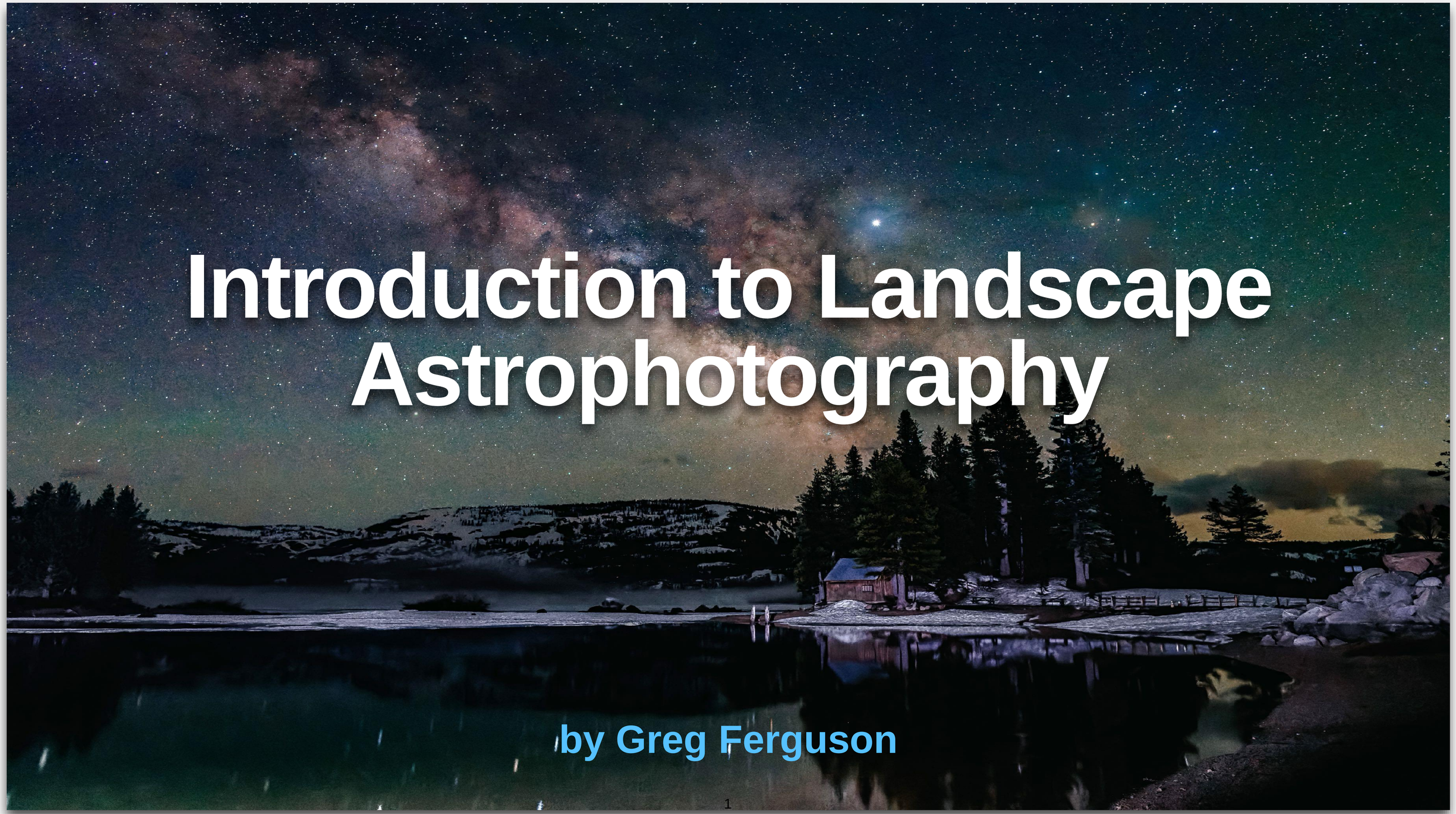


Introduction to Landscape Astrophotography

by Greg Ferguson

For this beginner’s guide to landscape astrophotography, I’ll cover all the steps to help you take amazing images of the night sky above Earth.

What makes a great landscape astrophotography image?
2. What equipment to use to do this successfully.

What is Landscape Astrophotography?

Landscape astrophotography is one of the three main categories of astrophotography, alongside planetary astrophotography and deep sky astrophotography.

Landscape astrophotography is the practice of photographing the night sky and the Earth’s landscape together.

It is a combination of traditional landscape photography and astrophotography.

Bonsai Rock, Lake Tahoe

Landscape astrophotography is the most accessible branch of astrophotography because:

It can be done with the least specialized gear. A regular camera, lens, and tripod are all you need (more on this below).

It requires little knowledge of astronomy when compared to planetary or deep space imaging. You are photographing the stars in the night sky rather than hunting a specific astronomical object.

It is a relatively easy step to make for someone who is already a keen photographer using a DSLR or mirrorless camera, especially if practiced in daytime landscape photography.

The challenges with landscape astrophotography are:

1. You need to go early and get to the location you want to shoot from at night. This might mean a long drive or walk at a time when you'd prefer to be sleeping, or you may have safety concerns.

2. You are at the mercy of the weather conditions—you need clear conditions to shoot the stars. You may be all set to go out one night, but clouds ruin your plan.

3. You have to plan your timing for what will be in the night sky. More on this below, but you need the moon phase to be right, and you may also want to time the position of the Milky Way core.

Let's look into what makes a great astro landscape image.

Alabama Hills

What Makes a Great Astro Landscape Image?

Images that are generally a combination of foreground and night sky brought together to create something exciting and unique.

Images (usually) follow the practices of good landscape astrophotography composition. Including:

The Rule of Thirds

The rule of thirds is a guideline in photography in which an image is divided into thirds or a three-by-three grid of nine squares.

You then position your key elements along these lines to make the image more pleasing to the eye.

With landscape astrophotography, this means that the horizon takes one-third of the composition and the night sky takes two-thirds, or the other way around.

Caples Lake Resort

Framing

This is using part of the foreground to create a frame around the central point of interest.

With nightscape astrophotography, this might be the Milky Way core, as you can see in this image:

Leading lines

This is using part of the foreground to lead the viewer’s eye to the central point of interest.

Again, the Milky Way core in this image:

There are no solid rules to this, but these best practices can lift a technically good image into one that makes people excited.

