

[0m30s]

- Hello
- I've had an on and off relationship with photography since I was younger but really only got into it in a big way once we bought a place on Lake Glenmaggie.
- Birds are my primary interest with cloud time-lapse a secondary interest but .....
- ..... I did inherit an astronomical observatory with the property so astrophotography joined the throng.
- This star trail is made up of nearly 9 hours of exposures .....
- ..... Shot through my lounge-room window .....
- ..... Looking South with the young blue stars of the Southern Cross and its two pointers at right.
- I'll tell talk about Star Trails later on.

*[Click] to END*



### Agenda

- Imaging basics
- Processing basics
- Extra tools to help
- Telescope-based astro-photography

### [1m00s]

- I'm going to talk about these aspects of night sky photography ..... for about 60 minutes  
.....
- ..... at an introductory level ..... using some fairly basic kit .....
- My goal is to get at least a few of you outside at night and having a go.
- Then we'll look at what you can achieve with some more dollars well spent.
- The focus will be on alerting you to the techniques to capture and best show off the night sky .....
- ..... These won't be full explanations or demos as the topics need depth and .....
- ..... I'm not going to dwell on integrating landscapes and night sky scapes .....
- ..... As the references I'll be showing explore this in detail – in other words, homework for you!
- This pre-dawn shot from my place shows the Moon below Mercury below Venus .....
- ..... And Saturn and Antares at top left, the Milky Way – actually the centre of our galaxy  
.....
- ..... And the glow of the Zodiacal light – sunlight reflected off interstellar dust.

[CLICK] to [END]

## Resources



01m15s]

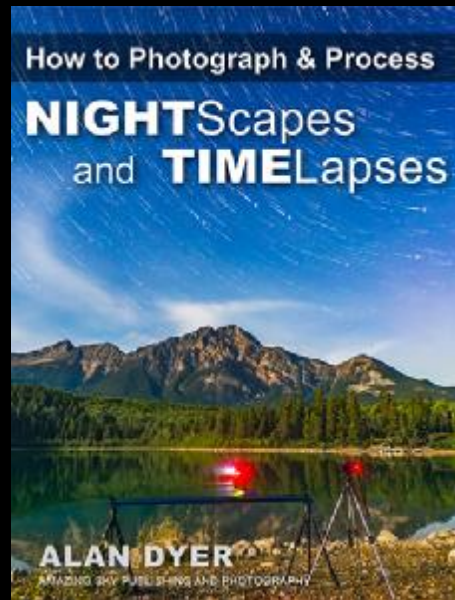
- First some useful resources for you to consider.
- I'll list all these at the end so you can photograph the list.
- Phil Hart's easy to read e-book provides a good starting point, good value at \$15 .....

[CLICK]

- ..... For a 140-page introductory look, as per this index.

[CLICK] to [END]

## Alan Dyer



[0m15s]

- Alan Dyer's 400-page e-book provides a great deal of information on many methods and is excellent value at around \$30 .....

[CLICK]

- ..... And very comprehensive in what it covers .....
- ..... Strongly recommended but Apple-based only – no Android or Windows version.

[CLICK] to [END]

## Astronomy Picture of The Day

[www.apod.nasa.gov](http://www.apod.nasa.gov)



[1m15s]

- NASA's Astronomy Photograph of the Day (APOD) provides a fabulous range of the best of the best of amateur and professional photographers using everything from simple DSLRs to the most sophisticated space-based equipment.
- You've made it if you get an image published.
- This is the full moon rising over the shadow of Mauna Kea in Hawaii.
- [\[CLICK\]](#) Partial Lunar eclipse moon over Sesimbra Castle in Portugal. Note the moon is only  $\frac{1}{2}$  degree in size so the huge size in this frame shows that the FOV is about 6 degrees vertically which means this was shot with a focal length of around 225mm if a full-frame camera.
- [\[CLICK\]](#) Eagle apparition in an aurora over Norway.
- [\[CLICK\]](#) Milky Way, Venus and Jupiter plus Zodiacal Light over a Queensland road.
- [\[CLICK\]](#) As well as some deep space images such as the Helix Nebula.....
- [\[CLICK\]](#) ..... And plenty of NASA space shots such as the clouds of Jupiter shot from the New Horizons probe.
- [\[CLICK\]](#) to [\[END\]](#)



**The World AT Night**  
[www.twanight.org](http://www.twanight.org)



[0m15s]

- The World At Night (TWAN) is an international effort to present stunning nightscape photos and time-lapse videos of the world's landmarks against celestial attractions.
- It also has some sections on techniques and galleries of specific types of images.

[CLICK] to [END]

## Photographer's Ephemeris

[www.ephemeris.com](http://www.ephemeris.com)



[0m20s]

- The Photographer's Ephemeris site shows you sun and moon rise and set direction and times, etc .....
- ..... For any location, date and time.
- This is for tonight, the line showing where things will be.

[CLICK] to [END]

## Windows Planetarium Software

[www.stellarium.org](http://www.stellarium.org)



[0m30s]

- Stellarium is free multi-platform planetarium software which will show you the night sky  
.....
- ..... for any location, date and time .....
- ..... and zoom level and FOV outline.
- This is for tonight at 1030 at a dark sky site .....
- ..... with the red square showing the FOV for an EOS60D with 16mm lens.
- [CLICK] Unfortunately, this is what you might see from within a typically light-polluted city like Sale.
- [CLICK] to [END]



