

An Introduction to Astrophotography

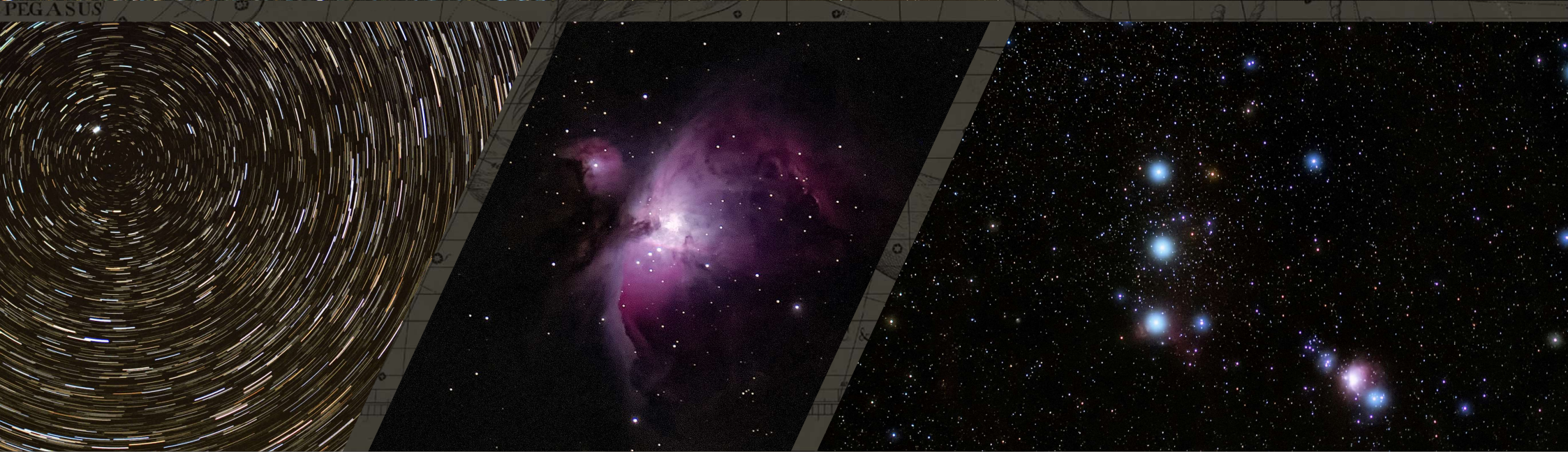
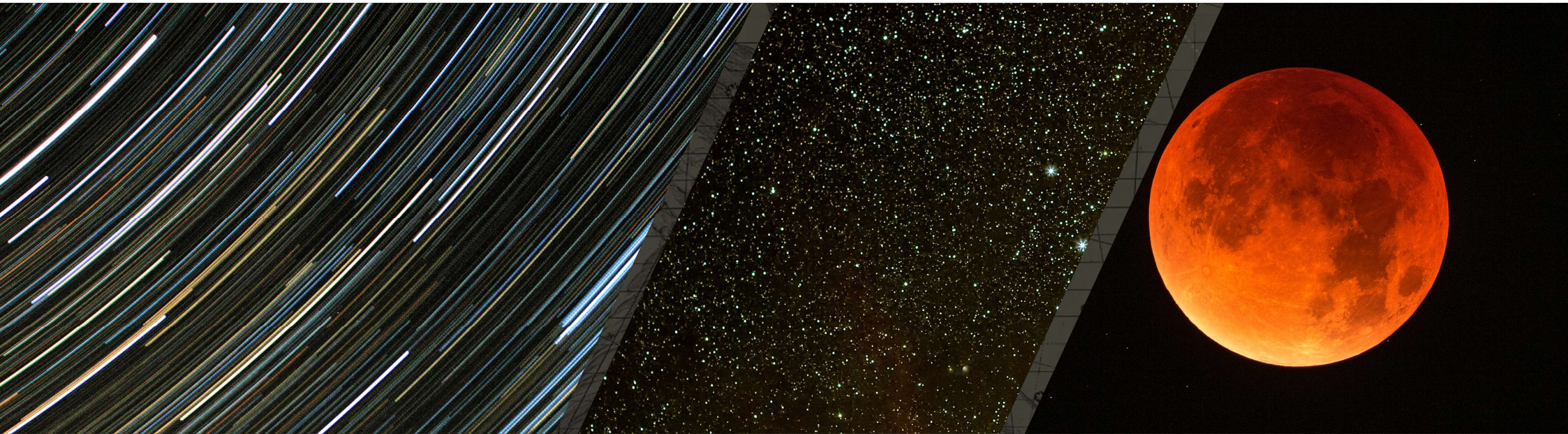


**Flamsteed
Astronomy
Society**



Mike Meynell
Flamsteed Astronomy Society
30th November 2024





PEGASUS



Planetarium Apps

WHAT DO YOU NEED?

Minimum requirement:

- Compact Digital Camera or a camera phone
- A tripod

Ideally:

- Digital SLR and/or Compact System Camera
- A basic telescope (depending on what you want to image)

Future extras:

- Tracking or Go-To Mount (Alt-Az or Equatorial)
- Webcam or CCD camera / Guide-scope

APERTURE



f/1.4



f/2



f/2.8



f/4

FOCUS

Method

1:

Autofocus

on a
flashlight

Place a flashlight about 50 feet away pointing back at the camera

Autofocus on the flashlight ; Switch the camera to manual focus and do not adjust the focus again

Method

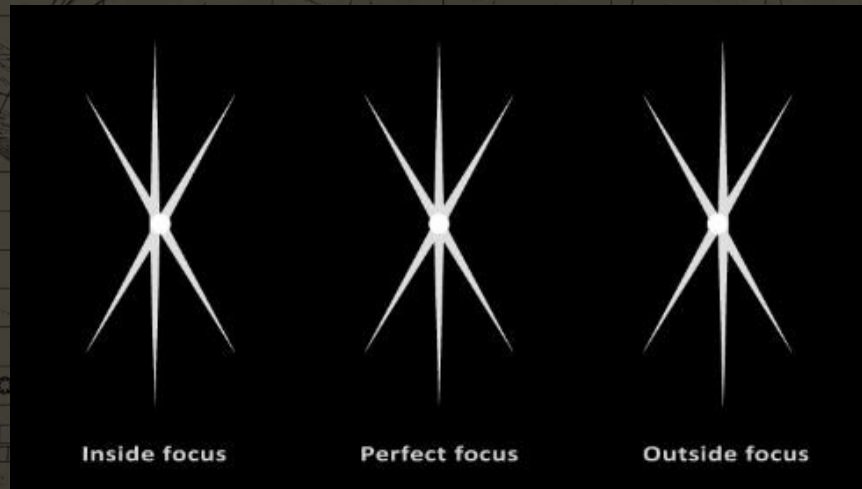
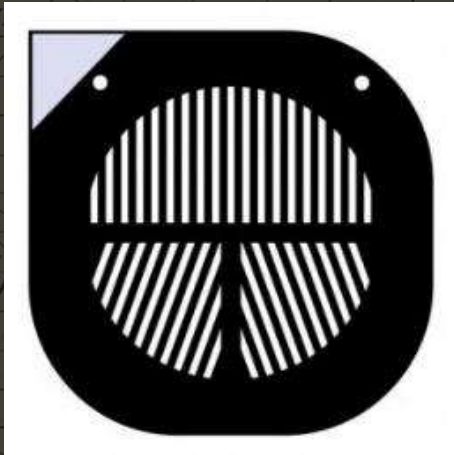
2: Live-
view on

Stars:

Most recent DSLRs have a 'live-view' option; Point the camera at a bright star and zoom in on the live-view screen.

Make tiny focus adjustments until the star is as small as you can get it

BAHTINOV MASKS



Inside focus

Perfect focus

Outside focus

SHUTTER SPEED

Stars move in the sky remarkably quickly.

10-30 seconds is a typical exposure time for a night sky scene with a wide-angle lens.

This keeps the trailing of stars down to an acceptable level

The maximum exposure time depends on the focal length of the lens

500-rule: you will start to see a trail if your exposure time is greater than 500 divided by the focal length of the lens (35mm equivalent)

ISO AND NOISE REDUCTION



ISO AND NOISE REDUCTION



High ISO settings (800 or even 1600-3200 depending on your camera) are recommended for most night-time images.

Some cameras are capable of very high ISOs $> 100,000$ (e.g. Sony A7S). Long exposure noise reduction removes 'hot pixels' and other defects from the image, but doubles exposure time.

Can also take manual 'dark' images which can be subtracted from your final images in post processing

Take an image with the same shutter speed, but with the lens cap on

Consider using an external battery.