Loon Lake, Dark Water Pond

Landscape Astrophotography Equipment

For landscape astrophotography, you will need at least three pieces of equipment:

1. Camera
2. Lens
3. Tripod

Plus, there are a few optional things that you may choose to add later, like:

1. Remote shutter release
2. Light pollution filter
3. Star tracker

Other things like flashlights, headlamps and battery packs, warm clothing, and coffee will also be needed, but you can probably rely on your common sense to know what you need when going out at night, wherever you are.

Cameras for Landscape Astrophotography

For the best results, you will use a DSLR or mirrorless camera for landscape astrophotography.

Compact cameras, bridge cameras, and even smartphone cameras can be used for this, but they lack the manual functionality and interchangeable lens versatility of DSLR or mirrorless cameras.

A full-frame sensor is better at performing in low light and enables you to capture a wider expanse of the sky.

They are more expensive, but this is the key characteristic you should look for over anything else, like megapixel count.

So overall, you will be ideally wanting:

1. DSLR or mirrorless camera
2. Full-frame sensor
3. Interchangeable lens capacity

Lenses for Landscape Astrophotography

The second most important piece of gear will be your lens.

For a great landscape astrophotography lens, you are looking for two things:

1. **A short focal length** - this allows you to shoot at a wide angle and capture a large expanse of the night sky.
2. **A fast aperture** - indicates how well the lens will gather light in dark conditions. This is indicated by an ‘f-number,’ where the lower the number is, the faster and better the lens will be for this purpose.

Typically, this will be:

- 12mm to 24mm focal length
- f/1.4 to f/2.8 aperture

Tripods for Landscape Astrophotography

The third key pillar of your landscape astrophotography setup is the tripod.

The key thing for this is to have one that is good quality and sturdy.

This is important as you will be taking long-exposure images, and any shake coming through your tripod will ruin your image.

The other factors to consider are:

1. Weight – especially if you are hiking out somewhere for your shot and need to carry it.
2. Height – how tall will it stand so you don’t have to stoop.

Landscape Astrophotography Planning

A hugely important aspect of landscape astrophotography is planning.

You need to plan ahead the location and how you are going to get there at night, and then you need to time the night sky and weather conditions.

Let’s look now at each of these elements.

Location

There are two main aspects to consider with regard to location:

1. **Composition**
2. **Light pollution**

With the composition, this is where you want to shoot from and what you want to include in the photograph.

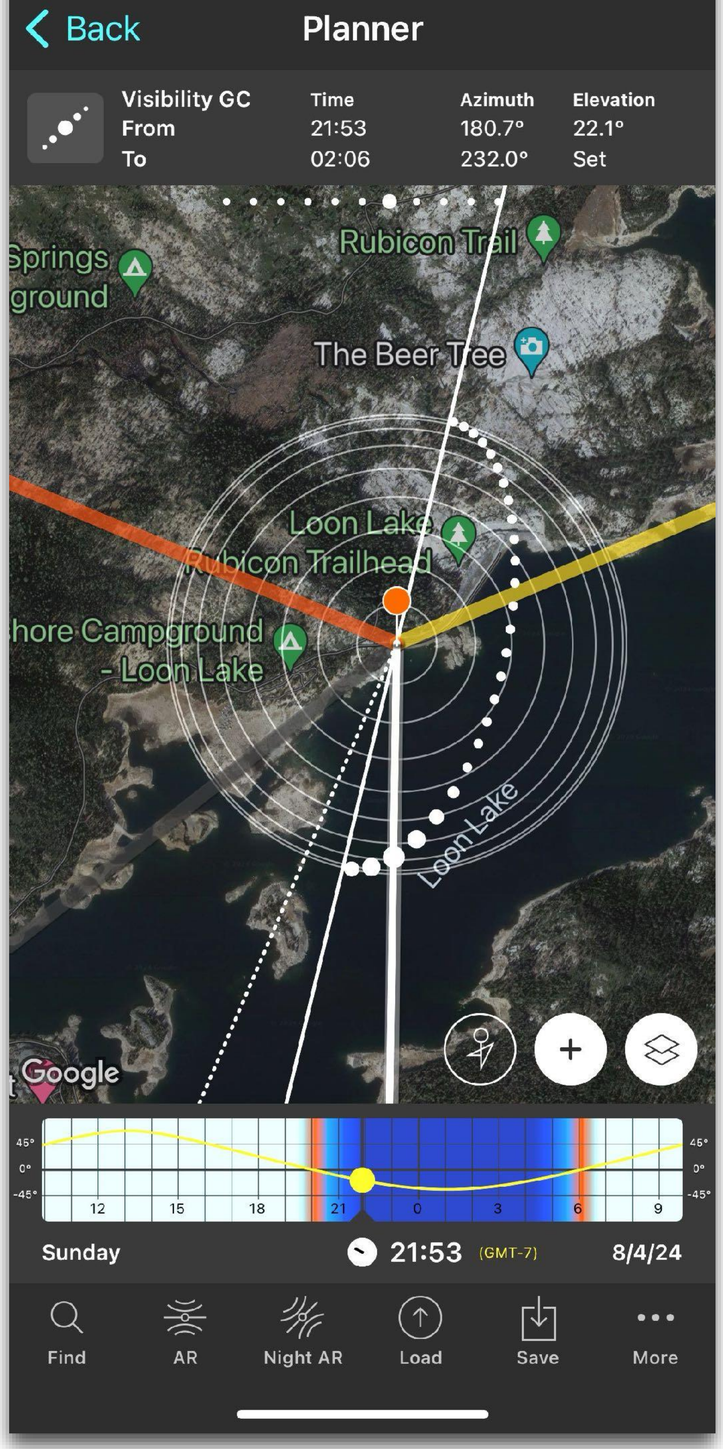
The biggest factor will be the foreground and landscape you want in the image. For example, a mountain, lake, or park that you can access.

You need to think about how you will get there and also the direction in which you will be facing to take the shot, as this will be a factor if trying to time and capture the Milky Way core (if that is what you are trying to do).

There are some great tools like **Photopills** or **Stellarium** to help plan this.

You can scout a location on your phone or computer to see things like the timing of dusk and dawn, when the Milky Way core will rise, and in what direction it will be.