## Mobile Apps



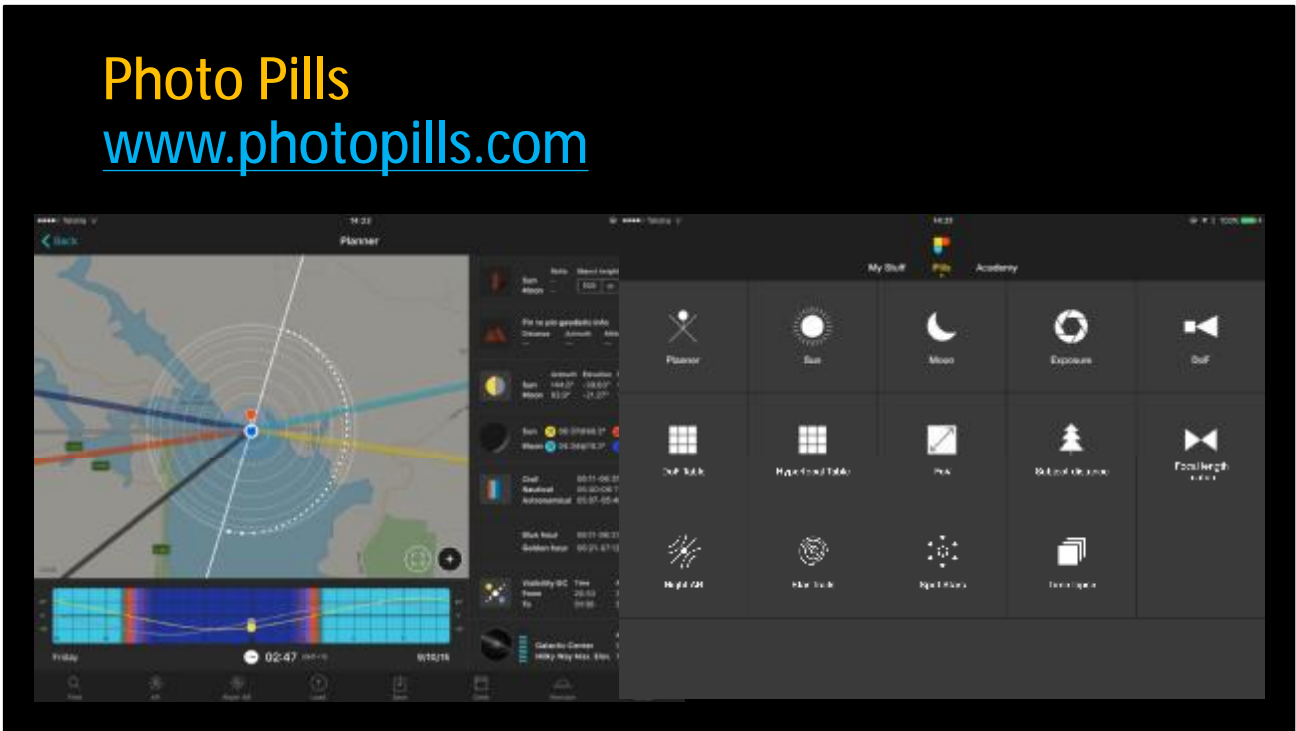
[0m10s]

- There are dozens of great, cheap astronomy apps .....
- ..... For your iOS or Android device.
- Just Google "best astronomy app"

[CLICK] to [END]

## Photo Pills

[www.photopills.com](http://www.photopills.com)



[0m15s]

- Photo Pills is a handy and more convenient phone app that does similar things to Photographer's Ephemeris .....

[CLICK]

- ..... Plus a pile of things like these .....
- ..... For about A\$12-13.
- I can demo this on my iPad linked to the projector later if anyone is interested.

[CLICK] to [END]



[0m20s]

- OK, onto taking some images.
- This single exposure shot, taken by Phil Hart at my place some years back shows .....
- ..... My observatory at lower right .....
- ..... The Large & Small Magellanic Clouds – satellite galaxies of the Milky Way 180-210,000 light years away .....
- ..... And a satellite trail at the top – a pain for us but also interesting.

[CLICK] to [END]

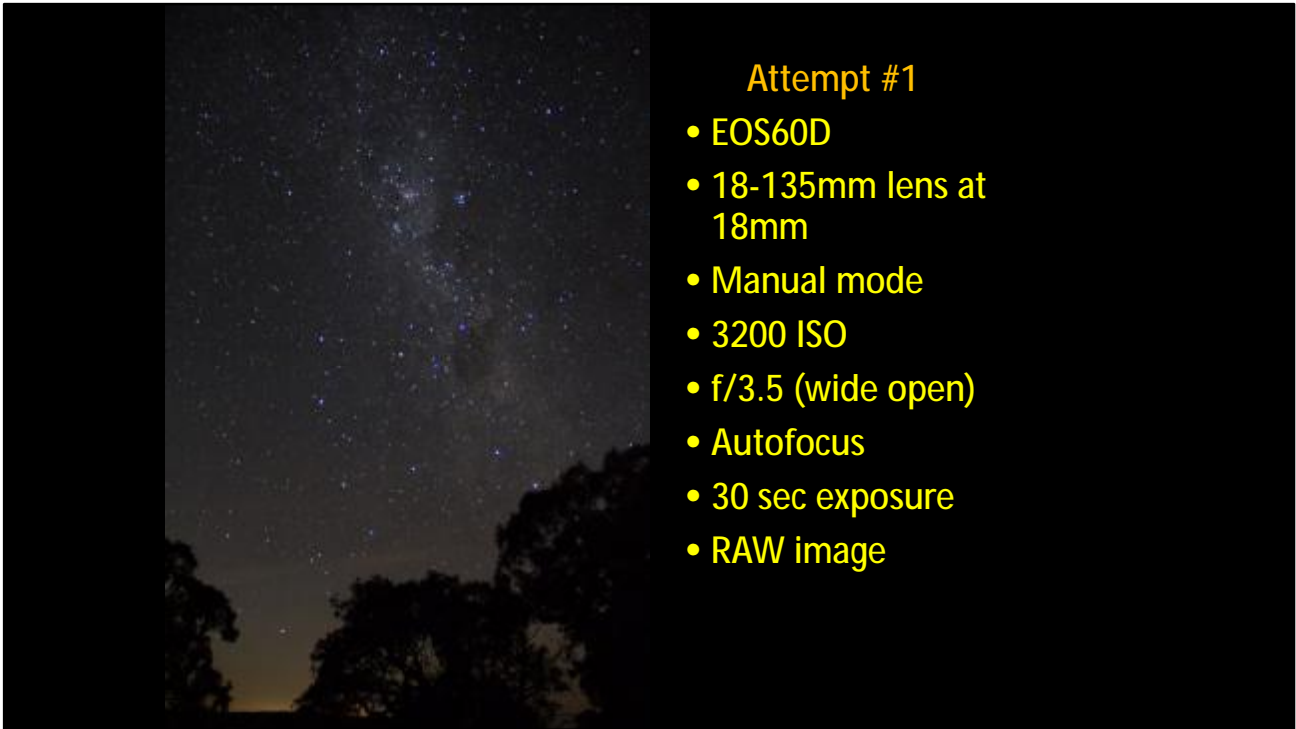
## A (really) Basic Imaging Kit

- EOS60D DSLR
  - RAW (14-bit) output, not “lossy” 8-bit JPEGs
  - Bulb & manual modes
  - Rotating fold-out display screen!
- Canon “kit” EFS lens 18-135mm f/3.5 – 5.6
  - 100 -12800 ISO
  - 1/8000<sup>th</sup> to 30 sec exposures
- Tripod – the sturdier the better
- Dark or darkish sky – shoot away from urban lights
- Head-strap torch

[0m25s]

- I’ll focus on shooting with a basic kit that some may have and many have better..
- A faster prime lens and/or a full-frame camera would be much better but lets get you hooked first!
- The most important part is the ability to capture RAW images as we are going to be digging for every photon we can get. Forget JPEGs for everything except final images.
- A rotating display screen is also essential when you are shooting upwards from an icy cow paddock late at night.

