

“Man Must rise above the earth to the top of the atmosphere and beyond for only thus will he fully understand the world in which he lives” (Socrates)

Unfortunately, there are just a very small minority in the world that have the opportunity to do what Socrates suggested above. However, I’m sure many of us have looked at images of the night sky in amazement at what has been photographed, and what is in the sky above us.

We have all looked up and seen the night sky, Moon shining down on us, a sky full of bright twinkling stars, a great expanse of darkness and light rising above us as far as the eye can see.

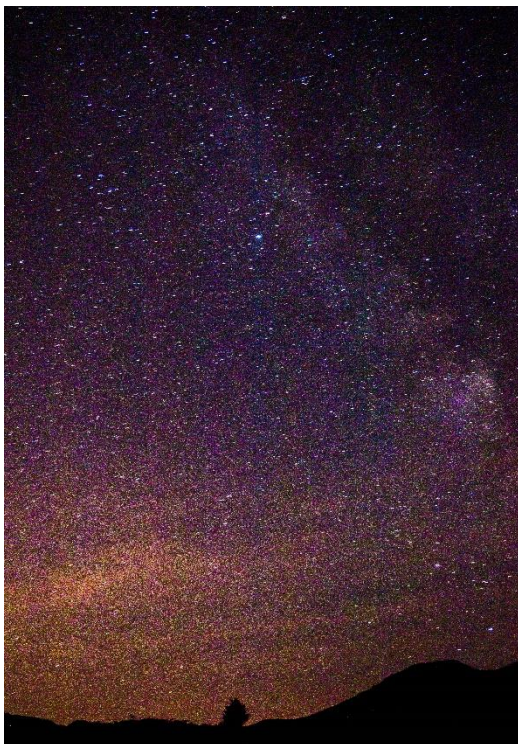
But how do we photograph it? Thankfully with advancements of cameras, its not just those with big expensive telescopes that can enjoy photographing the night sky. Modern day cameras can not only photograph what we can see, but also some things that we struggle to see.

I am by no means an expert and really just beginning my journey into the genre of Astrophotography as there is so much to learn. But I’ve always loved images of the night sky, even before I picked up a camera.

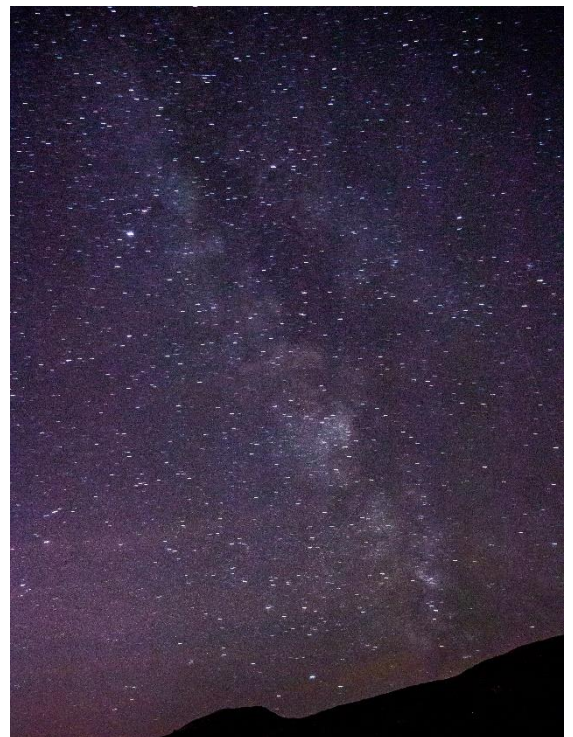
Hopefully this will help you take the leap and have a go yourself and fingers crossed answer some questions you may have, and introduce you to a whole new genre of photography that will challenge your mind.

We all have to start somewhere, when I went and did my very first attempt, I thought “it can’t be that hard” well its not really, if you have an idea of what you are doing, unfortunately, I did not have a clue! However, I was chuffed as I got my very first images of the Milkyway, albeit not quite the mind-blowing image I had imagined it would be, but it was a start. This spurred me on to do better and actually take the time to learn what I needed to know.

I’m going to share with you those 1st 2 images!