For example, in this screenshot, Photopills is telling us that at Loon Lake on 4 August 2024, the Milky Way galactic core (GC) will be visible from 21:53 to 02:06 and will be in the Southern skies:

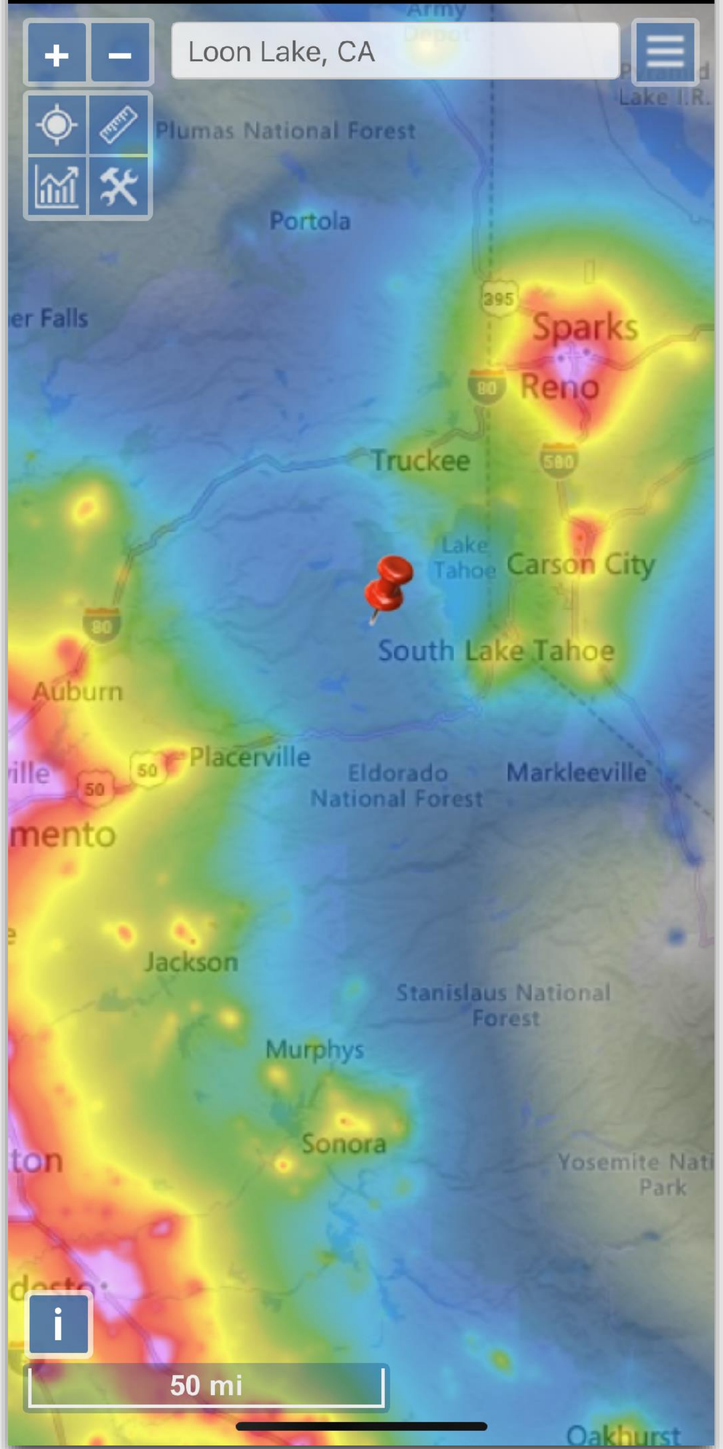


The other thing is light pollution. Most cities and towns create light pollution, brightening the night sky and making it harder to capture the stars.

Imagine the clarity of the stars in an area with low light pollution. It may require some travel, but the resulting image will be worth the journey.

See the phone app **Light Pollution Map** to help research this.

See the webpage **Light Pollution Map** to help research this.



Timing the night sky

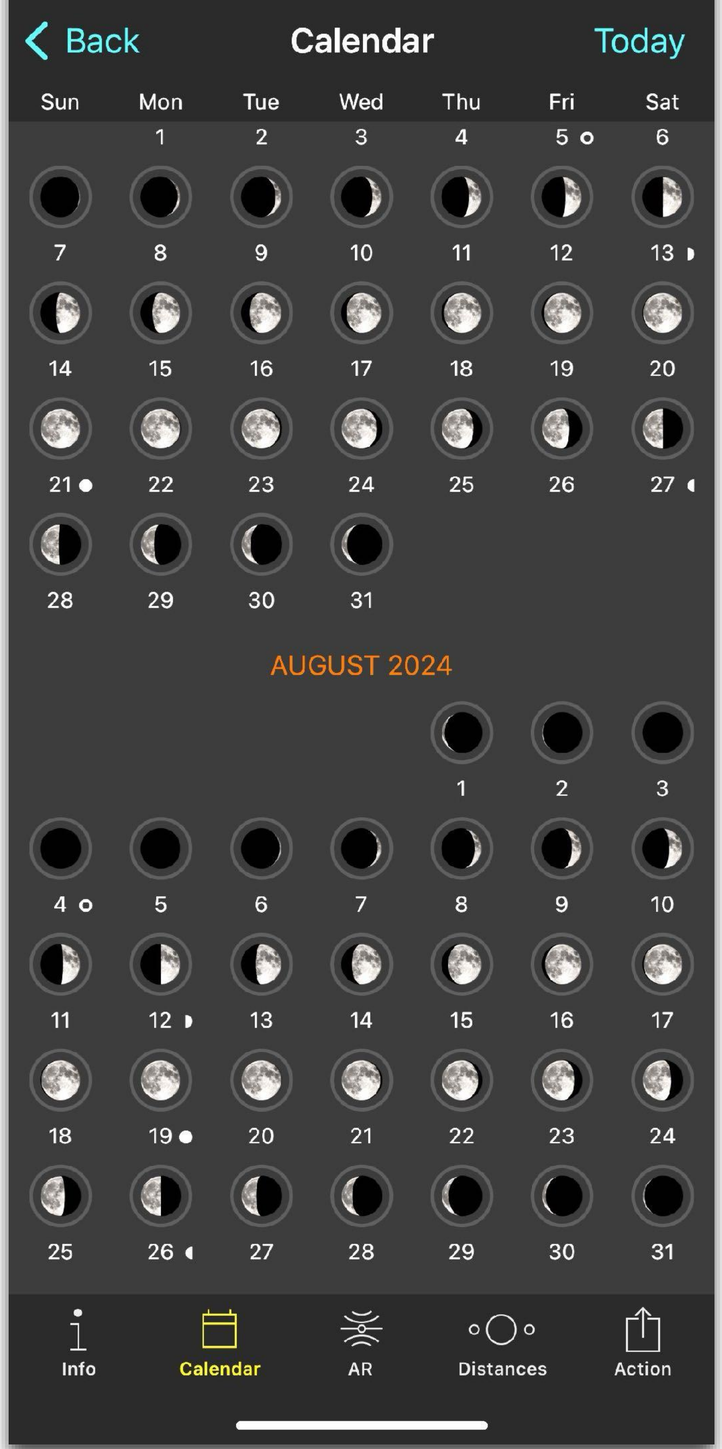
After finalizing your location, the next crucial step is to plan the timing. This is a critical aspect that requires careful consideration of two main factors:

1. **The phase of the moon**
2. **The location of the Milky Way**

The moon phase is important as a bright moon is effectively a source of light pollution that lightens the night sky and makes it harder for the stars to “pop” through.

You, therefore, need to be shooting around a ‘new moon’, which is when it is invisible in the sky.

You can google for a moon phase calendar, or one is included in the Photopills app: For example, August 4, 2024.

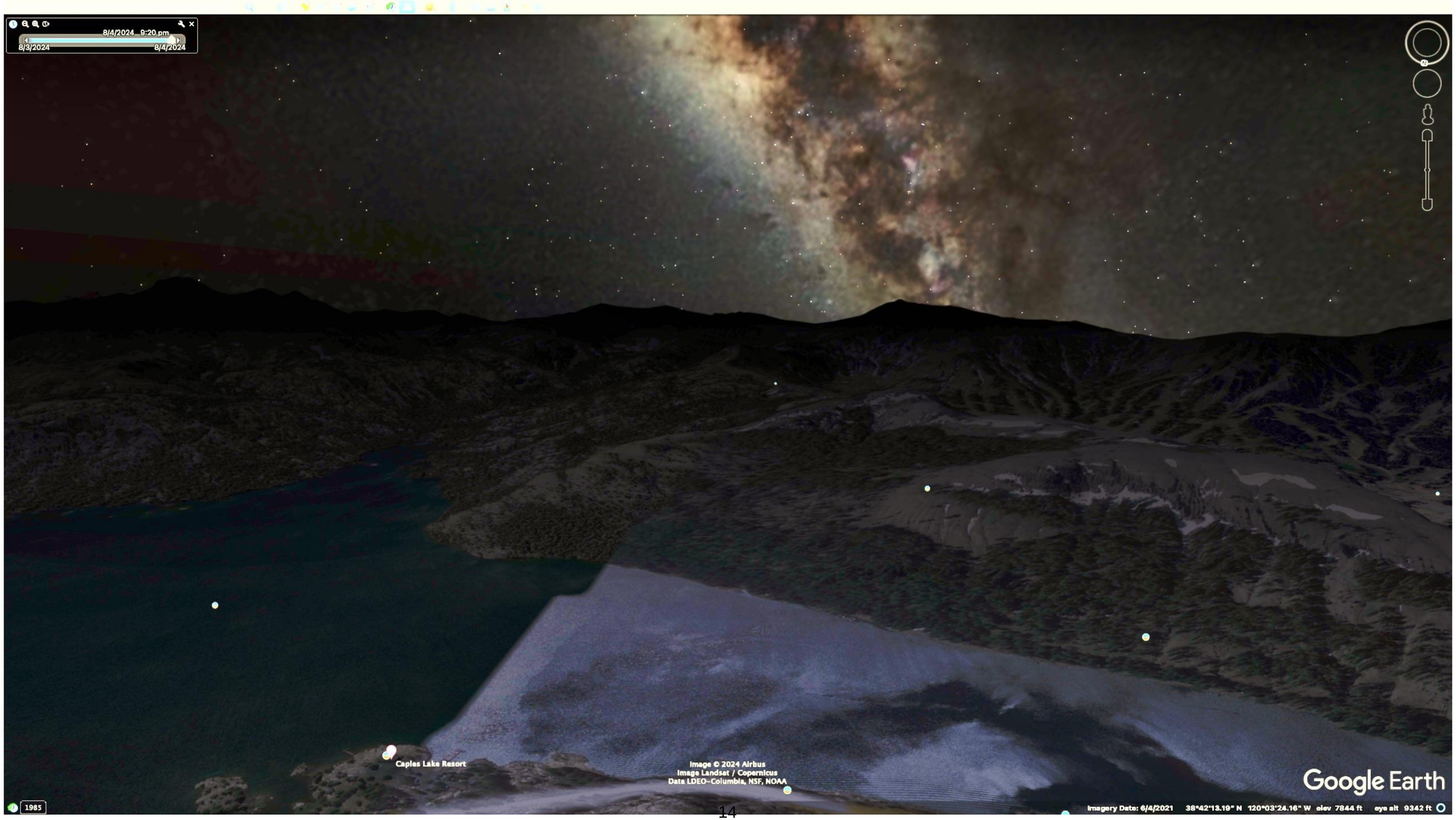


If you want to capture the Milky Way, you will need to research when it will be above you.

