

*This article was contributed by Stuart Kay following a night photography evening (Night Sky - 31st October 2024). I have taken the liberty of editing, incorporating some changes and reformatting it for this web site. Jim Bird 7th Nov 2024.*

## **Night Photography (Astrophotography)**

### **Exposure time**

The **500 Rule for Astrophotography** is a quick and simple way to estimate the exposure time for your camera settings when taking a photo of the night sky.

This is needed because:

1. To photograph the stars you need to take a long exposure to capture enough light, but
2. if this exposure time is too long the stars will blur because the Earth is rotating when you are shooting and so the stars “move”.

Therefore you need to estimate the maximum exposure time you can use to capture the most light, but before any blurring or trailing of the stars occurs. For this there is a simple formulae.

1. **Full Frame Cameras** The formula is:  
 $500 / \text{focal length of lens} = \text{exposure time (in seconds)}$ . (Eg  $500/24=21$ seconds approx).
2. **Some Cropped Sensor Cameras (Eg Canon R6)** have a crop factor of 1.6. The formula is:  
 $(500 / 1.6) / \text{focal length of lens} = \text{exposure time (in seconds)}$ , so this gives  $300 / \text{focal length of lens} = \text{exposure time (in seconds)}$  (Eg  $300/14=21$ seconds approx).
3. **Other cameras have various sensor sizes** and the crop factor can range from 0.64 for a medium format camera to 2.7 for cameras with a 1" sensor. The advice as always is "consult the manual".

## **The essential Gear you need**

1. Camera/Phone
2. Tripod torch/headlamp.
3. Spare batteries
4. Memory cards
5. Clothes (wrap up warm)

## How to shoot the Milky Way

Do you need a Full Frame body/camera to shoot the Milky Way?

**NO.** All you need is a camera with a large enough sensor to capture enough light to get a good photo of the Milky Way. So whilst you could use a full frame camera, you could also use an APS-C (cropped sensor) camera with a lens that can give you a f/stop that is low enough to capture enough light to get a clean image of the night skies.

I shoot with a Nikon d7500 cropped sensor camera paired with the Samyang 14mm f2.8.

A kit lens that came with your camera for example like a 18-55 f3.5-5.6 is good enough to get good images of the Milky Way.

It all comes down to settings.

The settings that you need are based on two things: shutter speed and focal length.

The first is knowing how to get the right shutter speed for getting the stars as pin point dots. For this you use the 300 rule for cropped or 500 rule for full frame. This is where you take the focal length and divide it into 300.

For example if you were using my Samyang 14mm f2.8 lens, you take the focal length of 14 and divide that into 300 which gives circa 21 seconds that you should be leaving the shutter open.

Please note this is a rule for a starting point and not a rule that you should necessarily shoot every image at. Start out with this and adjust shutter speed to suit. The rule is designed to get you into the ballpark of what you will need to capture stars that are not starting to trail.

In addition you are going to want to have stars that are properly focused in your frame. There are three ways to achieve focus:

1. Set your focus by going out during the day and set focus to infinity, taping the focus ring in place and setting the lens to manual focus. Then hope that you don't touch the focus ring.

2. Put the camera into live view and set your lens to manual focus and find a really bright star and make it as small as you can in the centre of your frame.
3. If you have a more modern camera, use the AF (auto focus) system to focus on a really bright star.

I prefer the second method for getting focus because this is the fastest and most effective way of getting focus on the stars.

The base settings that I use for shooting the night sky are as follows: ISO 3200; shutter speed of 20 seconds at f2.8 (if you are using the 14mm kit lens I mentioned earlier, this will be at f3.5) and my focal length is always going to be the widest at 14mm. These settings will get you started and remember to play with the setting to get the most out of the time that you are out shooting. It never hurts to take too many images.

It doesn't take a bunch of specialised equipment. You can get started with minimal gear now, and get fancy later as your creativity grows! But remember a wide-angle lens is generally best for capturing more of the night sky in a single frame and reducing star trails, with a focal length of anything from 10-35mm working well.