Guiding Light to the Stars by Mark Gee (Australia). Winner: Astronomy Photographer of the Year 2013

Settings: Canon 5D Mark III camera; 24mm f/2.8 lens; ISO 3200; 30-second exposure



Wanderer in Patagonia by Yuri Zvezdny (Russia). Winner: People and Space Winner 2017

Settings: iOptron Sky-Tracker mount, Sony A7S camera, 18 mm f/2.8 lens, ISO 5000, 30-second exposure



Aurora over a Glacier Lagoon by James Woodend, UK. Winner: Astronomy Photographer of the Year 2014

Settings: Canon 5D Mk III camera; 33mm f/3.2 lens; ISO 1000; 10-second exposure

STAR TRAILS

Star Trails:

With long-exposure images on a camera with no tracking, stars will appear to 'trail' as the Earth rotates

You can use this to your advantage to create some very effective images

Stacking:

To create an image with long star trails, take a series of equal length exposures and 'stack' using free software

e.g. StarStaX, Startrails, Sequator (can also be used for alignment and stacking)

Star Trails around Polaris— by Mike Meynell; Settings: 34x30sec, f/11, ISO 1000, 17mm



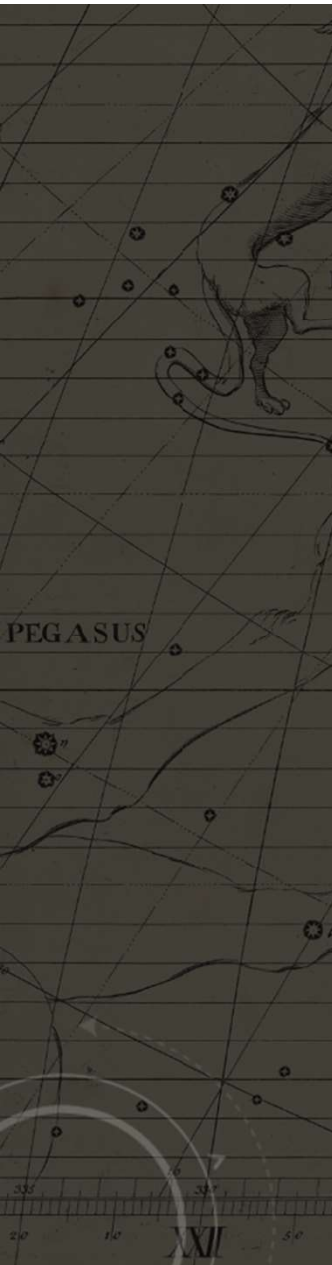


Star Trails over Romney by Mike Meynell; Settings: Canon 5D Mark II Camera. 24mm f/5.6. 197 x 30 second exposures

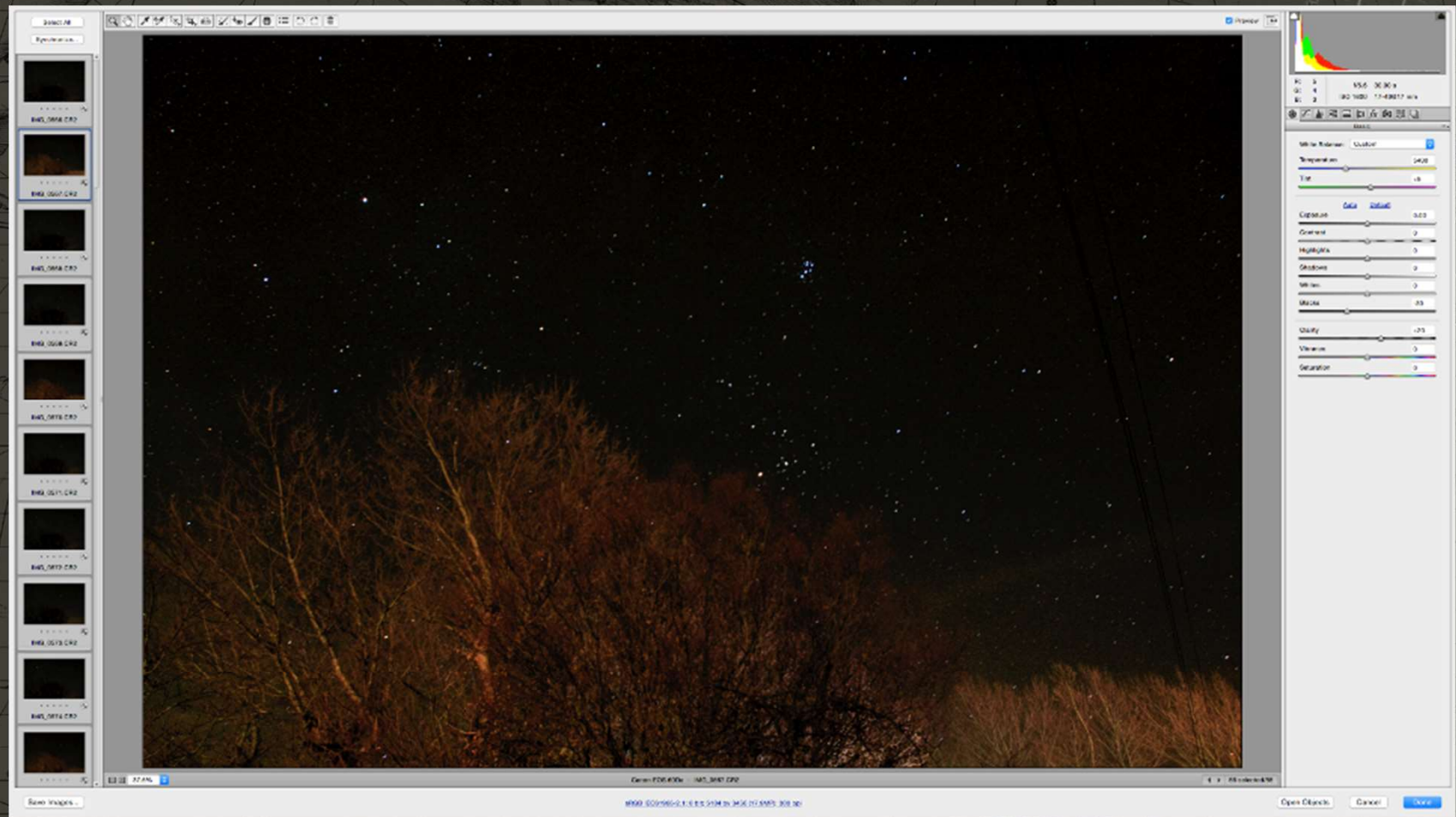


Summer Nights in Michigan by Michael A. Rosinski (USA). Highly Commended: Earth & Space Category, Astronomy Photographer of the Year 2012

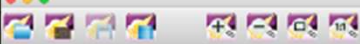
Settings: Canon T1i camera; Canon 15–85mm zoom lens at 15mm; ISO 800; 400 25-second exposures © Michael A Rosinski



Star Trails with Star Colours – Romney – Monday 24 November 2014 by Mike Meynell



132 x 30-second images: 17mm focal length (equivalent 25.5mm) at f/5.6, ISO 1600



- ▼ Inset Images
- IMG_0668.jpg
- IMG_0667.jpg
- IMG_0668.jpg
- IMG_0670.jpg
- IMG_0670.jpg
- IMG_0671.jpg
- IMG_0672.jpg
- IMG_0673.jpg
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- IMG_0712.jpg
- IMG_0713.jpg
- IMG_0714.jpg
- IMG_0715.jpg
- IMG_0716.jpg
- IMG_0717.jpg