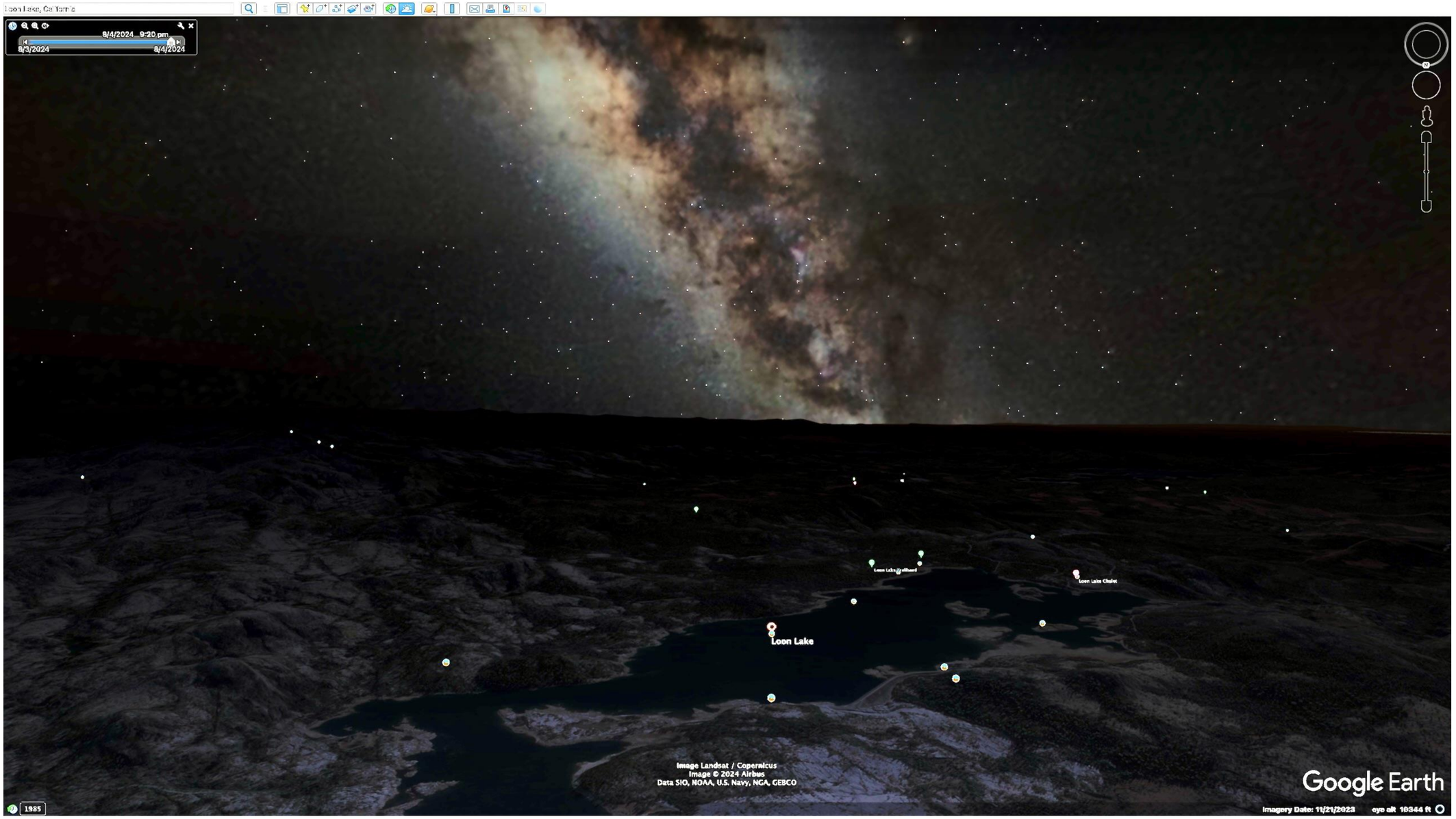
Stellarium is great for this and allows you to see the exact hour at which you can get the perfect shot:

Google Earth

“Take note of the southerly view from the shore of Caples Lake Resort.”



“Take note of the southerly view from the shore of Loon Lake.”



Planning for the weather

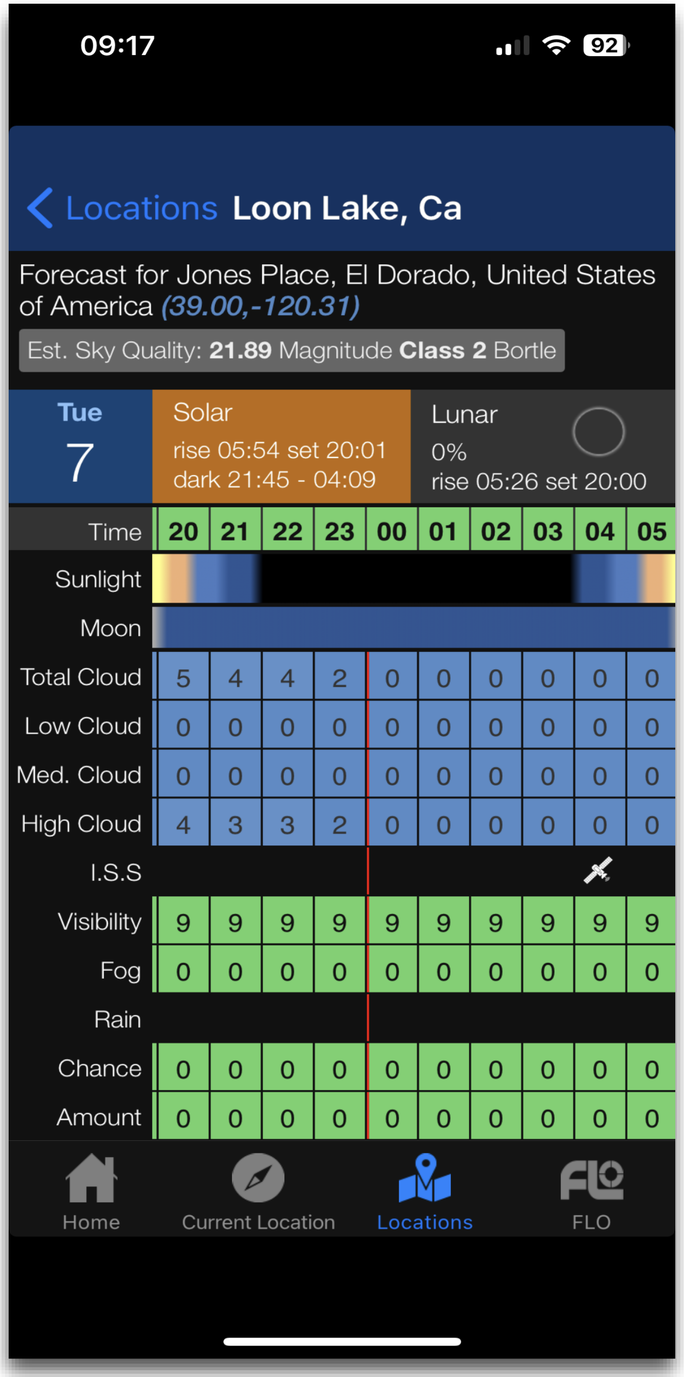
The final aspect is the weather.