[CLICK] to [END]



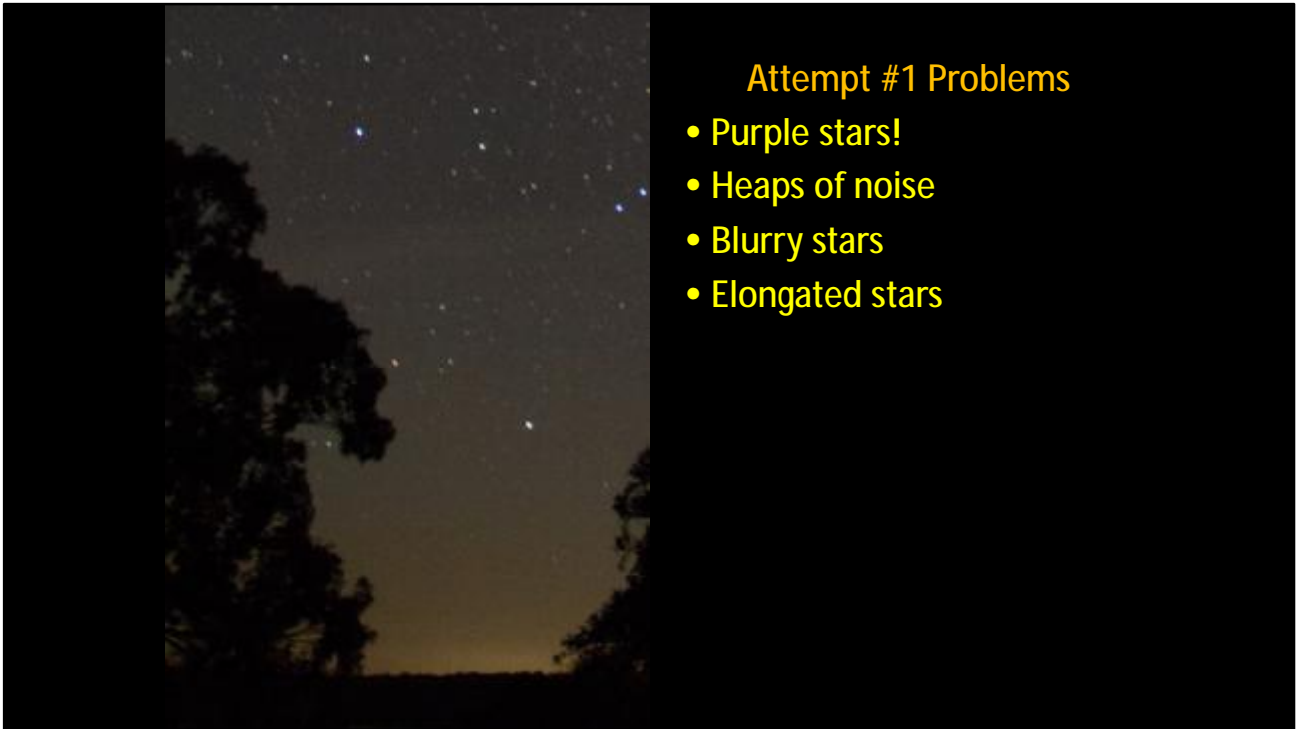
[0m40s]

- So, lets set some basic parameters, aim towards the Milky Way, shoot and see what happens.
- Start with a high ISO to get framing and focus right.
- A wide-open lens maximizes light captured.
- 30 seconds is the longest we can typically go without an intervalometer; more on them later.
- So, what did we get?

[CLICK] to bring up whole image

- This is looking towards Sale from my place so there is some light pollution; the Milky Way is where it is on any given day so you can't easily pick and choose direction and framing .....
- ..... But Stellarium helps plan things.
- Pretty enough you might say; we can see the Milky Way, the Coalsack, Southern Cross, the pointers, etc.
- But there are a few problems.

[CLICK] to [END]



[0m55s]

- Purple rings around stars (chroma) are due to different wavelengths focusing at slightly focal different positions.
- Fix it by stopping down 1-2 stops to f/4 or f/4.5 for this lens .....
- ..... Which will also sharpen and lighten the corners BUT .....
- ..... Costs us a bit of light.
- Can also do a bit of chroma repair in Adobe Camera Raw.
- Note you may need to stop down more to get your landscape into the depth of field.
- ALSO remove any lens filters (eg UV safety filter) to avoid reflections.
- It also has obvious noise, not unexpected at this ISO.
- Can fix a bit in LightRoom but I'll talk some more about best ISO & ETTR in a second.

[CLICK] to show second closeup

- Stars are blurry - focus doesn't seem right and .....
- ..... the stars are elongated.
- [CLICK] to [END]



## Focusing

- Use Manual focus not Auto-focus
- Use Live View mode and camera view zoom
- Focus on distant light point (not stars)
- Watch for colour & shape change near focus
- Mark focus point on lens for future nights
- More on automated focusing later on



[1m05s]

- Getting great focus is important (as always) and very hard to do at night.
- Take the time to get it right!
- At 18mm, stars are almost invisible even with maximum zoom on Live View so use a distant point light to get focus. Forget Autofocus for the same reason.
- On many lenses, infinity is not at the marked infinity focal ring point so measure where yours is and mark it .....

[CLICK]

- .... On this lens, autofocus at 18mm will end up nearer the 10 mark but best focus is at about the 6 mark.
- Some once-off effort to get this positioning right will pay big dividends and speed things up at night.

[CLICK] to remove photo

- Watch for colour change effect as you move through focus, caused by different wavelengths reaching focus at slightly different points.
- Later on I'll talk about using computer-controlled focusing and something called FWHM via a software program called Backyard EOS.
- It gives you that fine motor control that your clumsy fingers can't easily do at night.

[CLICK] to END



[1m05s]

- The stars are elongated because they're moving (well, the Earth is what is rotating but the effect is the same).
- This is a very fundamental hurdle in the way of long exposures!
- This is a Stellarium simulation looking South at 2200; the co-axial circles are 10 degrees apart and the radial lines are one hour apart.
- Astronomers call these declination and right ascension but you can think of them as latitude and longitude of things in space.
- Its obvious that length of the latitude lines between the longitude radials is longer the further away from the SCP you go.

[CLICK] to 2300

- An hour later, everything has moved but, from your camera's POV, less at the SCP than near the galactic equator.

[CLICK] to 2400

- And same again another hour later.

[CLICK] for star trail

- You can see the effect more clearly with this one hour star trail – star A has clearly travelled further through your viewfinder than stars B and star C.

[CLICK] to END

## Rule of 500

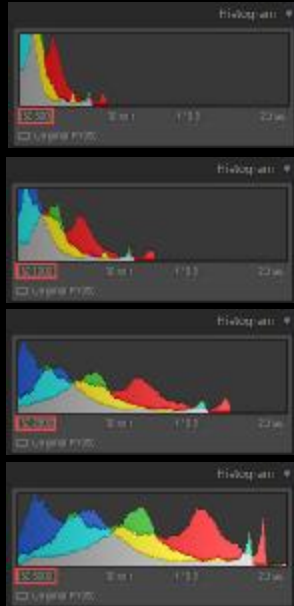
- 500 Divided By the Effective Focal Length of Your Lens = The Longest Exposure (in Seconds) Before Stars Start to "Trail"
  - Eg 18mm lens gives  $500/18=28$  seconds limit.
- Note: Effective Focal Length of lens = physical focal length X sensor crop factor.
  - Eg 18mm lens on EOS60D with crop factor of 1.6 makes it effectively  $18*1.6=28.8$ mm lens
  - Rule of 500 yields  $500/28.8=17$  seconds limit.
- Impact of rule depends on how image displayed
- See PhotoPills for formula dealing with declination of target.