Clear images

Memory		CPU	
System	Free	Usage	Free
Used	Used	Used	Free

Image info: 5184 x 8456 pixels, 32 bits per pixel



Preferences

Blending Images General

Blending Mode

Gap Filling

Cornel Mode

Process images in reverse order

Dark Images

Subtract Dark Images

Cumulative Image Saving

Save after each step

PEGASUS

HERCULES

XVI

XVI

XX

XX

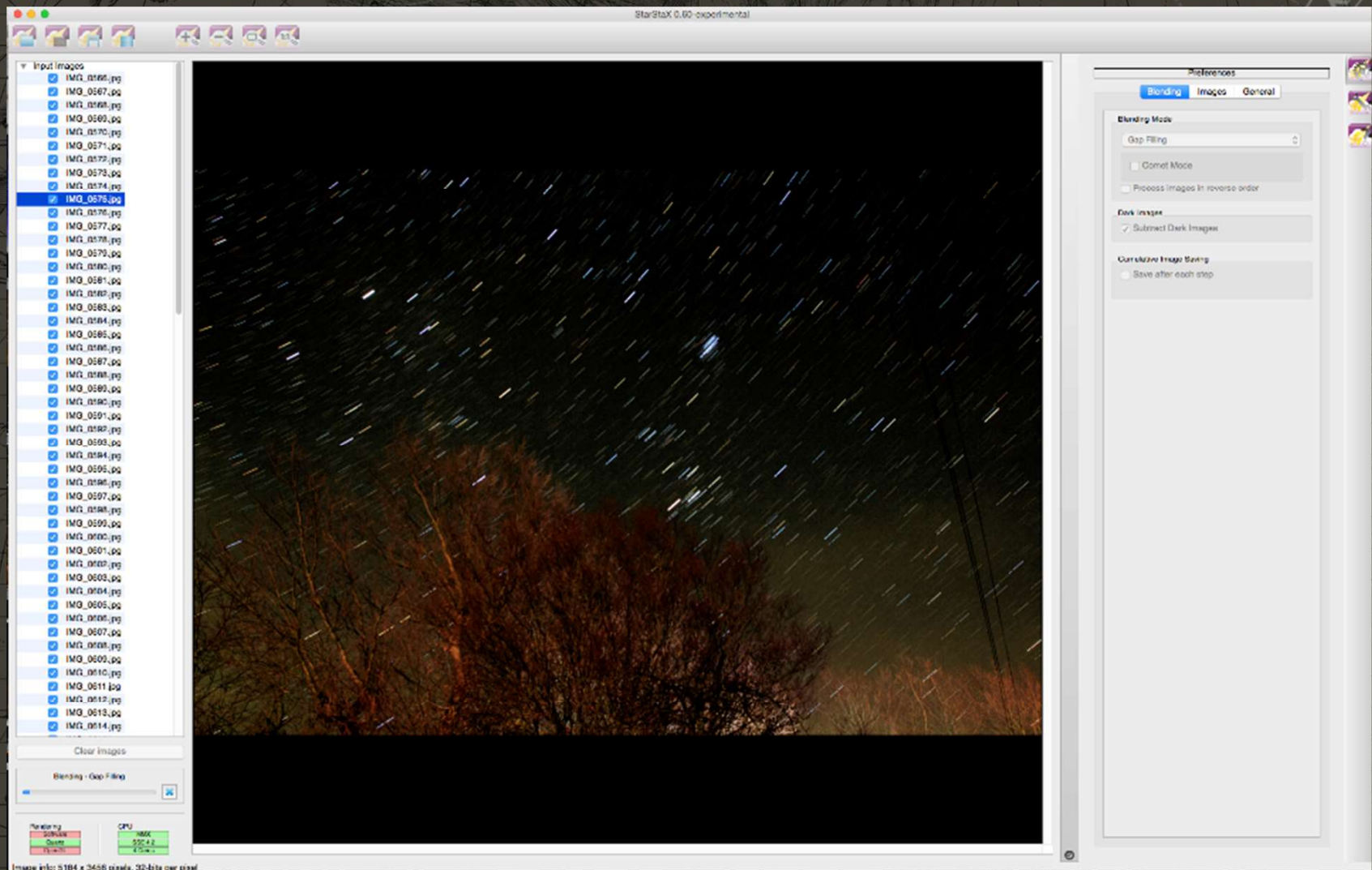
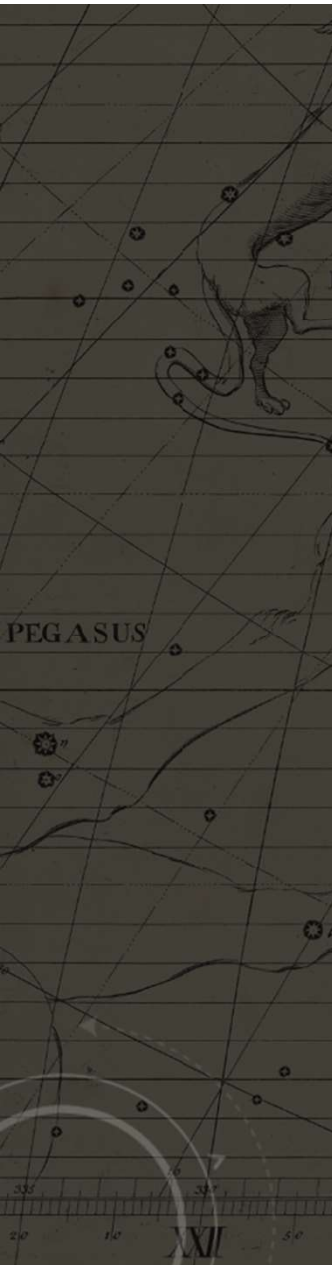


Image info: 5184 x 3456 pixels, 32-bit per pixel



Star Trails with Star Colours – Romney – Monday 24 November 2014 by Mike Meynell

THE MOON

A great target to photograph, but the Moon is smaller than you think!

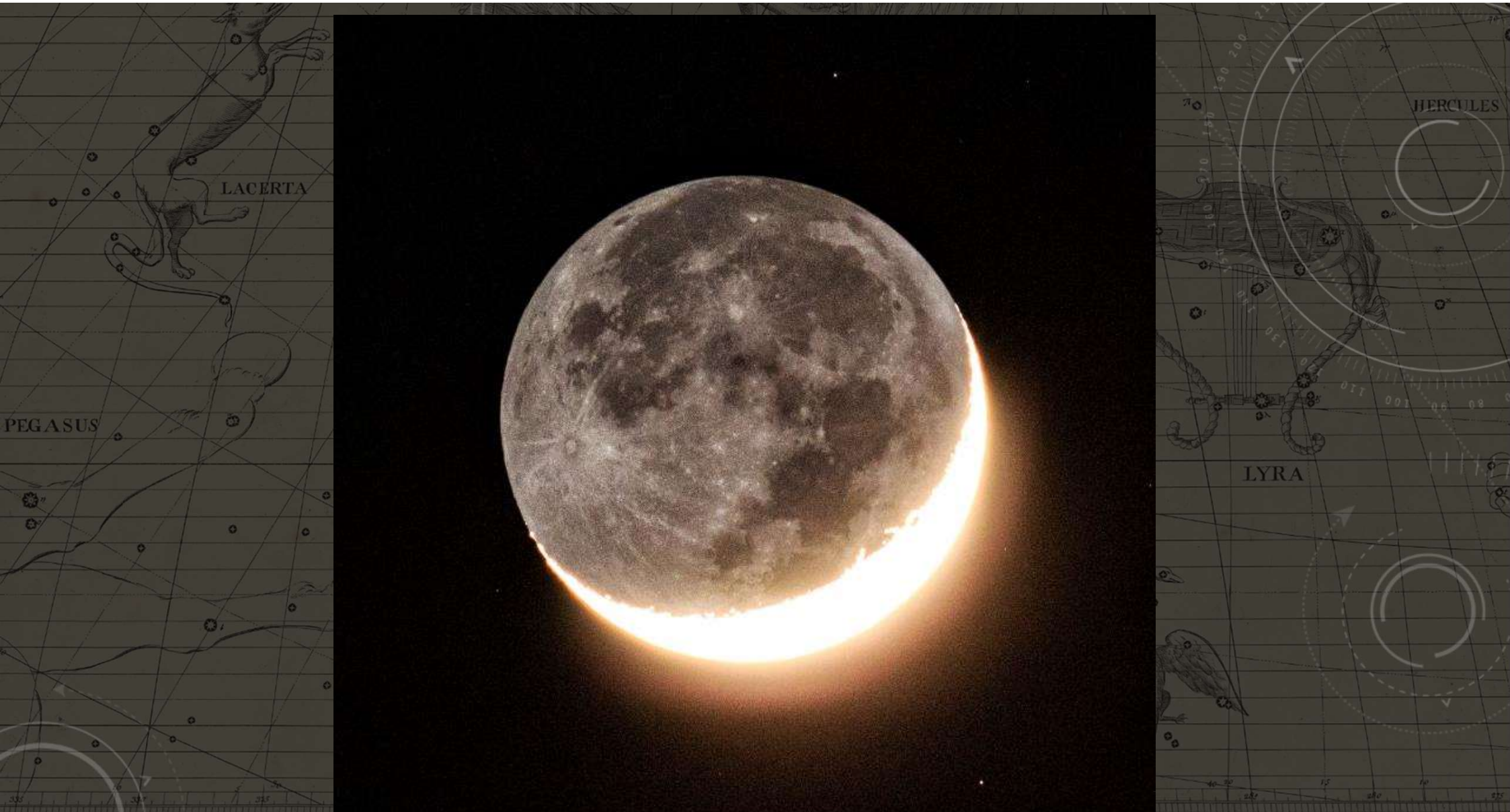
It measures only half-a-degree across in the sky. To completely fill the field of view in a camera requires a focal length of about 1500mm

Camera settings:

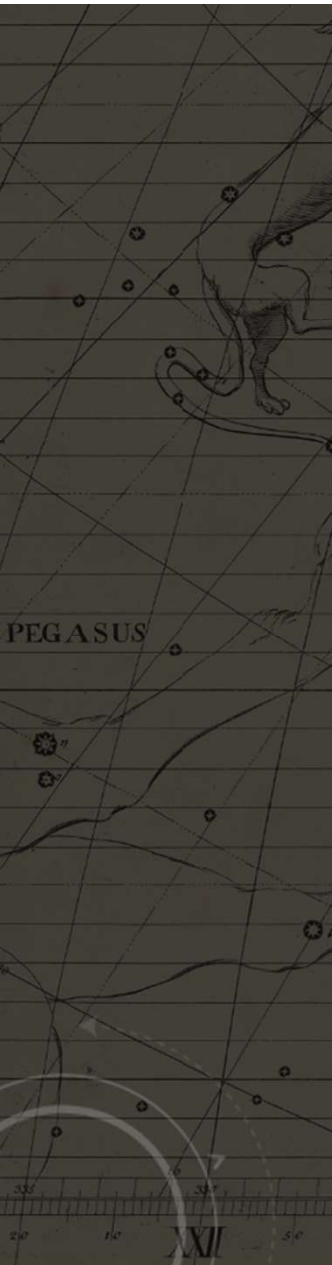
Always use a tripod. Focal length of 300mm for surface detail

Aperture f/5.6, ISO 200-800. Full Moon: 1/500 second; Crescent Moon with Earthshine: 1 second

Moon over Romney – by Mike Meynell; Settings: Canon 5D mark II – though Meade 14" telescope 1/25 second



Moon with Earthshine above Blackheath by Mike Meynell; Settings: 1 second, Canon 60Da attached to Skywatcher Esprit 80/400 (f/5), ISO 800



Lunar Eclipse at Maximum: Blackheath, London: 28 September 2015: Picture by Mike Meynell



1.5 Day Old Crescent Moon (2% illuminated) - Glyndon Park, Plumstead, London SE18
4 June 2019, 22:00 BST
Canon EOS 60Da, 1.0 seconds, ISO 200
Williams Optics WhiteCat51 APO f/4.9 D:51/F:250
TTS-160 Panther Mount

1.5 Day Old Crescent Moon by Mike Meynell. Settings: 1.0 seconds, f/4.9, ISO 200, 250mm
Mike Meynell



Lunar Halo by Martin Male

USING A TELESCOPE

Mounting a camera:

For very bright objects (e.g. The Moon) you may be able to hand hold the camera over the eyepiece

It is usually better to mount the camera using specialist equipment

Equipment:

Camera phones and compact cameras are usually mounted over telescope eyepiece

DSLRs can be connected to a telescope using a 'T-Ring' and 'T-Adapter' for prime focus imaging

Prime Focus Imaging:

The camera lens is removed and the telescope is used like a telephoto lens

A T-Ring is a coupling ring to connect a camera to a T-adaptor which then connects to the telescope

EXAMPLES OF MOUNTING TO A TELESCOPE



WHAT TELESCOPE?