You can plan all the other parts to perfection, but you don’t want to gather your gear and get up at 2 a.m. to travel to your perfect spot only to find it ruined by clouds.

Therefore, you need to monitor the weather days before your planned shooting night. This involves checking the forecast regularly, looking for patterns, and understanding how they might affect your shoot. This effort is crucial to determine whether it will be worth it.

Regular weather apps and websites are good for general forecasts, but phone apps like **Clear Outside** give you a much more granular breakdown:

An example here is of Loon Lake for Tuesday, May 7, 2024.



Landscape Astrophotography Settings

To take your landscape astrophotography photo, you will most likely be taking two photos and stitching them together afterward with post-processing software. This will be:

1. **One shot of the night sky** - The length of this exposure will be limited by your gear.
2. **One shot of the foreground -** You can take as long an exposure as necessary to capture enough light.

An alternative tactic to get the shot in one is to light the foreground yourself with a flashlight or even car headlights. If using a star tracker, though, you definitely need a separate foreground image, or it will blur with the camera's movement.

To capture these images then you need the right settings. The key elements of this are:

1. Exposure time
2. Aperture
3. ISO

Exposure time

When it comes to exposure time (or “shutter speed”), there are two precise formulas that assist you in calculating the maximum length before the stars begin to blur.

500 rule - is a simple calculation of dividing 500 by the focal length of the lens you are using. So, for a 14mm lens, this would be 500/14=35.7. Therefore, you could, in theory, take a 35-second image with a 14mm lens and get sharp stars.

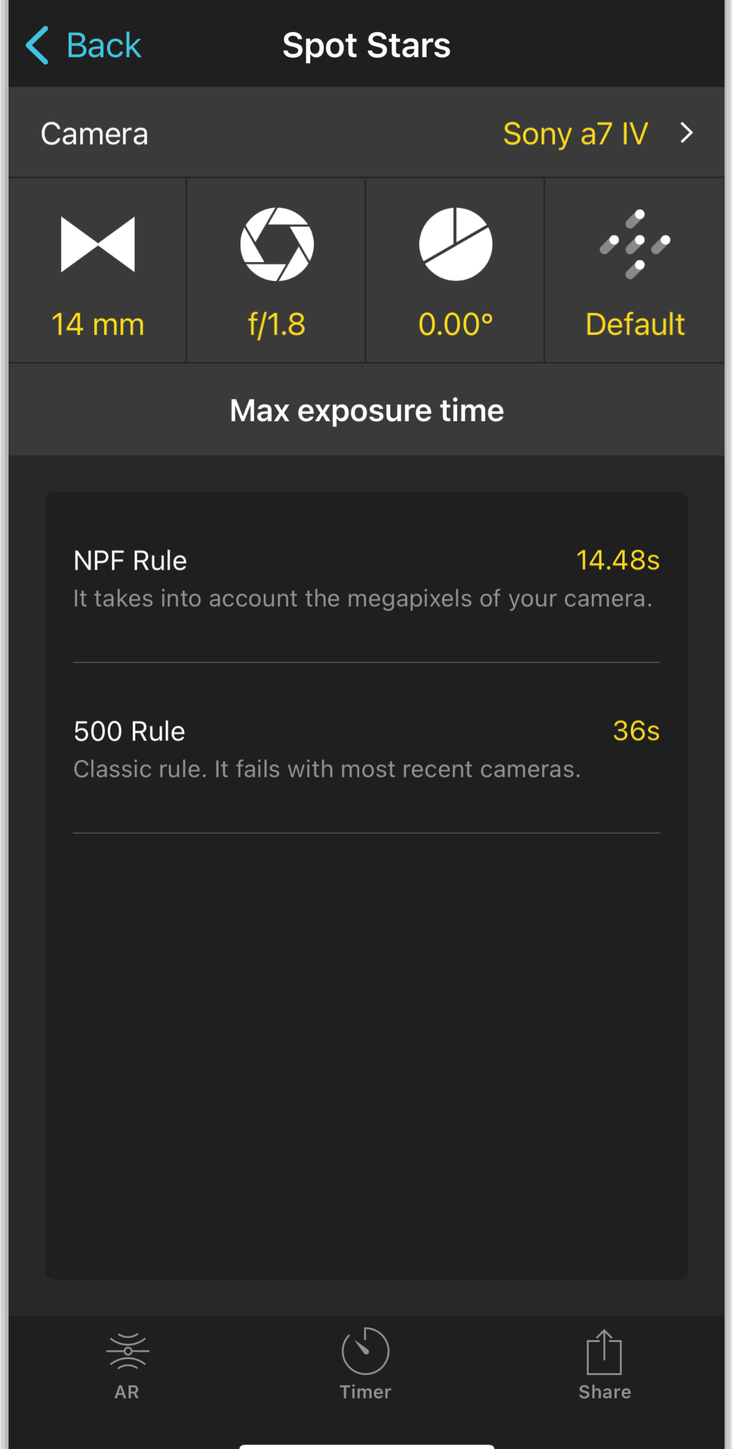
2. **NPF rule** – this calculation is more complicated and uses the pixel density of the individual camera model and the lens focal length and aperture. This is a much more accurate guideline to use.

There are calculators with apps like **PhotoPills** that allow you to input your exact camera model and lens focal length to get the most accurate recommendation.

You can see here the recommended (Default) exposure length if using a Sony a7IV camera and 14mm f/1.8 lens:

- 36 seconds with the 500 rule
- 14.48 seconds with the NPF rule (Accurate) exposure of 7.24 seconds.

The NPF rule recommendation is shorter because it takes into account the camera's high resolution, which would show up as star trailing if the time exceeded 14.48 seconds.



Aperture

With aperture, you generally want as fast/wide as possible.

This is because the widest lens setting lets in the most light, which is very important for night photography.

The speed/width is indicated by the f-number on the lens. I recommend using lenses that are ideally f/1.4 or f/1.8, but there are some great budget lenses at f/2.8.

The only thing to watch out for is that some lenses perform best when not at their widest. i.e. not using f/1.8 but bringing it down to slightly narrower.

You can discover this with practice and experimentation with your chosen camera and lens setup.