[1m00s]

- Now I could bore you with maths to show that stars will move over a pixel in 3-6 seconds  
.....
- ..... But there is a simple rule you can follow to determine the maximum exposure before noticeable trailing of stars.
- [CLICK] to show the rule.
- So, shorter focal lengths are better.
- [CLICK] to show the caveat.
- Now, there is a catch if you don't have a full-frame camera with crop factor=1 .....
- ..... And that is the effective focal length depends on your camera sensor size.
- Bottom line: use the fastest, shortest prime lens you can afford (eg 16mm f/1.4) to maximise the light captured.
- [CLICK] You can cheat here with longer exposures for videos and small images but can't with large prints
- [CLICK] PhotoPills has a formula that factors in the maximum declination in your target area; ie how close you are aiming towards the SCP.

[CLICK] to END

## Expose To The Right (ETTR)



- Expose so that the histogram moves to the right:
  - use 2-3 steps higher ISO
  - eg 6400 rather than 2500
- Over-exposure better than under-exposure:
  - more “room” to move” when stretching the curve
  - less noisy when stretched despite higher ISO used

[0m45s]

- Here is another concept you need to pay attention to – expose to the right or ETTR.
- In other words, you want the image’s histogram spread out towards the right like the bottom histogram at 5000 ISO.....
- ..... Not just jammed up at the left like the top histogram at 500 ISO OR .....
- ..... Clipped off at the top.
- It is better to overexpose than under-expose – boosting an under-exposed image in PhotoShop will actually end up with more noise than one shot with a higher ISO.
- So, shoot at higher ISOs – 5000 or higher.
- The shooting side is easy as is every day processing but .....
- It can be much more complex - Google “ETTR and Milky Way” and “Editing the Milky Way” to find many great videos on processing ETTR shots.
- [CLICK] to [END]

## Improving Exposures 1

- Obey Rule of 500 and ETTR
- Use camera tools to minimise vibration:
  - Delayed exposure (2 or 10 seconds)
  - Mirror lock-up
- Enable Long Exposure Noise Reduction (LENR):
  - Takes dark frame of same length as preceding image BUT
  - Doubles time taken for each image
- Ignore High ISO Noise Reduction (HINR) – only applies to JPEGS
- Stack multiple short exposures

[1m10s]

- So, what can we do to improve our exposures, especially without cost?

[CLICK]

- Use shorter exposures within Rule of 500 which is going to cost us light and thus details of faint objects .....
- .....plus, expose to the right.

[CLICK]

- Mirror lock-up pre-lifts the mirror at start of the delayed exposure before the shutter comes up at the end of it so use both methods.
- Note that a bigger, heavier lens may vibrate for 5-7 seconds after manual shutter pressing.

[CLICK]

- LENR reduces noise by imaging with the shutter down and subtracting the dark image from the light image..
- BUT doubles time of each exposure – OK for one-off images but painful in extending imaging.
- More on dark frames later on.

[CLICK]

- HINR sounds like it should be good but it is only applied to a resulting JPEG not RAWs so forget about it.

[CLICK]

- Of course you can stack multiple short exposures using some simple free software – more in a moment.

[CLICK] to END

Night Sky Photography © 2017 John Gwyther  
Sale Camera Club 02-Feb-2017



## Improving Exposures 2

- Buy fast (eg 14mm f/1.4) prime lens (\$\$\$):
  - 14mm allows 22 secs vs 17 secs at 18mm
  - f/1.4 gives 6-7 times more light cf f/3.5
- Buy full-frame camera à 60% longer exposures before trailing (\$\$\$\$)
- Buy portable tracker (\$\$\$) à 3-5 min exposures
- Stacking software
- Intervalometers
- Backyard EOS/Nikon software
- In short – stack 'em or track 'em

[1m10s]

- Now, what can we do if we're into spending cash?

[CLICK]

- Clearly a faster, shorter lens will help with both maximum exposure time and light collected but they cost money.
- Note a prime (ie non-zoom) lens will usually have a best aperture 2-3 stops lower than a zoom lens.

[CLICK]

- If you are serious, a full-frame camera helps a lot but we're now talking big money.
- Their larger pixels also means less noise.
- Also, any new camera of today will be far less noisy than one you've had for 5-10 years.

[CLICK]

- A portable tracker costs \$5-600 but extends your exposure times ten-fold.

[CLICK]

- Of course you can stack multiple short exposures using some various software.

[CLICK]

- If shooting multiple exposures, especially star trails and time-lapse, you will need an intervalometer to program multiple shots.
- Not expensive; \$30-40 for a basic one to \$150 for a wireless unit.

[CLICK]

- BYE lets you automate sequences of shots from your laptop .....
- .....and obviates the need for an intervalometer.

[CLICK]

Night Sky Photography © 2017 John Gwyther

- So, short of raiding your neighbors, you can't steal 'em or stack 'em.
  - In fact, stacking can always be used since it has other advantages.
- [\[CLICK\]](#) to END

## Stacking Basics

- Deep Sky Stacker ([www.deepskystacker.free.fr](http://www.deepskystacker.free.fr))
- Aligns and combines multiple "light" frames:
  - Creating longer equivalent exposure AND
  - Increases SNR by square root of number of sub-frames
- Can improve noise by using "calibration" frames:
  - Dark frames measure noise level at end of exposure plus detect "hot" pixels
  - Bias frames measure noise at start of an exposure
  - Flat frames measure lens dust and vignetting effects
- Can stack in "mosaic" mode to create much larger image areas when using longer lens

[1m15s]

- OK, lets look at each of these options.
- Stacking is like flattening layers in PhotoShop but you have to deal with image rotation – remember the curved star paths earlier?

[CLICK] to start

- Luckily there is a very nice and not too complex piece of free software to do this called Deep Sky Stacker.

[CLICK] for "aligns"

- We also get improved noise in the result due to stacking.
- So, you might shoot 15 x 20 second exposures ("sub-frames") to stack for an equivalent 5 minute image.
- Plus the final signal-to-noise ratio goes up by a factor or almost four. More light frames the better!

[CLICK] for calibration frames

- DSS will also merge calibration frames to improve the appearance (*run through these*).

[CLICK] for mosaic

- It can also stack overlapping images to create larger mosaics of the sky.

[CLICK] to END

## Laptop-controlled Imaging 1

- Using [Backyard EOS](#) or [Backyard Nikon](#) software on your laptop tethered to your camera
- Benefits:
  - Automated sequencing of shots (no Intervalometer)
  - Up to 25 groups of differing exposure sequences
  - Improved framing and focusing using FWHM
  - Auto-labelling of images with image parameters
  - Bigger screen makes it easier to assess image quality
- Drawbacks (minor):
  - Image downloads take 7-8 seconds each
  - More kit in the field (laptop, cable, battery, etc) that can go wrong
  - Minor cost (US\$35-50) – 30-day free trial

[1m05s]

- Now, using your laptop hooked up to your camera can be useful if operating from home.
- Every camera gets shipped these days with a computer cable and some basic manufacturer's software.