**What
Telescope?:**

Depends on what you want to image!

**Planets /
Lunar:**

Long-focal length refractor

Can cost around £100, but up to several thousand

**Widefield /
Deep-Sky /
Portable:**

Short-focal length refractor (fluoride/ED glass)

£500 - £1,000, but up to several thousand

**Galaxies /
Deep-Sky / Less
Portable:**

Newtonian (8-inch+) + coma corrector or SCT (Schmidt-Cassegrain)

£200 - several thousand; coma corrector (£150-£300)



TRACKING MOUNTS

Basic Star Tracker:

Sky-Watcher Star Adventurer
iOptron SkyGuider Pro

Cost is around £300 to £400 – but no GoTo functionality

Basic GoTo Mount:

Sky-Watcher AZ GTi (can be mounted in EQ mode) – but have to cobble together a suitable mount to be polar aligned

Cost is around £250 – but you need a way to polar align (e.g. use ball head on tripod)

More Advanced:

Sky-Watcher EQ6-R Pro Go-To

Cost is around £1,500 – exceptional mount for the cost



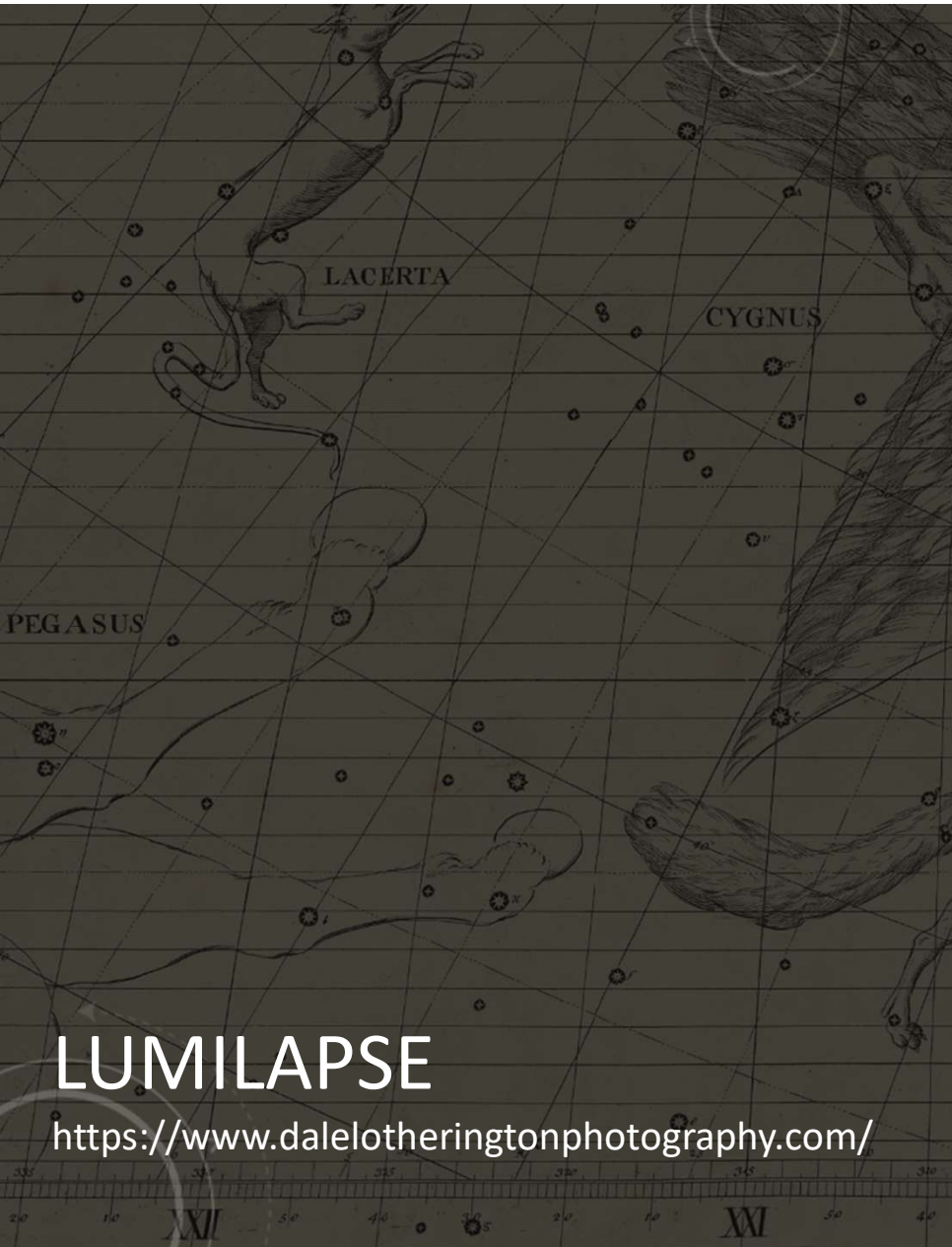
NEW TECHNOLOGY - SMARTPHONES

Smartphone Cameras

The latest Smartphones have very effective “night modes” allowing long-exposure astrophotography.

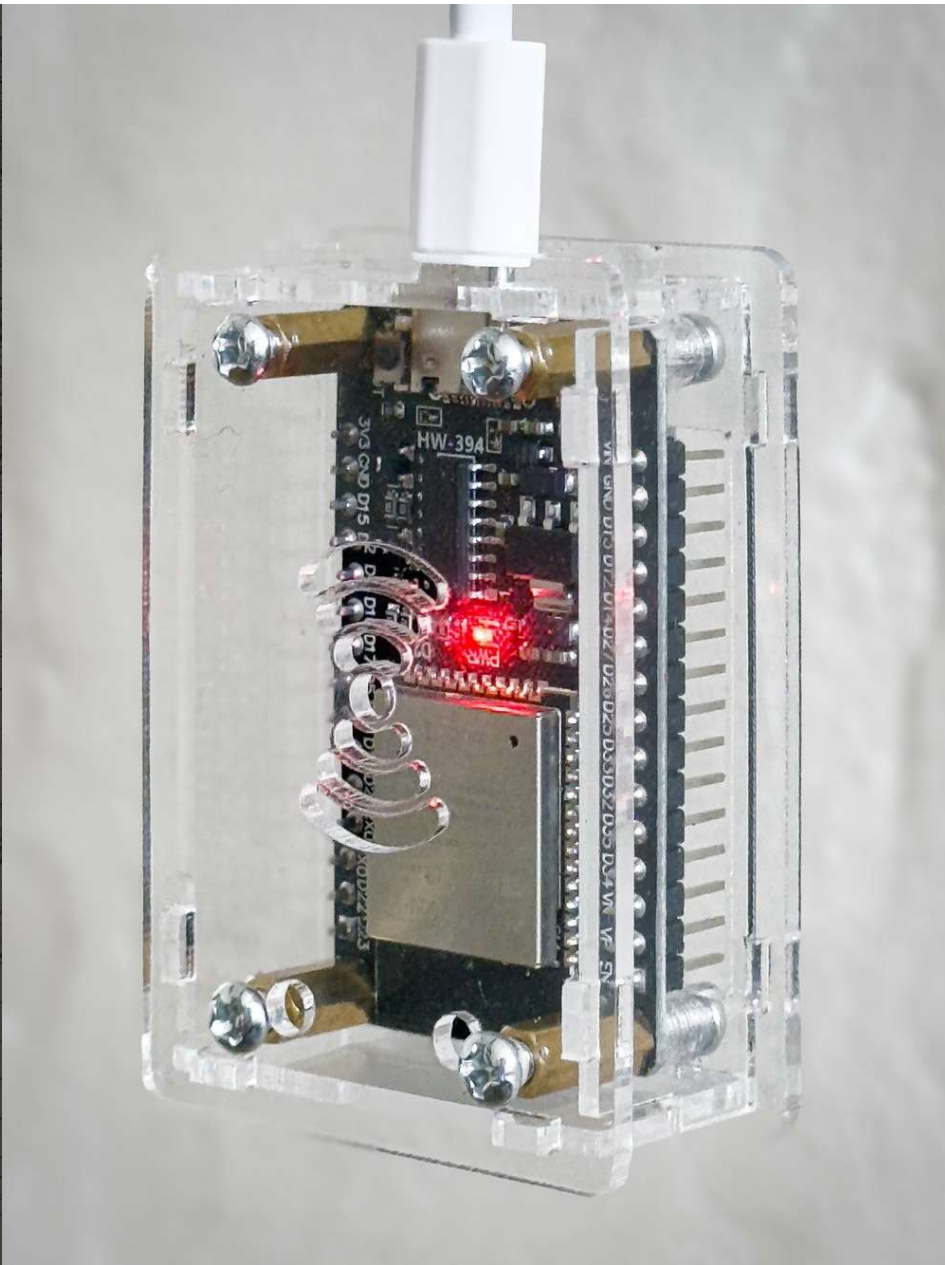
You will still need a tripod to hold the phone, or prop it up against a steady object!