15mm F3.7. ISO 800. SS 68 seconds



15mm F3.7. ISO 800. SS 82 seconds

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Hopefully by the end of this you will have the basics to enable you to go out and get some better shots than my ones above if its your 1st time trying it, and not make the errors I made.

some of you will be able to tell straight away looking the settings what mistakes I made on these first images!

First things first equipment what will you need.

Equipment & Gear.

- Camera, always helpful! Set to manual.
- Memory cards
- Batteries- a few of them as the cold will diminish the power really quickly. ***(Tip, keep the spares in your pockets close to your body to keep them warm, for the ladies another great place is tucked inside your bra.)***
- Lenses: this is really dependant on what and how you wish your photograph to look. Wide Angle 10mm to 35mm for scenes where you want to incorporate the landscape with the night sky. For those close-up shots of maybe just a constellation, 50mm up to telephoto. However, what is important is you want to get as much light on that camera sensor as possible so preferably a fast lens, that will open up to F2.8 or lower. (You can use F4 lenses but you will need to increase your ISO to compensate) For up close shots of the Moon, a telephoto or super telephoto. Many of my Moon shots are taken with my 150-600mm with a 1.5 teleconverter on so giving me the equivalent of 900mm.
- Remote Shutter release, not essential, but a good way to reduce the chances of camera shake when pressing the shutter. your camera may have a built in intervalometer which is fine but get used to how it works, before you go out to do your Astro. I find a remote shutter release much easier to use. You can also use the shutter delay on your camera either 2 seconds for smaller focal lengths or 10 seconds for the telephoto shots, but if you're going over 30 seconds you will need an intervalometer of some kind.
- Lens warmer (not essential) however on cold nights there is nothing worse than realising after taking 30 images that you have a build up of dew/condensation on your lens and your pictures are of no use.
- Lens cloth/microfibre cloth to remove any build up of moisture on your lens.
- Torch/headlight for safety and you may also want to do some light painting of the foreground. The more you use your camera in the dark the more you will be able to navigate the buttons on the back without having to ruin your night vision every time you turn your torch on.
- Tripod, essential, you will be dealing with slow shutter speeds (apart from Moon shots) so a nice stable firm base is essential to get good clear sharp images.
- Clothing and footwear suitable to the conditions, you may feel warm after you have walked to a location but after maybe an hour of standing still you will feel the cold.

What is there in the night sky to Photograph?

The list is long, from objects you can see with your naked eye easily to those that are a bit harder to see, I've seen some shots taken by amateur photographers of Saturn and its rings, Venus, even the International Space Station.

Below is a list of some of the easier things to get started:

- The Moon, be these smaller shots of the moon in your landscapes or those close up shots showing the craters and details on the Lunar landscape, or those wonderful ones of the full moon rising behind a building.
- Just a nice starry background to your landscape images.