[CLICK] for BYE

- If you have a Nikon or Canon camera, Google Backyard EOS and use this instead.

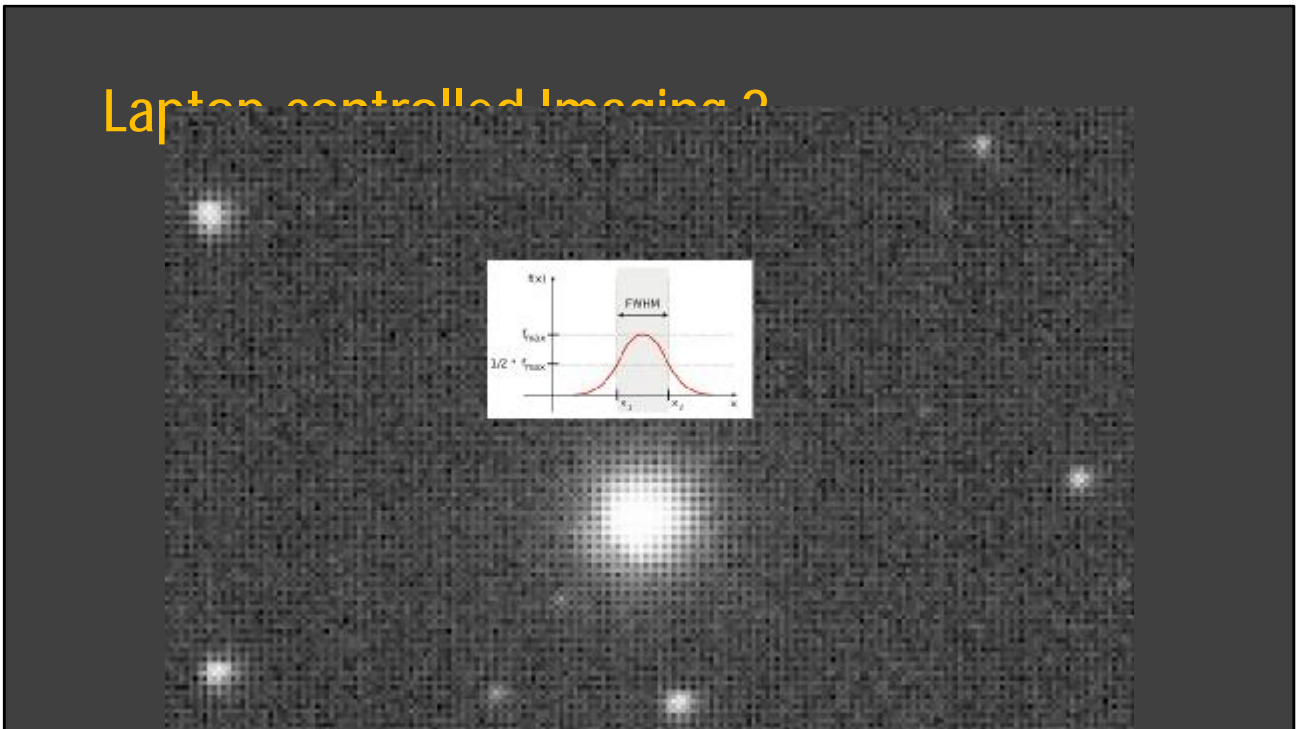
[CLICK] for benefits

- *5 clicks to bring them up*

[CLICK] for drawbacks

- 2 clicks to bring them up
- I put the camera and tripod outside and shoot from inside with a 3m USB cable.

[CLICK] to [END]



[1m30s]

- Here is a screen shot of BYE.
- Quick explain of Capture Plan Centre at lower right – explain sequence to be shot.

[CLICK] for second shot

- Frame and Focus is a powerful feature showing the image to be shot (Live View mode from camera) .....
- ..... Plus a close-up of the area around the cross-hairs .....
- ..... Plus the micro-focus adjustments above the image.
- At night, we use them to bring the FWHM number down to a minimum for the sharpest focus – much better than you can do with Live View focus on the camera's tiny screen looking at a tiny star.

[Click] for FWHM image

- Here is a highly zoomed image and you can see that the central star occupies a number of pixels, brightest in the centre.
- FWHM just counts the side to side width in pixels where brightness has dropped to half of the centre value.
- All you need to know is “make FWHM the smallest you can” with the micro-focus controls.
- I do recommend you try the 30-day trial – it's a fun piece of kit for any form of photography.

[CLICK] to [END]

## Tracking Platforms



- Level mount on tripod
- Elevate to your latitude
- Point to True South
- Check app for star position in polar-scope
- Adjust azimuth & elevation to match view in polar-scope to view in app
- Aim camera at target
- Turn unit on
- Start shooting

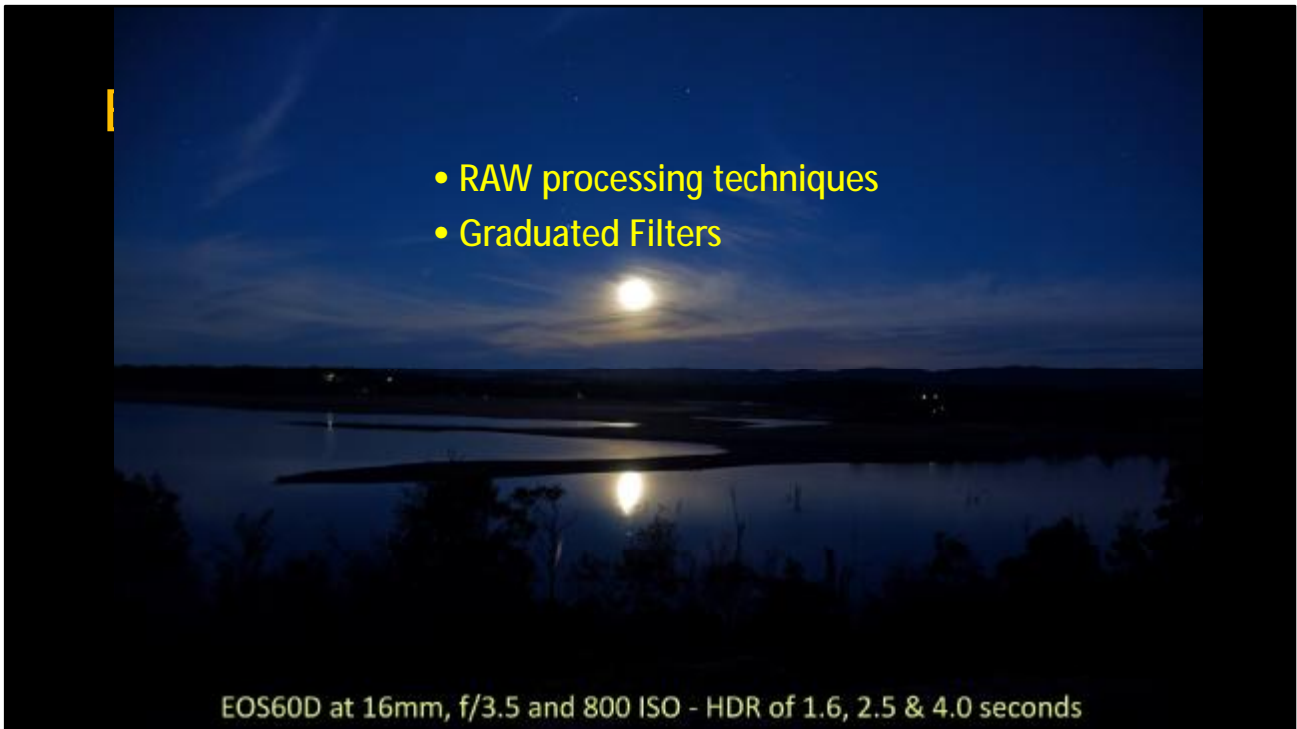
EOS60D + 16-300mm at 35mm, f/6.3, 1250 ISO, 300 seconds  
on iOptron SkyTracker