You can take multiple images and stack them using apps on your phone e.g. Star Stacker



LUMILAPSE

<https://www.dalelotheringtonphotography.com/>





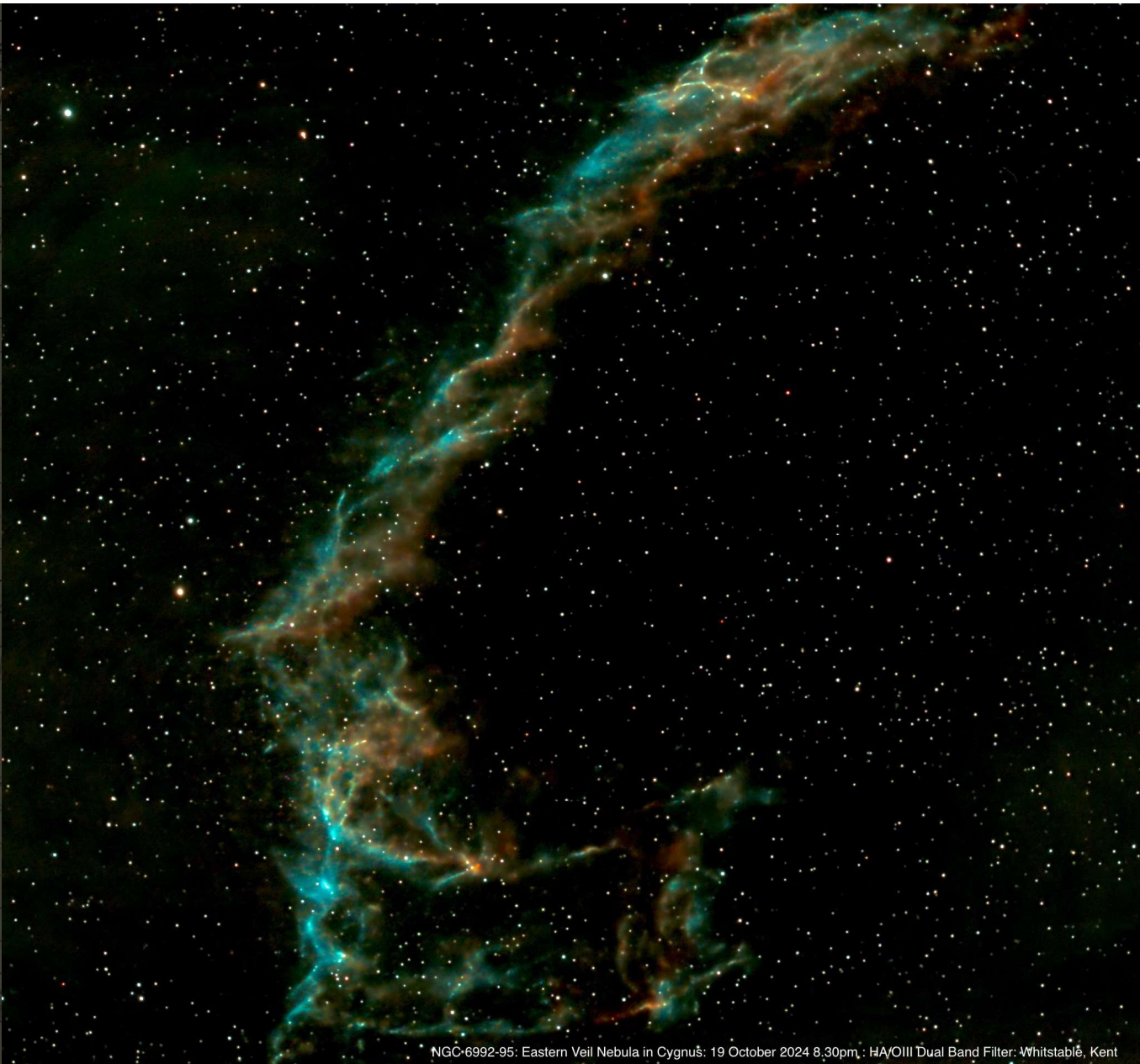
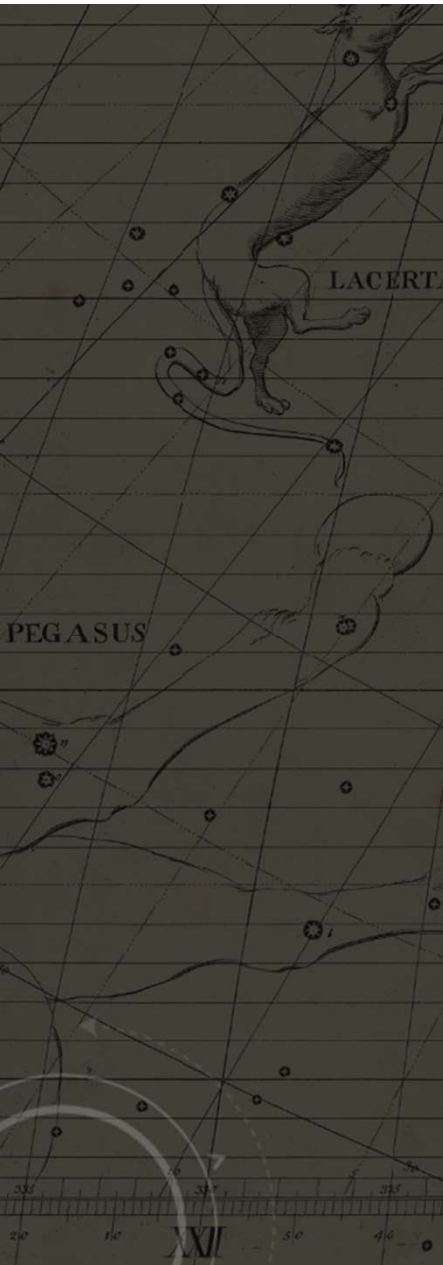
NEW TECHNOLOGY – SMART TELESCOPES

Smart- Telescopes or Automated Electronically Assisted Astronomy

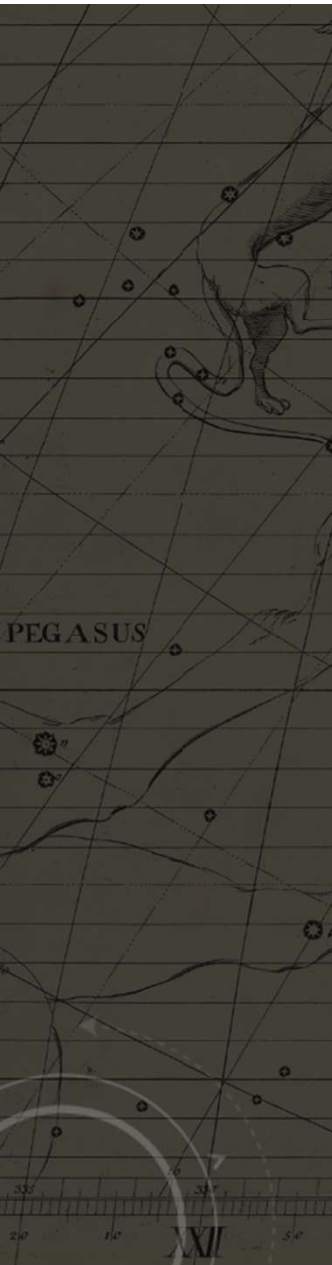
These are “all-in” solutions, a combination of telescope and camera, which integrate to your phone or tablet to give direct live-views of deep-sky objects.

Vaonis Stellina or Vespera (Pro) / Unistellar eVscope or eVscope 2 / Celestron Origin. Cost ranges from £1,700 to £4,000.

ZWO Seestar S50 (~£500) / S30 (~£370) / Dwarf II (~£350) / Dwarf III (~£500)



NGC-6992-95: Eastern Veil Nebula in Cygnus: 19 October 2024 8.30pm, : HA/OIII Dual Band Filter: Whitstable, Kent



NGC 7023 • Iris Nebula - Whitstable, Kent - 11 October 2024 - 8.30pm - 143x10s



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HERCULES

M33 Triangulum Galaxy: 360x10 seconds: 27 October 2024 7.30pm: Whitstable, Kent





PROCESSING IMAGES – THE “DARK ARTS”

Image format:

Wherever possible, use RAW format when taking your images, to give yourself the best range of processing options

Software:

Several software packages are available. The most versatile is Photoshop / Lightroom, but specialist astrophotography packages also available (PixInsight).