Constellations that are easy to see, for example

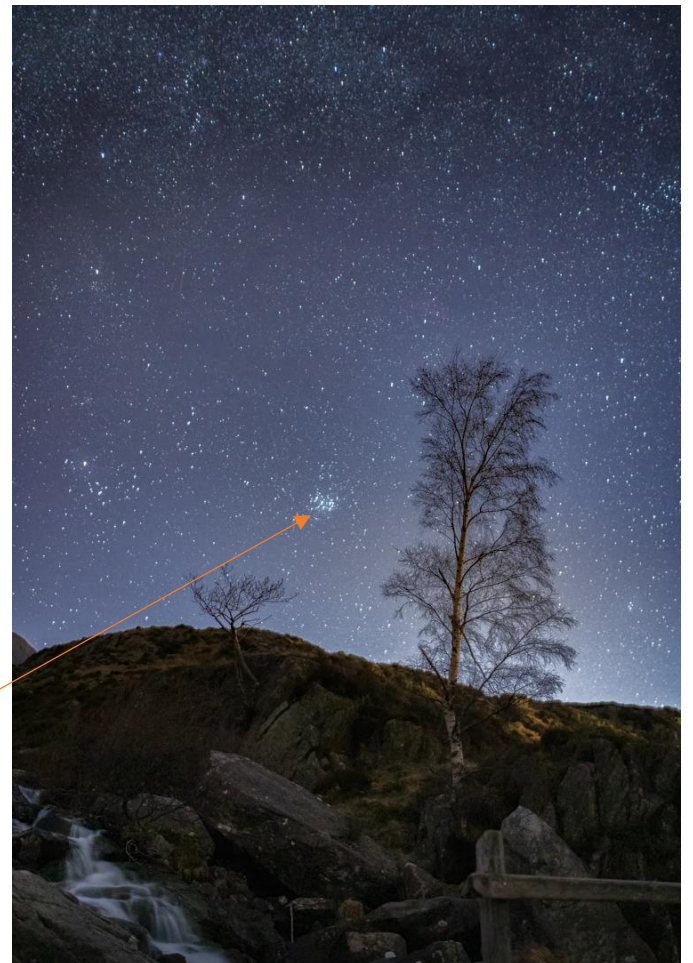
- Ursa Major, also known as the Plough, and big Dipper. In the Northern sky and is high enough that it never drops below the horizon its also a good way to find Polaris the North Star from there, handy for if you want to do star trail images.
- Another lovely one is Orion/ Hunter, a Northern Winter sky constellation, just look for the 3 bright stars in a straight line that make up his belt, again easy to find in the night sky and bright, a closer shot of this can even show the pink Nebulas within it.
- Cassiopeia in the Northern sky (looks like a "W")
- Pleiades, also known as the 7 Sisters due to it being a cluster of 7 bright stars in the southern sky. The Pleiades rise in the southeast after dusk and travel west during the night. During their peak in November, they climb high in the sky and disappear in the northwest before dawn. In late winter and early spring, they will only be visible for a few hours, traveling east to west across the southern part of the sky.
- Last but not least the Milkyway, you may have heard people talking of the Milkyway Season, I presumed that this meant you could only see it during this so-called season. This is not the case the Milkyway is there all year round. However, the season that they talk about is when the Milkyway core is visible in the northern hemisphere. This can be seen from around March to September, with the best time being April to late July, this is only because the Galactic core is visible for longer during the night. Although the other areas of the Milkyway can be photographed all year. Earlier in the year April time you can get a lovely arch as its lower to the horizon, however later in the season the milkyway is more vertically placed and spans across the top of the sky.
The core will rise in springs south easterly sky and work its way to South West till Autumn

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Orions. *Note the 3 stars in a straight line, that's his belt.

35mm. F2. ISO 6400. SS 8



Pleiades / 7 Sisters

35mm F2. iso 6400. SS 8sec

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Milkyway arching Horizontally in April.

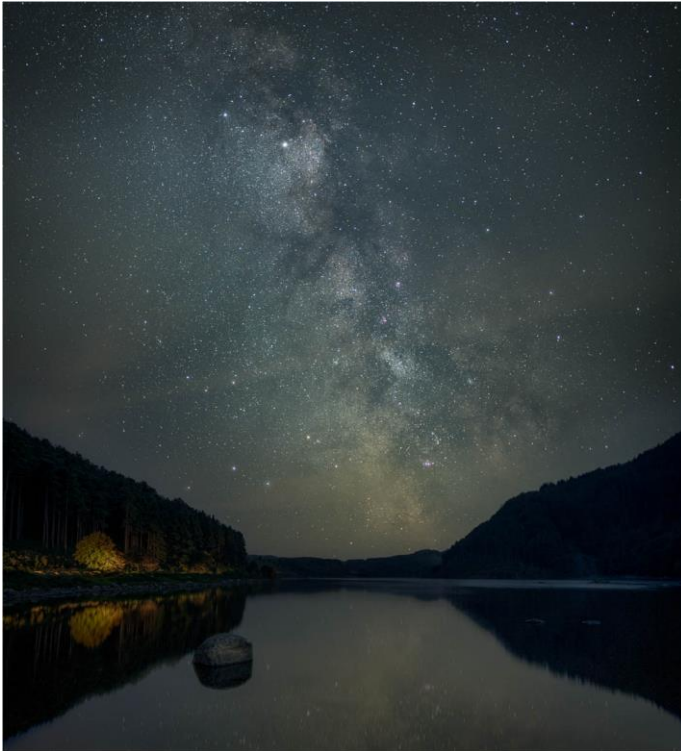
8 shot pano 4 top 4 bottom. Put together in Lightroom.



More Vertical Orientation July.