### [1m20s]

- Here is a tracked shot of the Southern Cross and the two Pointers.
- Without tracking, the Rule of 500 says 9 seconds is the max yet the Skytracker did 300 seconds with stars still round at 500% zoom level.
- [CLICK] If you want to single exposures beyond the Rule of 500, you are going to have to get a portable tracking platform such as the:
  - iOptron Skytracker shown here
  - Vixen Polaris
  - Skywatcher Star Adventurer
- All are around \$600 with needed accessories and you will need a tripod, the sturdier the better.
- With good alignment, you should be able to get 5-10 minutes at lower focal lengths without trailing ie heaps more light.
- To use it, we first align it by [CLICK] levelling it then .....
- [CLICK] ..... Elevating it – you can get your latitude off your smartphone (Sale=38 degrees)  
.....
- [CLICK] ..... Then pointing to True South, not magnetic South – use 168 degrees here (can get a compass app for your smart-phone).
- Now you are pointing roughly at the SCP and, to fine tune it .....
- [CLICK] ..... Use iOptron's supplied app which tells you where the target star (Sigma Octans) should be in the polar-scope eyepiece then .....
- [CLICK] ..... Twiddle the knobs until the app view matches the eyepiece view then .....
- [CLICK] ..... Aim the camera at your target .....



- [CLICK] ..... Turn the unit on [CLICK] to [END]
- [CLICK] ..... Start shooting [CLICK] to [END]



[1m00s]

- OK, lets talk about how we best process our shots, however we have captured, tracked and/or stacked them.
- This is a High Dynamic Range composite shot taken from my place looking West towards Glenmaggie Point pre-dawn in May.
- The challenge was to capture the setting moon, high clouds, stars and water gleam – hence the use of HDR and processed in Photoshop Elements.
- I could probably improve it now with Graduated Filters etc. in ACR, Lightroom, etc.

[Click] for text

- I'm only going to cover a couple of things as this topic is a talk in itself and .....
- ..... Dyer's book covers a fair bit and .....
- ..... there are plenty of good night-sky processing videos discoverable with Google and .....
- ..... and I do most of my astronomical processing using an astrophotography-specific platform called PixInsight which is a bit like mathematics meets Gimp meets theory only more complex .....
- ..... but tremendously powerful in maximising the photons you do manage to collect.

[CLICK] to END

## Tools?



[1m00s]

- First, show of hands on what tools do you use for RAW processing?
  - The Adobe Camera RAW-based tools such as Photoshop Elements, Photoshop CC, Lightroom?
  - GIMP?
  - Any other tool?
  - Actually, the tool doesn't really matter - just experiment with their settings to see what pleases you.
  - Astrophotography has heaps of debate about what is "right" and "wrong" about such fiddling but they do have a simple mantra – "respect the light" .....
  - ..... ie when we use all the available technology to reveal every bit of detail in an image we may lose the essence of the image so - "respect the light".
  - The other point I'd like to make is that, as long as we're using only the light that was actually there, then we're in the realm of photography rather than inventing something that wasn't there.
  - [ALT-TAB] to Lightroom – use IMG\_1279 to show basic techniques – refer Word notes.
- [CLICK to END]

## Star Trails - Imaging

- Multiple short exposures or single long exposure?
- 15 seconds, 1600-2500 ISO, +1 or 2 f-stops
- Shoot RAW or sRAW but JPEGs OK too
- Cadence (time between successive open shutter):
  - Separated dots: 120 seconds so use LENR
  - Solid lines: 15 seconds (shoot darks separately)
- Duration: 2-4 hours (remember 15 degrees/hour)
- Try defocusing to get coloured star bands
- Perfect your techniques at home – shoot out the window even if view and lighting are rubbish
- Need fully-charged battery so test battery duration too

[2m15s] Star trails are easy and fun plus you can use frames for a time-lapse as well.

- [CLICK] *for first line*
- Could shoot one long exposure (2-4 hours) at f8-f11 and 100-200 ISO but risk of clouds, satellites, planes, external lighting is high – better to do multiple short ones but you will need an intervalometer or BYE.
- [CLICK] Start with these numbers which also suit time-lapse videos but nothing to stop you using longer shots - eg 60 seconds at 800 ISO and +3 f-stops – remember, single shot trailing won't matter here.
- [CLICK] As always RAW gives you the best post-processing option but sRAW can save space and JPEGs work OK if exposures are good.
- [CLICK] You can do dot stars (like this shot) – I'll show you in a second how you can "fill the gaps" or shoot continuously.
- Experiment to ensure cadence=exposure time doesn't "snag" your camera; might need cadence=exposure+1 or 2.
- [CLICK] You'll need a few hours worth of shots, more so if you are aiming at the SCP to get nice circles
- [CLICK] Try focusing on something close in the foreground to get broader star bands which will emphasize their varying colours shown here.
- [CLICK] Practise by shooting out a window at home – just let it rip.
- [CLICK] Long imaging runs will also test your battery so do a test run to see how long a fully-charged battery will last.
- [CLICK] to [END]

## Star Trails - Processing

- Can do in PhotoShop for small number of images
- Or several free and paid PS add-ins can help
- I use StarStax – easy, fast, free – then process in LR/PS

[1m45]

- [CLICK] You have a choice of tools here including PhotoShop .....
- [CLICK] ..... Or choose one of several add-ins – Google “Star trails in Photoshop” which also finds great tutorials.
- [CLICK] I prefer StarStax because it is simple, fast, free and has options for filling gaps and comet mode.