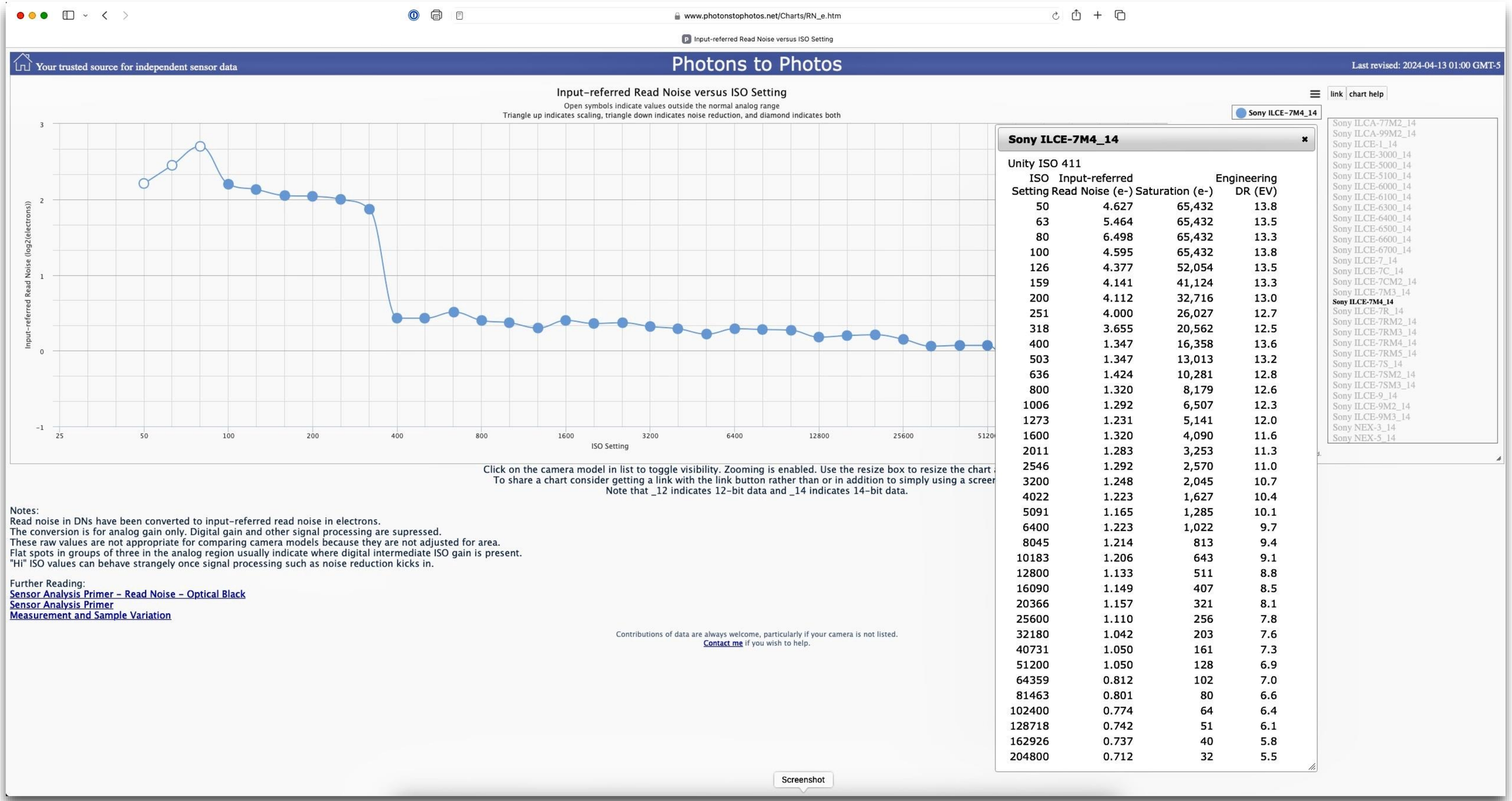
ISO

ISO is a setting that is adjusted according to the amount of light you are photographing. Low ISO is needed in daylight, and higher ISO is needed indoors or in darker conditions.

The caveat is that using higher ISO levels results in **NOISE** in your images. This noise is a sort of graininess that detracts from the quality of the image, especially if blown up large.

You need to experiment with your camera to find the right level. You don’t want it ultra-high, or it will be too noisy, but too low, and it will impact what you capture in the night sky. Or…

You can utilize a website called "[Photons to Photos](www.photonstophotos.net/Charts/RN_e.htm)" that can assist in determining the optimal ISO for your photography needs.



For the best results, you will take multiple images and stack them in post-processing (more on this below). This is very effective at removing noise but adds a layer of complexity to simple composing and shooting.

One thing a very high ISO can be used for is to take initial images to help you compose your shot, as this helps show where, for instance, the Milky Way core will be. You can then take your proper shot with a lower ISO

If using a star tracker, you can also use a lower ISO, as you will capture more light with a longer exposure time.

Shooting RAW

Another key setting is to make sure you are shooting RAW images and not jpegs.

When shooting JPEGs, the camera does some processing for you, but then it gives you less data to work with in post-processing, reducing its potential.

You might get images that do not look as good when viewed on the camera, but they retain more data for you to use later.

Landscape Astrophotography Post-Processing and Editing

Once you have had your photography session under the night sky, you need to bring those images home to make the most of them using software for post-processing.

Popular software includes Photoshop, LightRoom, and others.

We are not going to go too in-depth into the process here other than to touch on stacking.

Landscape Astrophotography Stacking

Stacking in astrophotography is the process of taking multiple images (*a minimum of 10 light frames)*—***an intervalometer is helpful***—and then 5 dark frames for a single composition and then laying them on top of each other using software like **Starry Landscape Stacker**

Stacking is your secret weapon in astrophotography, enhancing your images' signal-to-noise ratio (SNR) and bringing out the elements you want, such as the stars and astronomical objects. This technique instills confidence in your skills, knowing that you can reduce noise and bring out the best in your captures.

Stacking enables you to bypass the limits of your gear on your exposure time.

This is especially useful if not using a star tracker, as your maximum shutter time may be quite short.