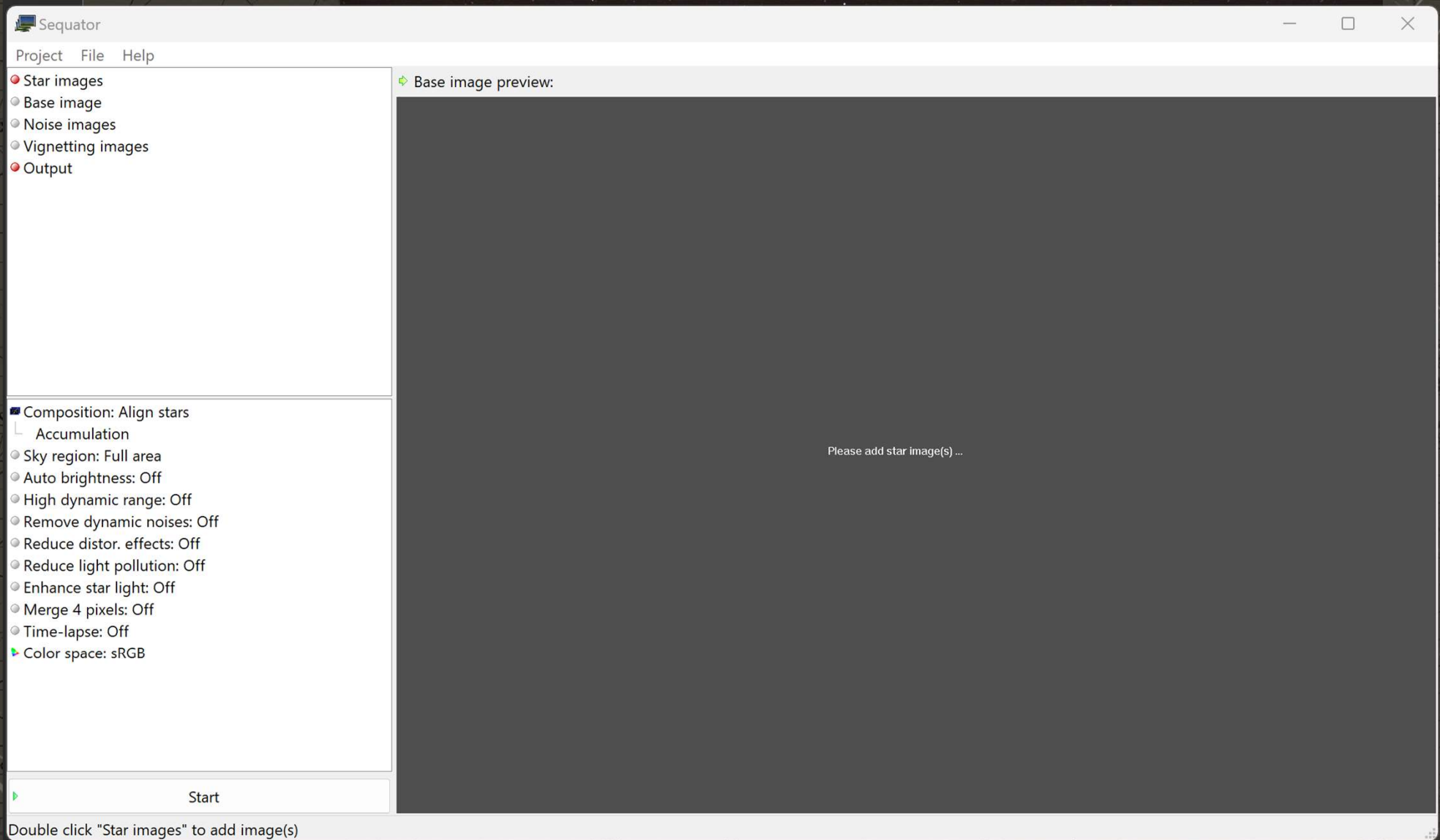
Stacking:

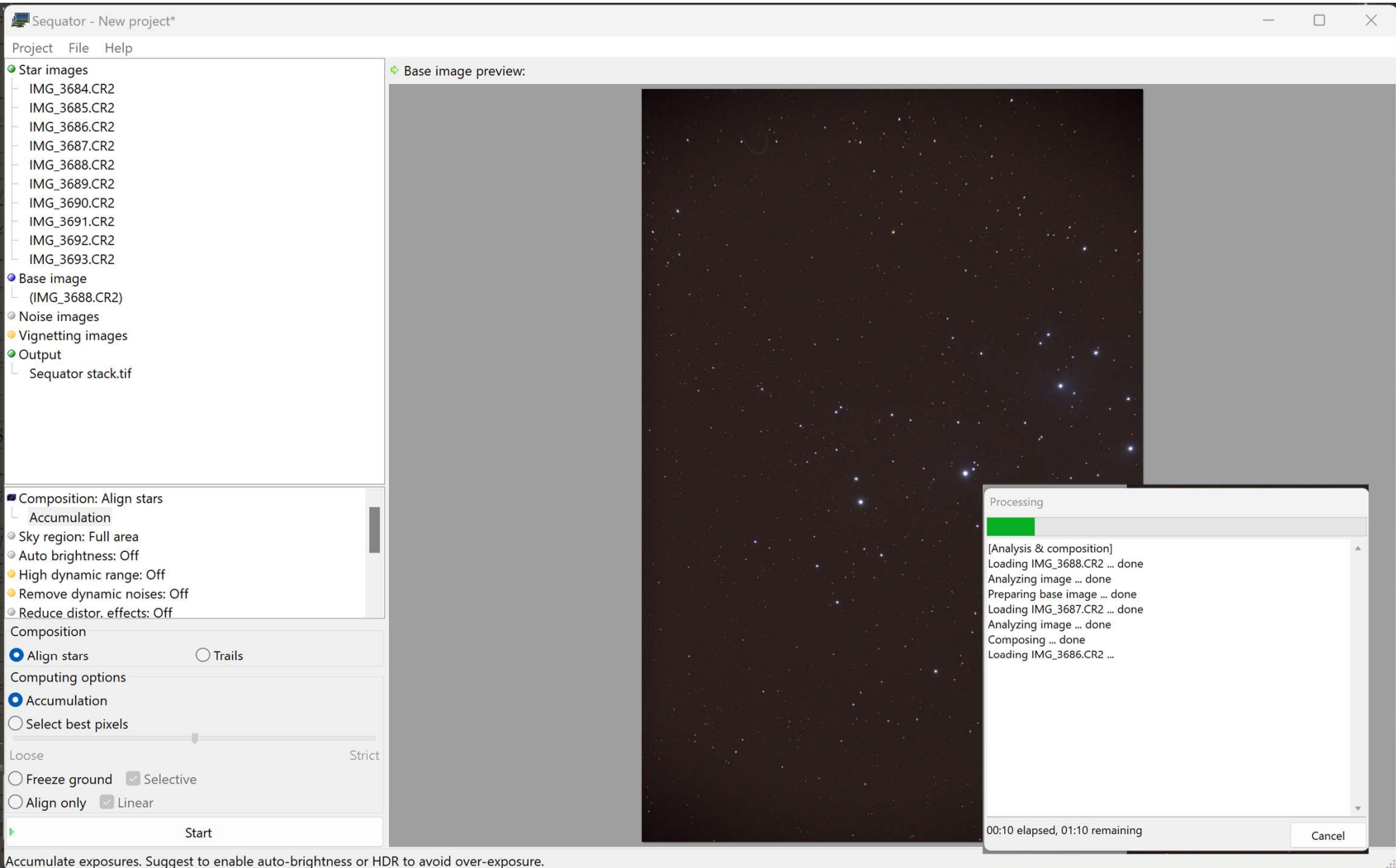
Images can be stacked to effectively increase exposure time, adding more detail to the image and reducing noise. Software for stacking includes Deep Sky Stacker, RegiStax, AutoStakkert!2, Sequator, Starry Sky Stacker (Mac)



UNPROCESSED Pleiades by Mike Meynell

Settings: 30sec, ISO 1000. Prime focus on Williams Optics 110mm refractor with auto guider





Sequator - New project*

Project File Help

- Star images
 - IMG_3684.CR2
 - IMG_3685.CR2
 - IMG_3686.CR2
 - IMG_3687.CR2
 - IMG_3688.CR2
 - IMG_3689.CR2
 - IMG_3690.CR2
 - IMG_3691.CR2
 - IMG_3692.CR2
 - IMG_3693.CR2
- Base image
 - (IMG_3688.CR2)
- Noise images
- Vignetting images
- Output
 - Sequator stack.tif

- Composition: Align stars
 - Accumulation
- Sky region: Full area
- Auto brightness: Off
- High dynamic range: Off
- Remove dynamic noises: Off
- Reduce distort. effects: Off