But you may want to experiment with different lenses and focal lengths. For example, if you're shooting stars or constellations up close, a telephoto lens (such as a 70-300mm range), could be better suited than a wide-angle lens. On the other hand, if you're trying to capture an expansive landscape along with stars, a focal length of 10 -16mm is often preferable.

For night sky photography, it is preferable to use an f/2 or wider aperture so as much light as possible enters your lens and captures all the stars in the night sky with sharp detail. So when choosing a lens, think wide and fast!

## **Additional Notes, Hints and Tips**

### **Lens Hood**

Remember your camera lens hood, this is helpful for keeping lens flare from headlamps etc.

### **Tripod**

Use a sturdy tripod with adjustable legs

### **Shutter release**

A simple remote shutter release to minimise camera shake is recommended. Alternatively use a wired /wireless trigger. Also phones apps for example like SnapBridge (Nikon) can be used. These will help eliminate shake in long-exposure images due to pressing the shutter.

### **Artificial Illumination**

If using a headlamp use in the red light mode so not to interfere with long exposures. An adjustable beam angle torch may be used to direct light where you need it.

### **Clothing**

Wear warm clothes, including a jacket, gloves, and hat. Layer up.

### **Stay safe**

Beware trip hazards, steep inclines etc.

### **Consumables**

Extra batteries and memory cards. Cold and long exposures burn through batteries quickly. Food and a hot drink too maybe.

### **Planning**

Use apps & websites for planning your night sky photography outing like PhotoPills or Stellarium.

### **Composition**

Remember, it's not just the sky that can be the "star" of the shot. The landscape underneath also has character. Use foreground elements to build a storytelling composition.

## **Preparing for a night sky photo shoot**

Photographing the night sky takes planning. First and foremost, watching weather conditions goes a long way toward ensuring you get the best shots possible. From cloud cover reducing the visibility of stars and other celestial objects to windy conditions, increasing light pollution to cold temperatures causing “dewing” on lenses and other equipment. Weather affects night sky photography in many ways. Plan for a night when the weather forecast indicates clear skies and low wind.

Not only does the weather matter but so does moonlight. Knowing what time the moon rises and sets is essential for capturing incredible photos of celestial events illuminated by the moonlight. Check moonrise and moonset times in advance to time your photography accordingly.

## **Celestial events, the sky in general**

Familiarise yourself with the varying objects and phenomena you’ll be capturing, such as stars, planets, galaxies, nebulae, phases of the moon, and constellations and star clusters.

Research upcoming events like meteor showers, eclipses, or comets to ensure you don’t miss out on a rare photography opportunity.

## **Things outside of your control**

Take advantage of things you can’t control, like cars going by. If there is traffic, try to figure out the timing of exactly when to release the shutter so that an oncoming car would “light paint” the scene for just the right amount of time. Instead of getting frustrated at traffic, it becomes a game of strategy and timing!

## **ISO**

ISO affects the amount of digital noise in your photos. Depending on how dark of a sky you’re shooting, an ISO setting of between 1600-3200 is best for low-light photography. If the ISO setting is too low, your photo will be underexposed and too dark. If the ISO is too high, the image could come out noisy (though noise reduction software can improve noisy images during post-processing).

Experiment with different settings to see your camera’s capabilities, and adjust until you find what works best for you.

## **Aperture**

Aperture affects the amount of light that reaches your camera’s sensor. When shooting night sky photography, it is important to set your

aperture as wide as possible (around f/2-f/4) to maximise light-gathering capabilities and get the highest quality image results. However shutter speed is possibly the most important choice you'll make. How long you keep the shutter open effects if you have pin-point-perfect stars, or star trails – and how long or short those trails are. The joy of this niche is how much creative experimenting you get to do in a single evening!

## **Shutter Speed**

Shutter speed determines the exposure time for your shot, which affects the amount of stars' motion (or rather, reveals the amount of the earth's rotation) captured in your photos. Adjust this setting based on the brightness of the sky, atmospheric conditions, and the level of detail you want in your shot. A longer shutter speed – upward of 60 seconds – is best for capturing star trails, but may introduce blur. A shorter shutter speed will freeze the stars where they are in crisp detail, perfect for the Milky Way. Adjusting as you go to find the balance that works best for you and your camera.

