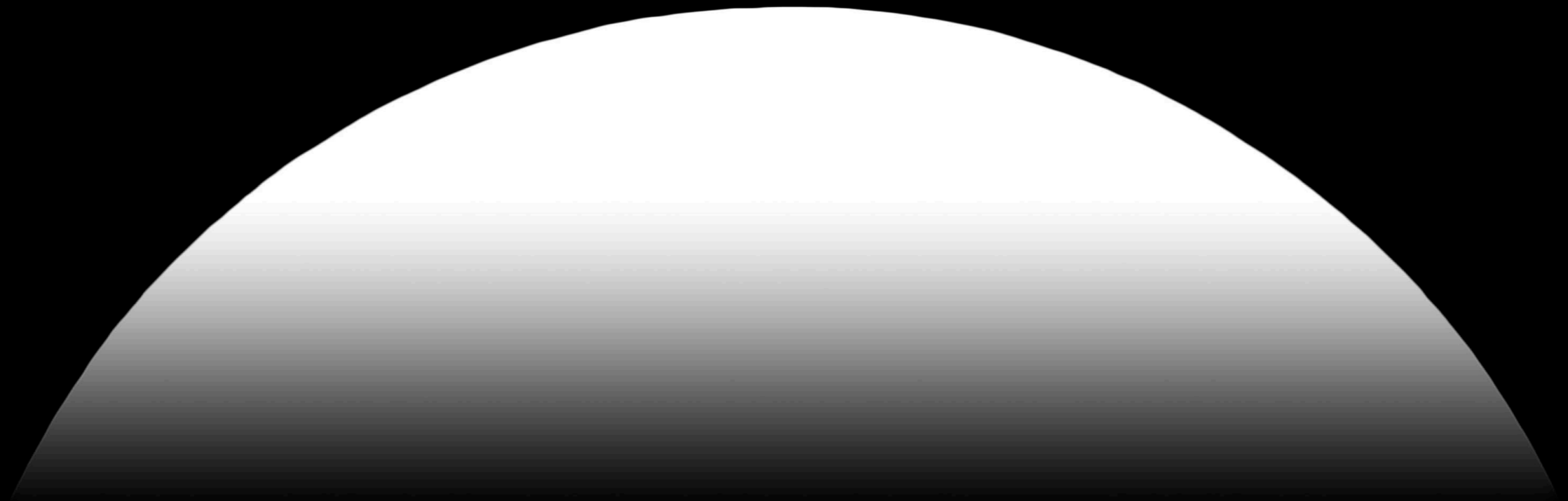
Post Processing Tips

- Make 0.1% of the range of light capture 100% of the detail
 - Stacking (more photons and reduced noise)
 - HDR compositing (extend dynamic range of sensor)
 - Exposure curve stretching (compress range to fit display)
- Sharpening / resolution recovery
 - Take it easy, watch for hard brittle details
 - Avoid processing artifacts like onion skinning or halos