Composition

- Align stars
- Trails

Computing options

- Accumulation

- Select best pixels

Loose

Strict

- Freeze ground
- Selective

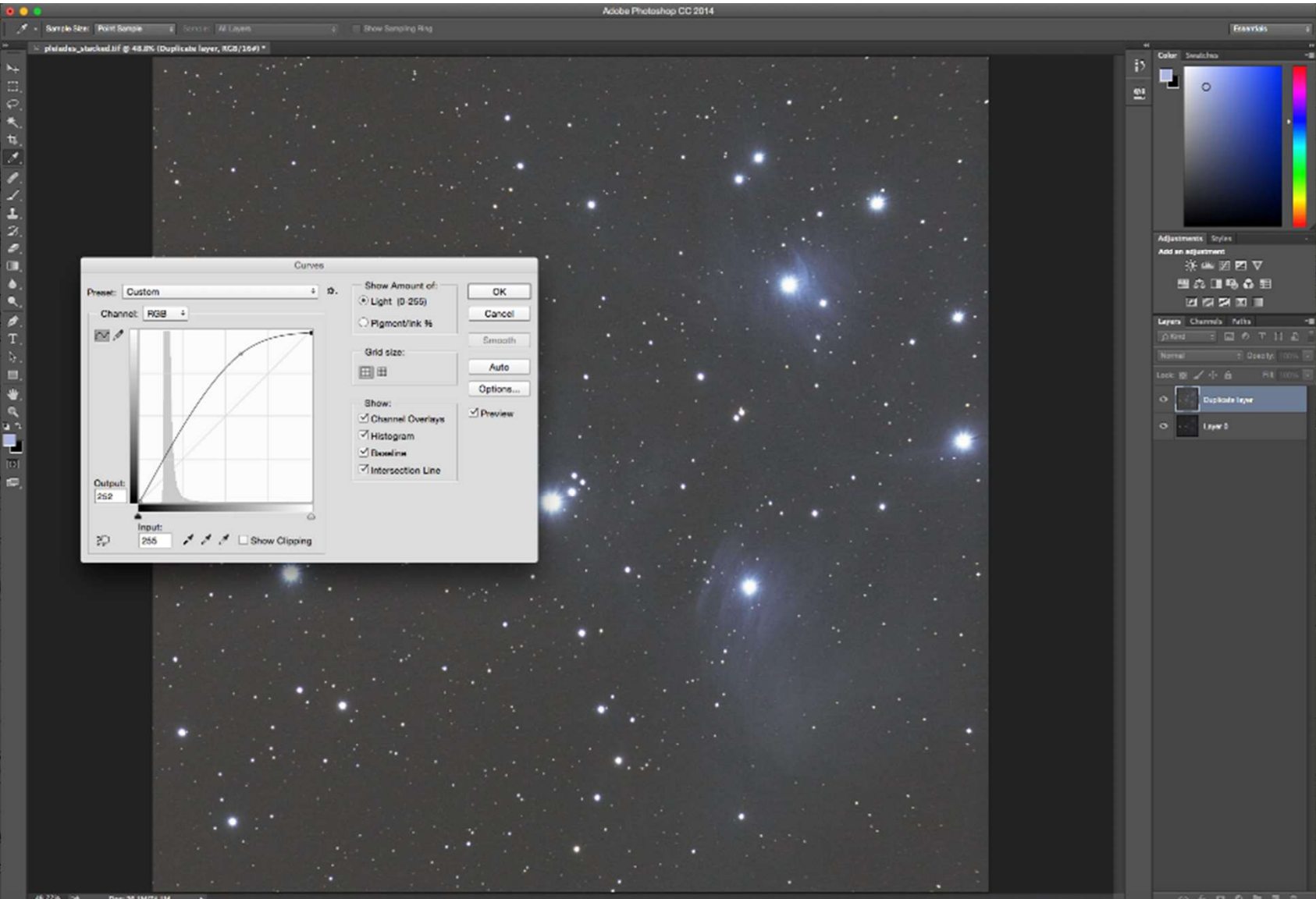
- Align only
- Linear

Start

Result: C:\Users\mikemeynell\OneDrive - MJM Consulting Limited\Documents\Flamsteed\Astrophotography presentation\Pleiades example\RAW\Sequator stack.tif



Accumulate exposures. Suggest to enable auto-brightness or HDR to avoid over-exposure.



Duplicate layer. Image -> Adjustments -> Curves. Brighten up the darker areas of the image.
Some more nebulosity, but the image looks washed out.

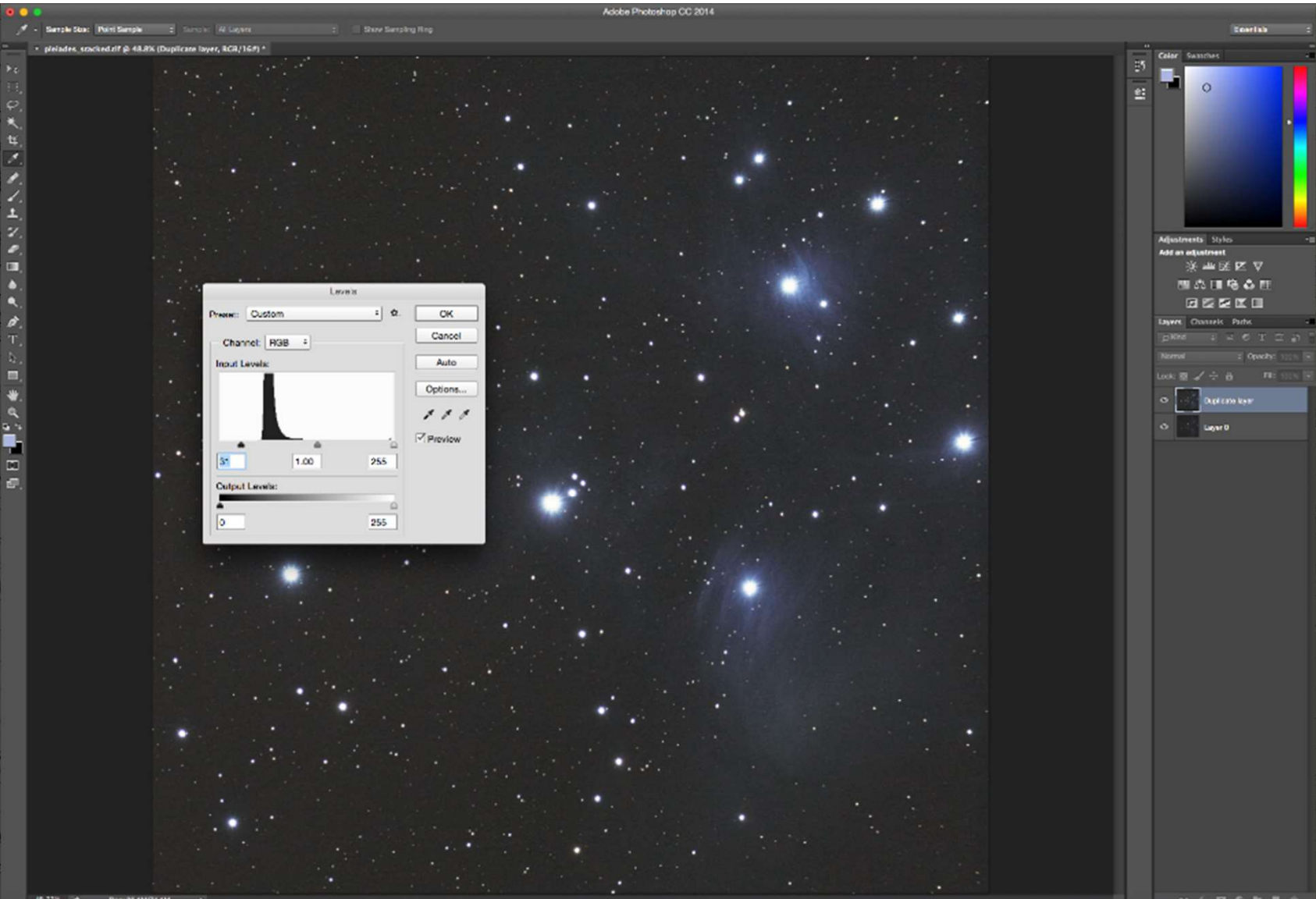
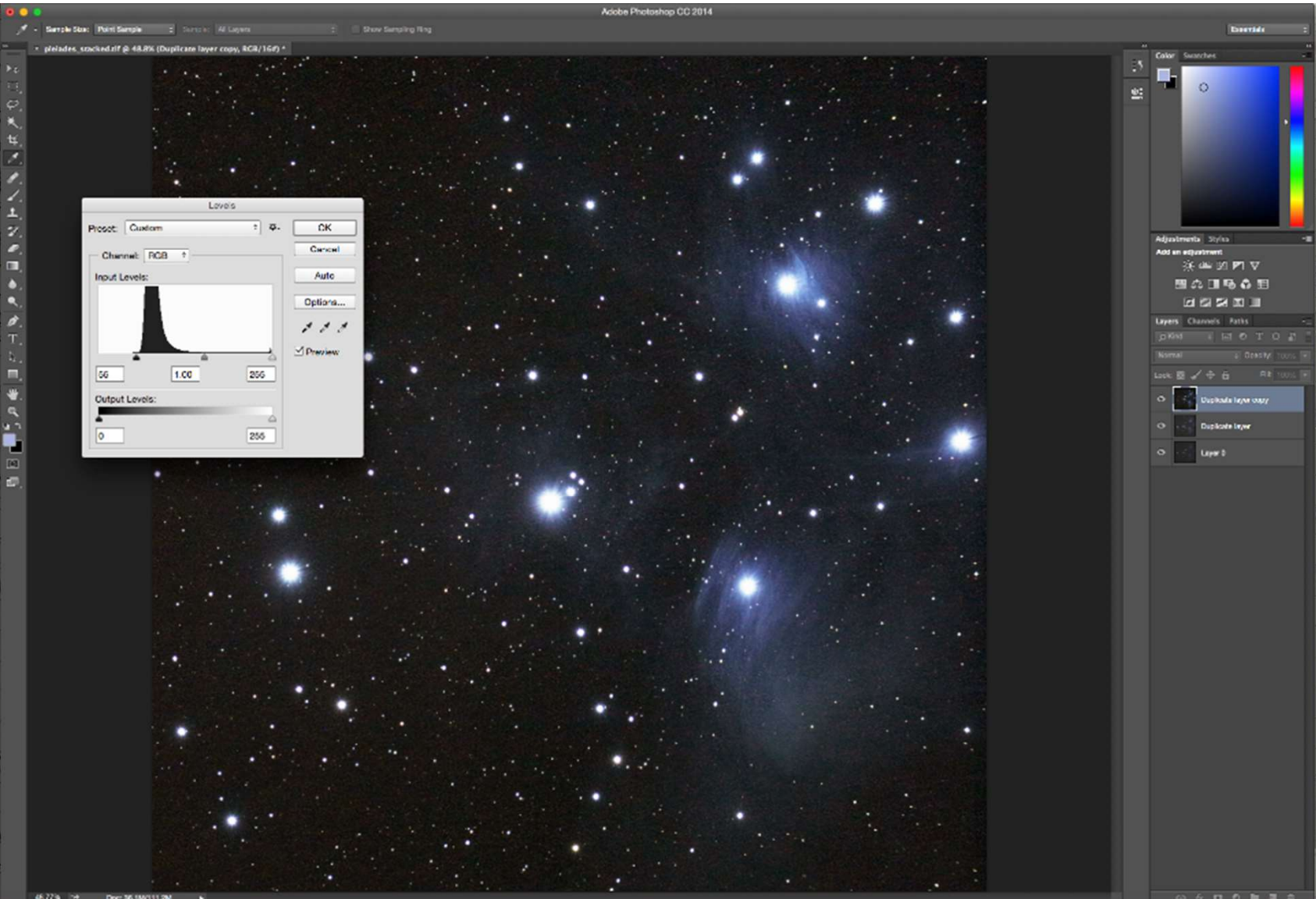