## **File Format**

File format affects the quality and size of your photos. Shoot in **RAW** format (instead of JPEG) to capture the maximum amount of data and detail.

## **Focusing**

To make sure that the stars are as sharp as possible, use manual focus and infinity focus, adjusting the lens focus ring until the stars appear crisp.

## **Image Stabilisation**

When shooting night sky photography, use a sturdy tripod or some form of image stabilisation to ensure sharp images. If you're using a tripod, you can turn off image stabilisation features. Keeping image stabilisation on during long exposures can actually create blur as the camera's motor causes movement. However, if you're not using a tripod, turn on image stabilisation when shooting at longer exposures to minimise camera shake and maximise the sharpness of your final image.

You can also try using continuous shooting mode to capture several images in a row, upping your odds of a sharp keeper.

## **Silhouettes**

These can be a powerful part of a night sky photo composition. Play around with placing points of interest in the sky next to, above, or under elements on the ground for added interest.

## **More Tips & Techniques**

Plan for a night with clear, dark skies. Utilise a tripod and a camera capable of manual mode, setting your lens to its widest aperture, and experiment with shutter speeds from 8 to 30 seconds (for APS-C) to avoid star trails for sharp star images. For those interested in photographing star trails, take multiple long-exposure shots and consider stacking them in post-processing to enhance the effect.

## **Take test shots**

Taking test shots is a great way to become familiar with the settings on your camera. Start by putting your camera in manual mode and choosing different ISO, aperture, and shutter speed setting combinations to see the effects.

Play with taking a test shot of the sky at different exposures and shutter speeds, tracking celestial objects such as stars or planets across the night sky. Review each practice shot on your camera's LCD screen to assess what settings worked best for that scene – make adjustments and keep experimenting.

## **Incorporate foreground elements**

Capture unexpected patterns by incorporating foreground elements such as rocks, trees, and buildings into the frame. This can add depth, texture, and interest to your photos.

Try using those elements as focal points in your frame, taking different test shots at different focal lengths and shutter speeds to see what works best.

## **Experiment with angles and perspectives**

Experimenting with different angles and perspectives helps convey the vastness of space through night sky photography. Try getting down low to include the foreground landscape or to create dramatic silhouettes against the starry sky.

Move around to allow you to shoot from multiple locations to reveal different compositions throughout the night.

### **Star trails are fun.**

You can create circular star trails by aiming toward the poles or straighter star trails by aiming toward the east or west.

Create a star trail image by intentionally underexposing and using a long shutter speed – usually 1-15 minutes, depending on how short or long you want the trails. This creates a sense of motion and highlights the contrast between the dark night sky and the bright stars.

### **Use longer exposure for meteors**

Capturing photos of meteors passing through is exciting. Capture the path of meteors by using long exposure times, typically 30 minutes or longer. With patience, practice, and a little luck, you'll capture stunning photos of meteors.

### **Try out focus stacking**

Focus stacking combines multiple photos with varying focus points and exposure levels into a single final image, ultimately creating a greater depth of field than possible with the camera's more shallow depth of field. Combining photos digitally during post-processing with software such as Adobe Photoshop/affinity can bring out more detail in shadows and highlights, reduce noise, and increase overall sharpness.

### **Play with light painting**

Using a light source such as a flashlight, lantern, or headlamp to paint dramatic streaks of light across the sky or to illuminate foreground elements while still exposing stars in the background can add drama and depth to night sky photography. When using this technique, keep in mind how the darkness will affect visibility – longer exposure times may be necessary to capture the details of light painting elements fully.

A little bit of light goes a long way in turning a silhouette into a subtly lit character. Play with adding a touch of light from a headlamp, an LED panel, or an adjustable flashlight with a colour filter over it. It takes a few tries to figure out how much light to use and where, but have fun and experiment.

### **What quality is acceptable?**

Without getting caught up in a detailed discussion here, just remember that the photograph only has to have the quality (resolution, sharpness, absence of light trails etc) required for the intended display medium, for example mobile phone, computer screen, projection or print all have different requirements. So whilst your stars may appear to have light trails and be slightly out of focus or blurred, the photo may well "do" for its intended purpose.

So the answer is really **What quality do you need?**