[ALT-TAB] to StarStax

- Load light images – here are 16 samples
- Load dark images – plus 4 darks – would normally use many more
- Press stack – explain status bar at lower left stacking darks
- Can save and post-process in Lightroom/Photoshop

[ALT-TAB] back to PowerPoint

- [CLICK] Experiment by adding a same-view frame but with highlighting foreground or Milky Way with better exposure and stacking and masking in PS.
- In this one, I varied the exposure over time in an attempt to show movement as well as a static sky image.

[CLICK] to END

## Timelapse Videos

EOS60D 16-300mm at 16mm, f/4.5  
and ISO 4000

72 frames per hour (40 sec exposure,  
plus 10 sec interval)

Video frame-rate 30fps

Looking SE from Lake Glenmaggie  
from 9.45pm 29/01/17 to 5.05am

[1m30s]

- OK, lets look now at making time-lapse videos.
- Here is one I shot recently to illustrate the output .....
- ..... Shooting towards the SE all night from about an hour after sunset to about an hour before sunrise .....
- ..... to capture the Milky Way, the LMC at top right and the shape the Aborigines know as The Emu .....
- ..... Plus some satellites, jets, clouds and 1-2 Iridium satellite flares.....

[CLICK] to make the text disappear.

[CLICK on PLAY] on the on-screen control panel to start video

- I did a fairly quick and dirty processing cycle here – lowered the white balance to 3800 K (about the “natural” level of the MW), +0.5 exposure increase, 10-20 contrast increase, ditto darks and some luminance and colour noise reduction.
- OK, now lets look at the imaging and processing steps I went through.
- [CLICK] to END



## Timelapse - Imaging

- Need Milky Way for pizzazz – plan with Stellarium
- Dark sky: 30-60 sec, ISO 3200, 0-2 f-stops down
- Bright moon: 15 sec, ISO 800, ditto
- Cadence=exposure time + 1-5 sec (flexible though)
- Can't use LENR so take some darks
- sRAW (11.1mb) vs S2 (1920x1280) JPEG (1.3mb)?
- Going to need hundreds of frames over hours
- Practice at home no matter what
- Also during the day (use P mode, Auto ISO, manual focus and 5-10 second cadence)

[1m45s]

- [CLICK] Stars on their own can be a bit boring unless the Moon rises or sets or clouds come or go so.....
- ..... Try to get the Milky Way or the Magellanic Clouds into the frames so .....
- ..... Use Stellarium etc to plan what you can see in available directions at what times.
- [CLICK] Exposure will vary with sky darkness and [CLICK] presence and stage of the Moon which can be a very bright object.
- Aperture can be as open as you like but 1-2 stops down is useful
- [CLICK] Keep interval between shots low but you can still go out long enough to use LENR – even 60s cadence on 15s exposures doesn't show jumping in the video.
- [CLICK] Note that this rules out using LENR so take 6-8 darks for post-processing in PS – not something I can say I have done but plenty of Google articles on how to do it.
- [CLICK] Same issue of JPEGs vs RAW but small RAW (sRAW 11.mb) is fine and better for post-processing.
- [CLICK] So, how many frames are we going to need? Assume 30 fps playback for 20 seconds = 600 frames.....
- ..... With a 30 second cadence, that will take 5 hours!
- PhotoPills has a nice calculator for this.
- [CLICK] Once gain, practice at home out the window despite ambient light or poor views – you can use start delays on intervalometer and not worry about weather or dew on lens.
- [CLICK] Also, shooting some daytime time-lapse (especially clouds) provides material to master the video production using these settings.

[CLICK] to END

Night Sky Photography © 2017 John Gwyther  
Sale Camera Club 02-Feb-2017

## Timelapse - Processing

### Via Adobe Creative Cloud:

- **Lightroom:** import RAWs, re-sequence, adjust sample frame, sync to all others, export as JPEGs
- **PhotoShop:** import JPEGs as "timeline", export "render to video"

### Via Standalone tools:

- **Freestone Image Viewer** convert RAWs to JPEG
- **Virtual Dub** JPEG to AVI creator
- **Wondershare Video Converter**

[01m15m]

- You can process all the way in Adobe products or use stand-alone shareware.

[CLICK] First in Adobe CC:

[CLICK] Using LightRoom gives you great tools for bulk adjustments and so.

- Import your RAWs – if the image sequence numbers are out of order, sort by capture date and renumber so video comes out in order.
- Develop a sample frame to look as good as you can.
- Select all other frames and "sync" settings takes a while.
- Export all as HD size JPEGs.

[CLICK] Move over to PhotoShop to create the video:

- Open a new "timeline" and open the first JPEG as an "image sequence".
- Save everything as a PSD file so you can revisit.
- Export everything via "render to video".
- Has tools to let you apply different edits to different sequences – useful for rising Moon changes.

[CLICK] Plenty of free stand-alone tools to do video production - for example:

[CLICK] Freestone IV is still my choice of card reader and first view tool plus can export to JPEGs – often add image parameters as text to an image for improving video quality.

[CLICK] Virtual DUB will stack your JPEGs into an AVI but end file is mega-huge so .....

[CLICK]

- .... I post convert with Wondershare to get best iPad, Windows, web, etc format.
- Must say I'm enjoying LR & PS for their bulk edit capability.

[CLICK] [CLICK] to [END]

## Telescope-based Astrophotography



[0m30s]

- Last topic – a brief look at how deep-space images like this are captured.
- This is the Flame Nebula and the Horsehead Nebula in the constellation Orion .....
- .... Which we know as the Saucepan.
- The bright star in the centre is Alnitak which forms the bottom right-hand base of the saucepan.
- The image is the result of several hours imaging through multiple filters on a 1000mm telescope.
- I'd like to claim it as my own but no.

## My Observatory



1. 5° aiming gunsight
2. 1° aiming telescope
3. 2000mm SC telescope
4. OSC CCD camera
5. Equatorial tracking mount
6. 900mm refracting telescope
7. Guiding webcam on 160mm telescope
8. DSLR mount
9. Mount handset

[0m45s]

- So, here is what is in my observatory at Lake Glenmaggie.
- The big scope is a Schmidt-Cassegrain model with a triple light path to get 2000mm inside a smaller tube .....
- ..... Fixed aperture at a slowish f/10.
- The CCD camera is a One-shot Colour camera ..... fixed ISO and one-shot storage ..... Plus cooled to 30°C below ambient.
- Note that I can mount my DSLR on either of the telescopes for deep-space imaging or .....
- ..... On top of the left-hand scope for wide-field imaging.
- The laptop at lower left drives the imaging software of both cameras and the guiding software .....
- ..... Even though the mount tracks quite accurately, you use guiding to to be able to use 5-10 minute sub-frames without trailing.
- This works with the webcam watching a guide star and, as soon as the star moves from one pixel to the next, it nudges the mount to back one pixel, ensuring nice round stars.