Image -> Adjustments -> Levels. Adjust the 'black' point of the image to be higher, thus re-darkening the black areas (take it only half-way on this occasion).

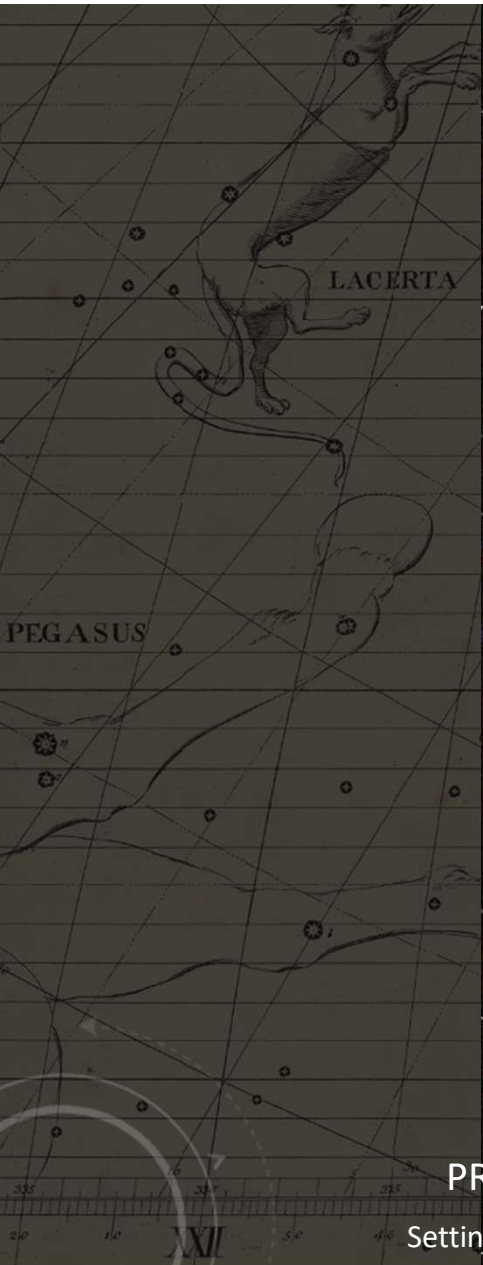


Repeat Curves and Levels adjustments. This time adjust the 'black' point of the image all the way to the left hand side of the input level.



UNPROCESSED Pleiades by Mike Meynell

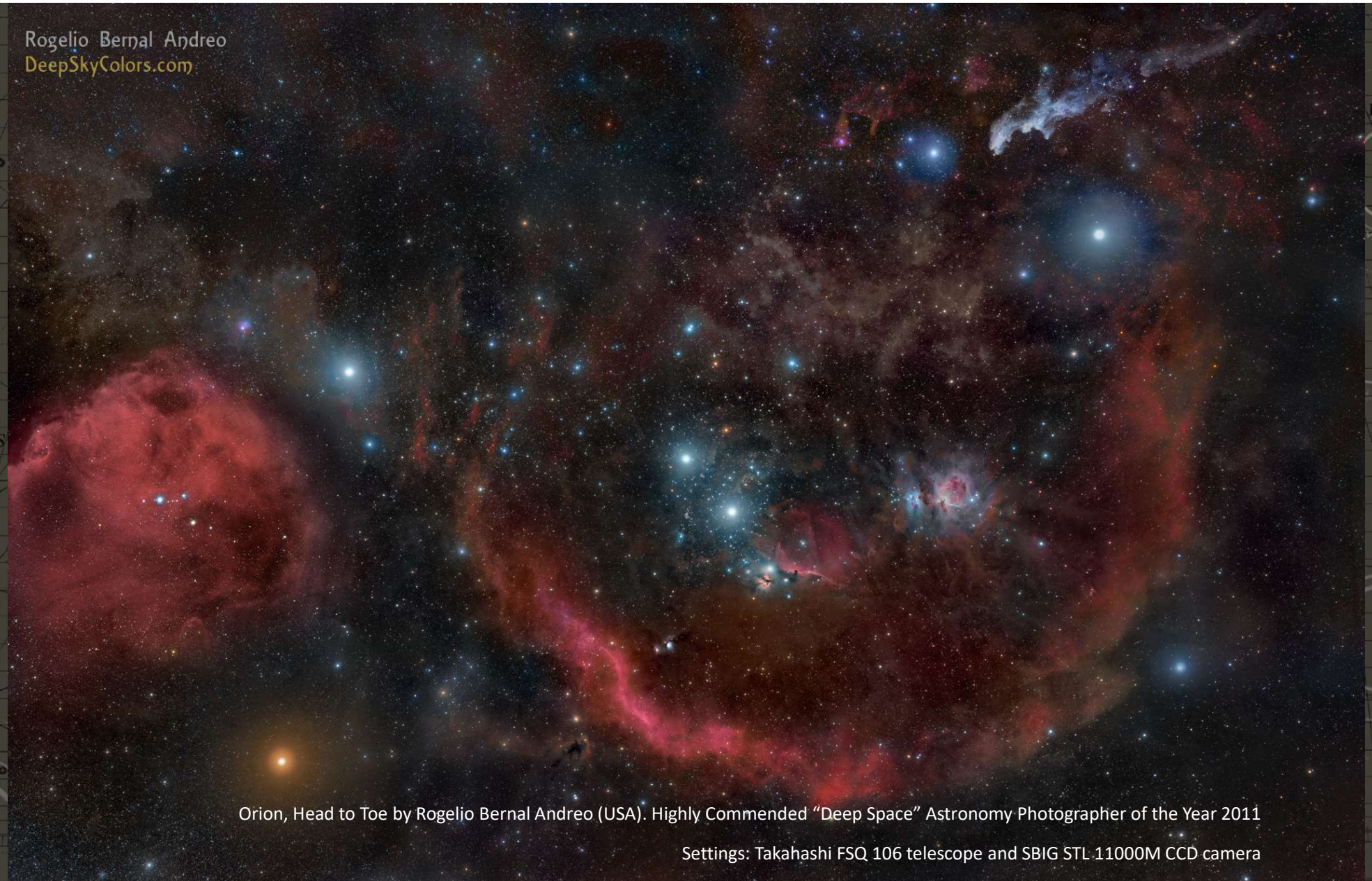
Settings: Canon 5D mark II, 30sec, ISO 1000. Prime focus on Williams Optics 110mm refractor with auto guider



PROCESSED Pleiades by Mike Meynell (cropping, stacking, levels and noise adjustments)

Settings: Canon 5D mark II, 7x30sec, ISO 1000. Prime focus on Williams Optics 110mm refractor with auto guider

Rogelio Bernal Andreo
DeepSkyColors.com



Orion, Head to Toe by Rogelio Bernal Andreo (USA). Highly Commended "Deep Space" Astronomy Photographer of the Year 2011

Settings: Takahashi FSQ 106 telescope and SBIG STL 11000M CCD camera

NEXT STEPS

Getting Help:

Buy a magazine (e.g. Sky and Telescope, Astronomy Now, Sky at Night)

Use the internet – YouTube / CloudyNights / Stargazers Lounge

Astronomy Societies:

Join your local astronomy society

The British Astronomical Association (BAA) / Society for Popular Astronomy (SPA)

Practice:

In theory there is no difference between theory and practice. In practice there is.

M51 – The Whirlpool Galaxy by Martin Pugh. Winner Astronomy Photographer of the Year 2012

Settings: Planewave 17-inch CDK telescope; Software Bisque Paramount ME mount; Apogee U16M camera

Thank you for watching!



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Astronomy
Society**