Camera Settings

Shutter Delay:

Even the slightest camera movement, like pressing the shutter button, can create a blurry photo when taking a long exposure. However, this can be easily eliminated by using a remote shutter or a built-in self-timer. Most cameras have a 2 to 5-second delay, giving you enough time to settle after you press the shutter button, ensuring sharp images with no movement. ***(Please cover the autofocus assist lamp with Gaffers Tape so as not to ruin your image with the flashing RED light.)***

Monitor setting

Making the EVF/rear LCD monitor display darker. Reducing the display brightness to a more appropriate level can also help to reduce battery consumption. Display brightness affects how you see the images. The display brightness could make the exposure of your shot look brighter or darker than it really is, especially if you adjust it. To avoid underexposing or overexposing your shots, don't rely on what you see onscreen. Refer to the histogram, which will show the highlights and shadow distribution more accurately.

(Optional) Long Exposure Noise Reduction OFF:

This feature, available on some cameras, takes a second exposure after you set the exposure to remove hot pixels. However, I usually opt to leave this setting turned off. It can save you valuable time and preserve your camera’s battery life.

Focusing in the dark

When it comes to focusing in the dark, manual focus is your best friend. Start by setting your lens to manual focus using the AF/MF switch on the lens. Remember, autofocus will not work in the dark. Next, utilize the ‘Live View’ feature of your camera to display an image preview on the camera’s LCD screen. Spot a bright star or distant light source and digitally zoom in on that point of light. Now, the key is to adjust the focus ring until the star or distant light source becomes as small and sharp as possible. This meticulous step will ensure your image is crisp and clear.

Once you're focus is set, now all you have to do is take the shot and wait for the image to pop up on the LCD display — it may take some time before you see the image on the LCD screen, as the camera can take a while to write the file to the memory card. If your foreground is looking a bit dark, try light painting your subject with a flashlight or your smartphone light during the exposure to help brighten the scene. You may need to adjust the ISO or aperture slightly to find what works best for your location, but you are now firmly on your way to capturing your own images of the beautiful night sky.

Foreground

If you're trying to balance the light and focus between the foreground and the night sky, we suggest you take multiple exposures of each element and merge the images together when you edit them, as they will require different settings to get the best of each. You may even find that getting your foreground shots an hour or so earlier during the blue hour will help, as there is more light to work with for your foreground objects without having to crank the ISO up. This isn't always possible, though.

Reflections

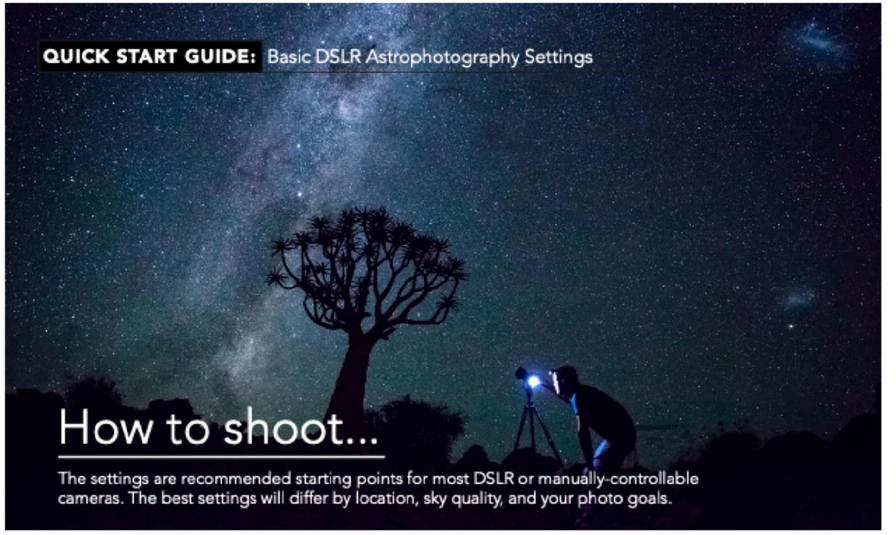
If you're shooting the night sky near a lake, and the weather is still, there's a great opportunity to try capturing the reflection of the stars in the water. Here's how you can do it: First, change your focal point to the water and take an exposure. Then, return your focus to the night sky and take the same shot. You can merge these two shots later in the edit to create a stunning image with the night sky and its reflection.

When capturing reflections, you may need to balance your shutter speed. A 20-second exposure will capture the reflection of the stars, but it may also pick up movement on the water, which can reduce the clarity. You could try shorter exposures for your reflection shot, but remember that you may have to work harder to bring out the stars in the edit.

White balance

While I usually recommend setting your white balance to a slightly cooler temperature for astro shots, you can experiment with the manual WB settings, or the presets to create interesting tints and variations in your shots. I'm drawn towards cooler skies and usually live in the Kelvin range of 3800 to 4800, depending on the scene.

If you're getting a little light pollution, adjusting the white balance can actually make it look like a feature of the photo (I recommend cooling it right down and seeing the effect that has), although you'd need a gradient filter to reduce noise if you're closer to an urban area. To start out with, you can just use the 'Auto White Balance' setting and experiment with cooler and warmer adjustments when you edit to see which effect you prefer.



	MOON	STAR TRAILS		MILKY WAY	
SHUTTER SPEED EXPOSURE LENGTH	1/160 TO 1/400 SEC	30 SECONDS		**10-20mm lens** 25-30 SEC	**20-30mm lens** 15-20 SEC
ISO	100 - 200	**URBAN** 400 - 800	**DARK SKY** 800 - 1600	**URBAN** 400 - 800	**DARK SKY** 1600 - 6400
APERTURE	F/6 - F/10	1-STOP HIGHER THAN WIDE OPEN		WIDE OPEN, AS LOW AS POSSIBLE	

Essential settings

LENS: Image stabilisation off. Auto-focus off.
CAMERA: All auto-function should be disabled, settings to be set on manual.
IN CAMERA NOISE REDUCTION: Disabled for star trail shooting. Optional for Milky Way shooting. Post processing software can eliminate noise effectively.

WHITE BALANCE: Location dependent. In light polluted skies, 2900-3800K, in darker skies, 3500-4500K. Shooting RAW format allows you to change WB in post.
STAR TRAILS: Use continuous drive mode with a remote shutter release locked on.
MILKY WAY: Enable 2-sec delay shooting to minimise camera shake

Astrophotography doesn't require a lot of specialized equipment to be successful. Along with a passion for the subject, you need to invest time in planning, practicing, and being patient. Once you have done all this, you should have some great images to share.

“The result of all the effort you have put in will be worth the payoff.”

“I wish you the best of luck with clear skies ahead.”

Questions???