[CLICK] to END]

## Typical Imaging Cycle

- Assume target requires 5 hours of data
- Use grey-scale CCD plus filters for better sensitivity
- Take 5-minute sub-frames for each of:
  - Luminance (2 hours) – no filter
  - Red, Green, Blue filters (1 hour each) OR
  - Same with Ha, SII and OIII filters
  - Dark frames (1 hour) – lens cap on
- Take 25-50 1/8000<sup>th</sup> sec bias frames (lens cap on)
- Take 25-30 short “flat” frames of flat light surface

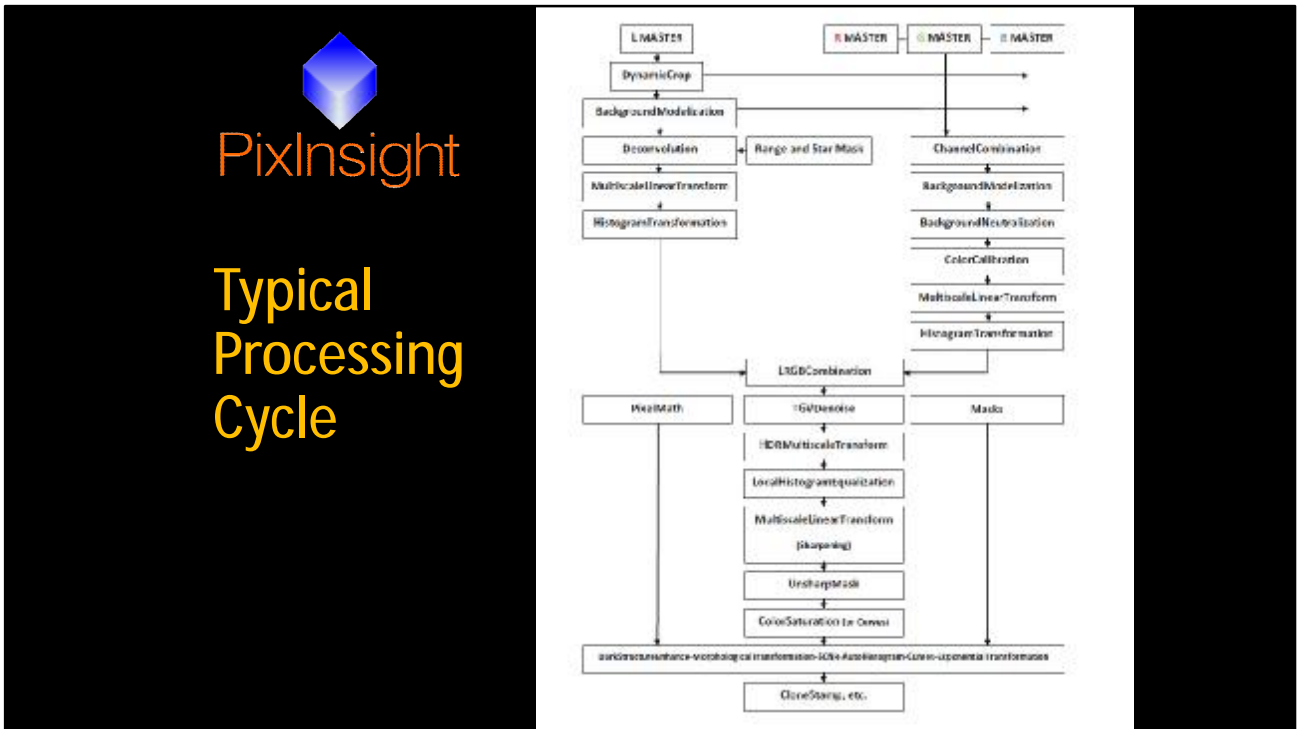
[0m00s]

- There is a lot of field-work to get an image like this of the star Antares and associated dust lanes in Scorpius.
- BTW, there are more than 20,000 stars visible in this FOV.
- Ignoring all the aligning, framing and focusing steps and .....
- ..... Assuming target is visible long enough so we can get all of imaging in one night and .....
- ..... Assuming no clouds, rain or extraneous light and .....

[CLICK] for 5 hours

- ..... Assuming we think we'll need 5 hours of exposures to get enough detail in our target, how will we do it?
- Note that this is not a long number for really faint objects – 20-30 hours not uncommon.
- [CLICK] for CCD
- Explain 4.3um Bayer DSLR compared to 7.8um CCD camera – 3.25 times bigger pixel – better SNR.
- Plus R & B filters get 100% of CCD pixel versus 25% of DSLR pixel – 13 times receiving area – better SNR.
- [CLICK] explain sub-frames
- [CLICK] explain bias frames
- [CLICK] explain flat frames – uniform dawn sky, white wall or light box.
- So, we end up with a lot of data which we have to process

[CLICK] to END]



[0m45s]

- You can do a lot in PS & LR but, for quality results you'll need specialist software like DeepSkyStacker (which we saw earlier) or PixInsight.
- The rule of thumb for quality deep-space object image results is that .....
- ..... For each hour spent imaging, you'll spend 1-2 hours processing.

[CLICK]

- Thus, this complex-looking PixInsight workflow, which I won't bother explaining.
- The point here is that you are really "down in the weeds" in terms of extracting all possible signal from a low-signal, high-noise image.
- That said, you can get decent results using DSS then LR & PS.
- Have a look at some of the sites referred to earlier for examples.

[CLICK] to END]

## Northpoint on Lake Glenmaggie



[0m20s]

- OK, before I finish, an offer.
- I'm fortunate to live at a dark sky site on Lake Glenmaggie with .....
- ..... a house that can sleep 20 .....
- ..... a fixed observatory dome .....
- ..... And some pretty nice daytime scenery too.
- We're more than happy to organize an overnight excursion for anyone interested in shooting from truly dark skies.

[CLICK to END]



Thank You



- Thank you for your attention.
- Feel free to contact me for more details or a copy.
- This photo is M20 Trifid Nebula in Sagittarius.
- [\[CLICK\]](#) here are the references listed.

## References

- Shooting Stars ([www.philhart.com](http://www.philhart.com))
- Nightscapes & Timelapses by Alan Dyer  
[www.amazingsky.com/nightscapesbook.html](http://www.amazingsky.com/nightscapesbook.html)
- Stellarium ([www.stellarium.org](http://www.stellarium.org))
- TWAIN ([www.twanight.org](http://www.twanight.org))
- APOD ([www.apod.nasa.gov](http://www.apod.nasa.gov))
- Photographers Ephemeris  
[www.app.photoephemeris.com](http://www.app.photoephemeris.com)
- StarStax  
[www.markus-enzweiler.de/StarStaX/StarStaX.html](http://www.markus-enzweiler.de/StarStaX/StarStaX.html)
- John Gwyther  
[jgwyther@bigpond.net.au](mailto:jgwyther@bigpond.net.au)  
[www.npeye.blogspot.com](http://www.npeye.blogspot.com)



- This moon shot was through my 900mm telescope; note how the half-Moon's terminator brings up lots of interesting features that you don't see with a full Moon.
- [\[CLICK\]](#) to bring up list
- My blog has a few more of my astro shots amongst the birds and weather, etc.