Blended image, Sky taken using a star tracker. 30mm. F4. ISO 640. SS 120 seconds.
Foreground. 30mm. F5.6 ISO 640. SS 240 seconds.

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12 shots stacked in Sequator.

Sky 35mm F2.8 ISO 2000. SS 8 seconds

Foreground 24mm F5.6 ISO 800

SS 3 mins

Blended together in Photoshop using Photoshop's Sky Replacement, replacing PS sky with my own.

Ursa Major. (Big Dipper /Plough)

35mm f2.8. ISO 6400. SS 8 Seconds

Star spikes added using "star Spikes"



Single shot. 14mm F2.8 Iso 4000

SS 25 seconds.

Notice how much less detail there is in the Milkyway due to the Light pollution from Colwyn Bay.

PLANNING.

Some images don't take much planning like simple Moon shots. It's easy to spot and can be shot from your own front garden, so long as the skies are clear. As you learn and get better you will want a bit more, maybe a landscape shot with Ursa Major in the sky, so then you have to look at what or where you want your landscape to be and work out if the direction, you're going to be shooting in actually has Ursa Major in the night sky.

As you become more accustomed to the basic layout of the night sky this will get easier. For example, if I went to Dolbadarn Castle in Llanberis and wanted a nice night time shot of the Castle from within the grounds, you know the view everyone takes their shot from. Well, it's not going to have Ursa Major in it as that would be somewhere behind me, however, I will get the Milkyway. There are many apps that can help with all this, some even have the ability to show an augmented reality sky based on your phone's GPS. As you move the phone around the sky the different constellations appear and you will learn what is where. I will put a list of helpful apps and computer apps at the end.

Also learning how to find Polaris, the North Star can really be helpful if you want to try your hand at doing star trails, as if you get Polaris in the middle of your frame you can achieve a lovely circle of star trails around it. It's really easy to locate as the diagram below shows:



I've only ever done star trails once, but this gives you the idea. The star trails were actually taken from up on the great Orme then I dropped them in behind Penmon. Not very well I may add.

Polaris.

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If you're planning on photographing the stars or Milkyway, the Moon can become your Nemesis as the Moonlight will wash out the brightness of the stars. Generally, the best time for stargazing and photographing them is a crescent or gibbous Moon, depending on what you want to photograph, or even better when the Moon is not in the sky at all. You need to check what stage the moon is at or what time its rising and setting. For example, when I took the shot at Llyn Geirionydd I had a half hour window from when Dark sky began following sunset till when the moon began to rise. Again, there are apps that can help you with this or websites.



Weather, that's the one not so easy to plan. Even the professional Weather Forecasters get it wrong! But we need to look at Clouds and cloud coverage Ideally, we want nice clear skies, but sometimes if we want to shoot something that's higher in the sky it doesn't matter so much if there is a small band of cloud on the horizon and sometimes some wispy clouds in a star scape image can look quite nice and give some interest. Many apps have Satellite imaging for a few hours ahead showing what direction the cloud is coming and how thick the cloud cover is. From this we can often see that there may be a break in the clouds for an hour or so giving us a window of opportunity.

With the Milkyway we can plan what time the Galactic core is rising for a certain date that coincides with a night with no Moon, or when the Moon is rising later or setting earlier. The image previously of the old derelict farm house, I knew on that particular night the Core would be visible from 11pm but the Moon was not rising till 2am, so weather dependant, I had a 3hr window to get my shot. you can even go as far as plotting where you are taking your picture from to see exactly where the MW will be to what focal length you are using and how much of the scene you can get it. This sort of planning can be done months in advance so then its just left in the lap of the weather gods as to whether you get the shot or not.

Light pollution is another big problem and a mistake I have made. I went up to Old Colwyn's Marian Way, did all my planning, knew that the MW would be behind the bench, did a reccy in daytime. However never thought that the light pollution for Colwyn Bay would impede so much on the brightness of the stars and MW this can be seen also in one of the previous images.

We are exceptionally lucky where we live having Snowdonia national park on our doorsteps. In 2015 Snowdonia NP was declared the worlds 10th International Dark Sky Reserve, so we don't have to travel far to get some wonderful dark skies with stunning landscapes. If anyone wants a few ideas of easy to get to places for the MW please just ask, I'm more than happy to share locations.