Post Processing Example Stacked & Deconvolved



Post Processing Example Limb & Terminator Masked



Post Processing Example Unmasked Processing

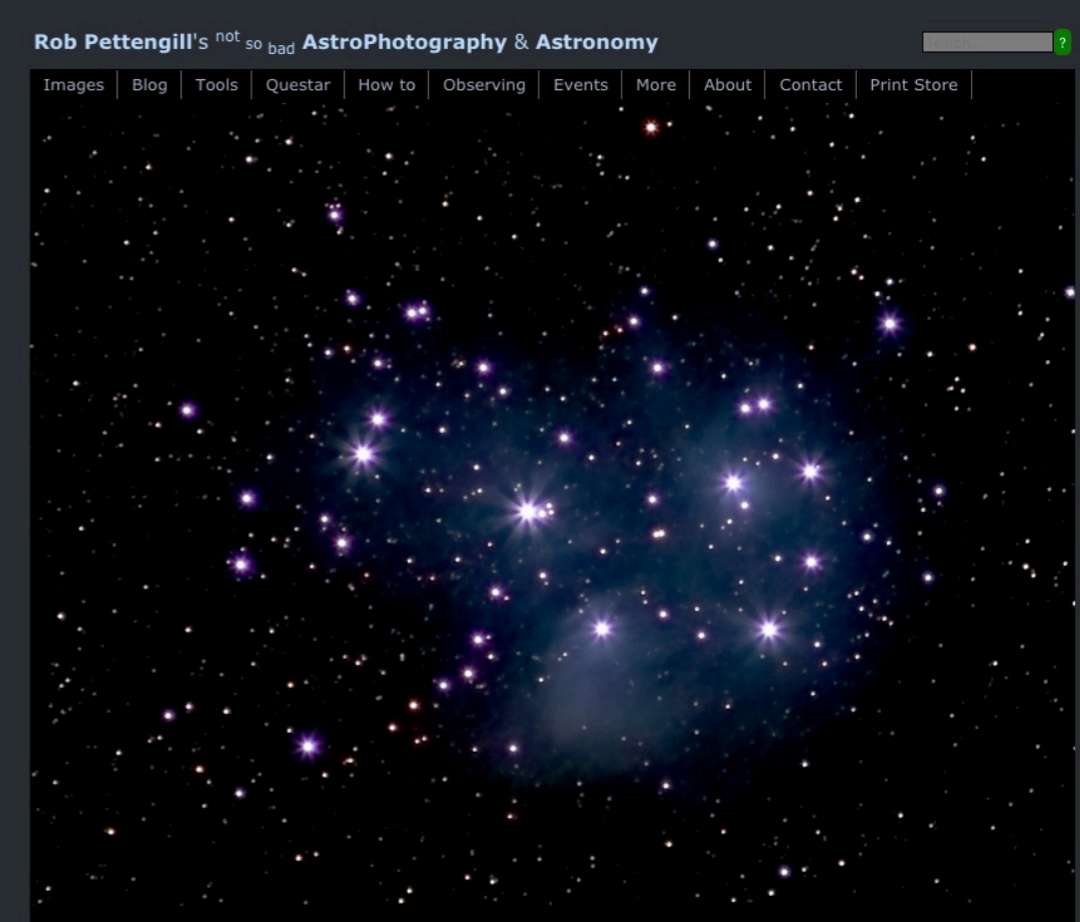


Post Processing Masked Processing



Learn more

- Getting started in astrophotography?
<http://BadAstroPhotos.com/gettingStarted.html>
- Urban Observing and Austin Sites
<http://BadAstroPhotos.com/urbanObserving.html>
- Coat Pocket Astrophotography
<http://BadAstroPhotos.com/coatPocketAstro.html>
- Moon photography - a dozen ways to shoot the Moon
<http://BadAstroPhotos.com/lunarPhotography.html>
- Day-lapse Images of Earthshine on the Crescent Moon
<http://BadAstroPhotos.com/daylapse.html>
- DSO Astrophotography without a Telescope
<http://BadAstroPhotos.com/withoutTelescope.html>
- Planetary Image Workflow (update coming soon)
<http://BadAstroPhotos.com/planetWorkflow.html>
- Facebook: Austin Astrophotographers, Austin Urban Stargazers
- Yahoo: Austin Dam Astronomers



Rob Pettengill's ^{not so bad} AstroPhotography & Astronomy

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Ultra-portable, small telescope, light camera astro-photography and urban astronomy, mostly from Austin, Texas

You'll find: astrophotography with grab and go equipment, astronomical events, how-to tutorials, processing techniques and software for small telescopes and cameras including the Questar. For Austin and the Texas Hill Country, you'll find astronomical weather, observing locations, and an astronomy events calendar.

new gallery images...


Mars 2018 24.1 arc sec (2018-08-10)	Mars 2018 closest approach (2018-08-02)	Jupiter GRS, Europa, & Io transiting (2018-06-26)	Super Blue Blood Moon Time-lapse Lometa Texas (2018-02-01)
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new content...

Crescent Moon with earthshine from Austin (2018-10-11)	10" GEM Reflector for Austin High (2018-09-20)	Planets: Missions to exotic worlds (2018-09-17)	Sierra Madera Astrobleme (2018-09-02)
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revised content...

Recognition (2018-10-07)	Austin Astronomical Forecasts (2018-09-05)	Pfluger Pedestrian Bridge (2018-08-24)	North American Total Solar Eclipse 2024 (2018-08-23)
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