I live by the saying of "fail to prepare, prepare to fail," by doing some, sometimes time consuming and also occasionally frustrating planning you can optimise your chances of getting the shot you want.

GETTING THE SHOT AND SETTINGS.

FOCUSING:

Before you do anything, you need to be on manual and manual focus and shooting in Raw format not Jpeg, you want as much info in the data as possible. If your just doing stars and have nothing in your immediate foreground you would be focusing to infinity, most lenses have an infinity mark, however this isn't always accurate so best not to rely on it, again a lesson I learnt.

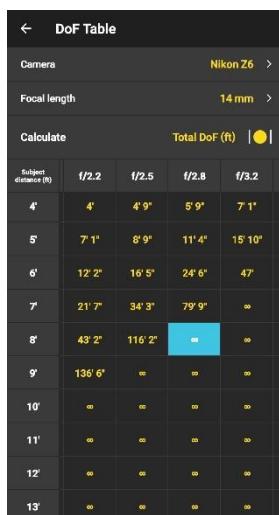


There are a few ways you can do this, firstly dial in your start off settings (I will discuss start of settings further down) Find a bright star in the sky and use live view if you have it, zoom in 10x, when you turn your focus ring you will notice the star gets bigger and smaller. You want to make the star as small as you can, then without touching the focus ring once you have dialled your setting in take a test shot and zoom in on the image to check its in focus.

- Another way that I use if I'm using my 14mm lens I have a small pen mark on it. I took my camera and lens out in the daytime and focused on something off in the distance using auto focus, I then made a mark exactly where the focus ring was lined up, it was just before the infinity mark. Now if I use this lens at night, I can just turn it straight to that mark and I know I'm focusing to infinity.
- Depending on how well your camera can function in low light it is possible to use auto focus. if there is a bright light that's far enough away that it can lock onto. But as soon as you have that focus, lock it off to manual focus, especially if you don't use back button focus as when you hit the shutter button it will try to refocus.
- Focus Peaking, check your cameras user guide to see if your camera has this option. If it, does it's really handy and what I use mostly. Makes life even simpler and once set up you can leave it turned on. When you switch to manual focus and you have focus peaking turned on everything that is in focus will have a red line around it. For the stars just turn it till your stars turn red. As shown in the image below.



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| DoF Table | | | | |
|-----------------------|---------|--------------------|--------|---------|
| Camera | | Nikon Z6 | | |
| Focal length | | 14 mm | | |
| Calculate | | Total DoF (ft) ● | | |
| Subject distance (ft) | f/2.2 | f/2.5 | f/2.8 | f/3.2 |
| 4' | 4' | 4' 9" | 5' 9" | 7' 1" |
| 5' | 7' 1" | 8' 9" | 11' 4" | 15' 10" |
| 6' | 12' 2" | 16' 5" | 24' 6" | 47' |
| 7' | 21' 7" | 34' 3" | 79' 9" | ∞ |
| 8' | 43' 2" | 116' 2" | ∞ | ∞ |
| 9' | 136' 6" | ∞ | ∞ | ∞ |
| 10' | ∞ | ∞ | ∞ | ∞ |
| 11' | ∞ | ∞ | ∞ | ∞ |
| 12' | ∞ | ∞ | ∞ | ∞ |
| 13' | ∞ | ∞ | ∞ | ∞ |

Another method is by using a depth of field table. The app Photopills has one. On this you input the make of camera, your focal length and F stop then scroll down till you see the infinity mark, on the left side it will tell you how far Infront of you to focus to achieve sharpness from that point to infinity. So, you could then go that distance, say 8 ft, shine a torch and auto focus on that. Switch to manual focus and then do a test shot. I used this method when I first started and it worked well.

NICE ROUND STARS.

Unless you are doing star trails, you want to achieve nice round pin point Stars. As we look at the night sky, we see the constellations travelling across the sky or should I say it looks like they do. They are not moving it's the rotation of the Earth that makes it look like this, the stars are stationary. Because we know we need to get as much light as possible into

our sensor we can be tempted to leave the shutter open for as long as we can. However, if we do this and its open too long, we will end up with trailing stars.



The amount of time you can expose for before trailing occurs is dependent on many factors' camera, full frame crop sensor etc how fast your lens is (how wide open can you have your aperture), what focal length you are using. As your focal length increases the length of time you can expose for gets shorter, so less light gets in. for example, 14mm f2.8 you should be able to get around 20 seconds before you get notable star trails, whereas 35mm f2.8 its around 8 seconds, so you would need to increase your ISO if using the 35mm to compensate for the reduced amount of light hitting your sensor.

Therefore, I can give you basic start off settings but you may have to change your iso to achieve the right exposure.

There is 2 ways you can work out what shutter speeds you can expect to be able to use:

- The 500 rule, however with most modern cameras this fails, but can be used to get a starting point, take a test shot zoom in in if stars are trailing increase your shutter speed until you get to the point that they are round. (Handy to jot this shutter speed down for future reference.) Photopills does have a free online calculator for this and the depth of field table, shown in the image above amongst other useful tables on their website and these can be found here [Calculators | PhotoPills](#) The more accurate rule is the NPF Rule, however the only calculator I can find for this is on the actual Photopills app and this is a paid for app but it's been the handiest app I've ever had for Photography in general.

Editing Your Images.

This could be a whole new document on its own if I'm honest, and a lot of it is personal preference too as with all our other Photography. You can use Lightroom, Photoshop, or any other Photo editing Software you may use. But what I will say is you will be doing global edits (the whole image) but also some selective edits to bring out the Milkyway, for example a selective brush ran over the Milkyway and a little bit of Dehaze bring out a fair bit of detail. You may also find that you do the opposite of what you normally do with the Highlights and shadows sliders, Raising the highlights and decreasing the shadows on the Milkyway section, or on starry skies just to make them pop a little more.

Noise in your images will also come into play due to the Higher ISO being used and your cameras low light capabilities. This can be minimised in many various ways. By using noise reduction techniques in your editing software, or standalone plug ins that can be used alongside your normal editing software. I use Topaz Denoise which is a paid for plug in but very good at what it does, (often they have good discounts prior to Christmas).

When I first started I did completely global edits but now I'm much more selective. The best resource I can offer for how to edit your Astro images is YouTube, basically I've learnt it all from there, just search for specific editing technique be it "constellation editing in PS/LR" or "how to edit the Milkyway" and you will see a whole load of tutorial that are easy to follow along. Just play and pause, play again, as you follow each step on your own images. Soon when you have the basics you will develop your own personal workflow and know what works and what doesn't.

If you get a liking for Astro as you develop you may want to start looking into stacking images. This is where you take multiple shots of the night sky one immediately after the other, (I usually do between 12-20) Then if it's a landscape Astro scene, you then take another shot for your foreground. However, you change your settings as follows, you can have a much longer exposure time to get a better exposed foreground shot, some of mine have been 4 mins long, therefore allowing you to drop your ISO down to around 600-800, so less noise in the foreground straightaway. You also can close your aperture down a little bit, often giving you a crisper foreground something like F5.6.

The multiple shots are then taken into a stacking program, I use a free one called Sequator, and just with a few clicks of the mouse it lines them all up and gives you a stacked single image. the benefits of this can be instantly seen and particularly good if your camera doesn't handle higher Iso very well. The images have nowhere near as much noise and the detail in the objects in the sky is much more defined. You are also able to mask off your foreground in this program so that it doesn't get distorted during the stacking process, so you may not need your extra foreground image. (This is all done prior to any edits being done on the images) then you just take it back into the editing suite and begin your edits.

With photoshops latest Sky replacement it makes blending your own sky shot with your foreground shot so much easier than ever before, as there is the facility to be able to add your own sky image and again a few clicks line it up and you're done.

I now use a star Tracker for my Astro and if anyone want info regarding the one, I have please just ask. This has enabled me to be able to do my first ever deep space image on the Andromeda Galaxy which is a mere 2.5 million Light years away! Something that I've often admired in other Photographers' images, but never dreamed I would ever be able to photograph, especially when I look at those images I first took. Yes, it's not the best out there, but it's my best at the moment.

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I hope this has helped somewhat, and even if you have a go and decide its not for you, I urge you, if are having a go at Astrophotography, take a moment, step away from the camera, forget about the shot, and look up and take it all in. Its wonderous sight and good for the mind and soul.

If anyone has any questions or queries, I'm more than happy to try and help if I can, be it planning or settings. Don't forget these are just the things I've found out on my journey and are not set in stone. At the end of this I will do a couple of handy little start off sheets that you can print off and pop in your camara bag, so that should you have a go, you have an idea of where to start. Also, there will be a list of resources you may find helpful.



3 Galaxy's in one shot, Andromeda (M31) M110 below Andromeda, the Elliptical shaped one, & M32 the bright spherical one just on the top edge of Andromeda. When you think the light emitted from Andromeda took 2.5million light years to reach the sensor of my camera this night, Amazing!

Star Tracked image. 60 separate, 15 second exposures. 300mm. F6.3. ISO 2000. Along with 50 of each Biased, Flat, and Dark exposures all stacked in Deep space Sky Stacker and Edited in Photoshop following a YouTube tutorial.

Handy Apps & Resources.

Info for all these Apps can be found with a simple Google search.

- **Photopils** / Android & iPhone. approx one off payment £9 also has a website so you can learn how to use it.
- **Planit Pro** – Android. very similar to Photopils but the MW planner is a bit easier to understand. Approx £10 one off payment.
- **Photo Ephemeris**. Web and App.
- **Stellarium**. Free PC/Mac Planetarium so you can see easily what's in the night sky you can do lots of forward planning with this. Also available as mobile app.
- **Sky View**. App free for the basic one which is great.
- **Sky Walk**. App, approx £2.99
- **Clear Outside**. Weather app where you can search locations and see what percentage of cloud cover is also whether its high mid or low cloud cover, does get it wrong sometimes.
- **Met office app**.
- **Weather radar**. Good for satellite images of cloud cover with a few hours forward info.

Printable help sheets on following two pages.

GET STARTED FOCUSING.

PRINT OFF AND KEEP IN YOUR CAMERA BAG TO REFER TO

- SET CAMERA/LENS ONTO MANUAL FOCUS.
- PUT CAMERA ONTO LIVE VIEW.
- SET APPERTURE WIDE OPEN F1.8 -F3.
- ISO 1600-6400.
- SHUTTER SPEED 20 SECONDS, IF USING A WIDE FOCAL LENGTH.
- USE 10X ZOOM (NOT YOUR LENS) TO ZOOM INTO BRIGHT STARS.
- TURN FOCUS RING TILL STARS GO AS SMALL AS YOU CAN GET THEM.

ALTERNATIVELY:

- USE FOCUS PEAKING IF YOU HAVE IT ON YOR CAMERA AND TURN FOCUS RING TILL STARS TURN RED.
- OR SHINE A TORCH ON SOMETHING LIKE A TREE, ROCK OR STRUCTURE ABOUT 20 METERES AWAY AND THEN TRY AUTO FOCUS OR USE MANUAL FOCUS.

IF USING AUTO DON'T FORGET TO FLIP IT BACK ONTO MANUAL WHEN FOCUSED

GETTING STARTED SETTING SHEET.

PRINT OFF AND KEEP IN YOUR CAMERA BAG TO REFER TO

- PUT CAMERA INTO MANUAL MODE.
- SELECT WIDEST APPERTURE- F1.8-F3.5.
- SHUTTER SPEED BETWEEN 10 SECONDS – 25 SECONDS. ***REMEMBER THIS IS DEPENDANT ON YOUR FOCAL LENGTH, SO THE WIDER THE LENS THE LONGER A SHUTTER SPEED*.**
- SET YOUR ISO TO BETWEEN 1600 & 6400. ***ADJUST AS NEEDED***
- SET WHITE BALANCE BETWEEN 3200K (GIVES A COOLER SHOT) & 5000k (GIVES A WARMER SHOT.) *** I USE 4000K***
- TURN OFF AUTO FOCUS ON LENS/CAMERA
- TURN OFF LONG EXSPOSURE NOISE REDUCTION IN CAMERA IF YOU HAVE IT TURNED ON.

***If stars are trailing increase your shutter speed and work your way down till, they are no longer trailing.**

*** Remember if you increase your shutter speed you must therefore up your ISO to compensate.**

*** If your stars are round using the above settings but your image is too dark, increase your ISO one third at a time till it looks ok. If you image looks to bright decrease your ISO.**