

**INTRODUCTION TO  
LANDSCAPE  
ASTROPHOTOGRAPHY**  
ADAM WOODWORTH





adam  
**WOODWORTH**

- **CAMERA :** Nikon D810A
- **LENS:** Nikon 14-24mm f/2.8 lens @ 14mm and f/2.8
- **SKY:** Star stacked blend of 10 exposures, each at 10 seconds and ISO 10,000
- **FOREGROUND:** Blend of 2 exposures, 1 at ISO 1600 for 20 minutes and another at ISO 6400 for 2 minutes, both at f/2.8.

## COVER IMAGE

### BIOLUMINESCENCE & THE MILKY WAY

Blend of multiple exposures taken in the same spot, on the same night, without moving the camera.

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# ABOUT THE AUTHOR

## NIKON OFFICIAL PHOTOGRAPHER

Adam Woodworth is a landscape photographer originally from Kittery, Maine, and he now resides in Lubec, Maine. He has had a love of photography most of his life, and since 2008 he has focused on landscape photography. His goal as a photographer is to create compelling images using high quality tools and techniques. His attention to detail as a long time computer programmer is not lost in his photography and fine art printing.

Adam regularly works with Nikon on reviewing cameras and lenses, and has spoken at their booth at the PhotoPlus Expo in New York City and the Consumer Electronics Expo in Las Vegas. He also has articles and images published in magazines and websites such as Outdoor Photographer, Digital Photo, Digital Photo Pro, The Luminous Landscape, Nikon's Image Chaser, DPReview, and Down East.

He teaches workshops and has tutorials available at [adamwoodworth.com](http://adamwoodworth.com).





# INTRODUCTION

## WELCOME TO THE NIGHT SKY!

In this tutorial I will describe many of the tools and methods I use to create fine art landscape astrophotographs. I will be focusing on capturing photos of the Milky Way with minimal star movement. This tutorial does not cover star trail photography. My goal as a landscape astrophotographer is to create high quality dramatic images of the night sky, and as such I will be focusing on using professional grade tools with a strong attention to detail, with the end goal of being able to create large fine art prints, not just small photos for the web or social media.

Keep in mind that my method isn't the only method, and you should experiment and figure out what type of images you want to create and which tools and methods work for you.

I should point out that this article assumes that you already have a fair amount of photography knowledge. If you're jumping straight into night photography as your first photographic endeavor then you should familiarize yourself with camera exposure settings, lenses, etc. Photography is a technical field, and fully grasping the details is essential.

So let's get started by talking about camera gear!



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**WOODWORTH**

- CAMERA: Nikon D800E
- LENS: Nikon 14-24mm f/2.8 @ 14mm, f/2.8
- SKY: ISO 3200 for 25 seconds
- FOREGROUND: ISO 1600 for 20 minutes

# EQUIPMENT NEEDED

## CAMERA

Night photography pushes image sensors to their limits, and recent full frame sensors are better at handling noise and dynamic range than ever before. That said, in the few years since I wrote the original version of this article, sensor technology has improved so much that even introductory level cameras from the major manufacturers can produce great results at night. But if you're looking for the highest quality, full frame is it.

Within the full frame size you can choose a high pixel density or low pixel density sensor. Low density means fewer but larger pixels (technically these are photosites on a sensor), and high density means more but smaller photosites. The trade off is that sensors with larger photosites will gather more light and thus have a greater signal-to-noise ratio but with a lower resolution, while sensors with smaller photosites will be more noisy but with a higher resolution. For example, the Nikon D5 is 20 megapixels and will thus have a higher signal to noise ratio than many cameras with higher pixel counts (as of this writing). But as the years go on and technology improves, the high pixel density sensors are getting better and better at handling noise.

Chances are, whatever camera you have can be used for astrophotography, but older cameras will have much more noise. However you can greatly reduce the amount of noise with a technique known as star stacking, a method that averages multiple noisy exposures to produce a result with far less noise. This is explained more below and in much more detail in in the [Star Stacking article](#) on my website.



## FAST & WIDE LENS

This is probably the single most important piece of equipment. The lens is your camera's view of the world, and cheaping out here will mean you're not using the full potential of your camera. You'll want a very fast (large aperture) wide angle lens. Arguably the best lens around for super wide angle night photography is the Nikon 14-24mm f/2.8 lens. Both Canon and Nikon make 14mm f/2.8 prime lenses, but the Nikon 14-24mm f/2.8 is sort of the gold standard of fast ultra wide angle glass. The Rokinon 14mm f/2.8 lens (also manufactured under the brand names Bower and Samyang) is a popular fast wide angle lens that is very good and affordable, but the quality varies from copy to copy. Overall, you want a lens that is sharp at its largest aperture (smallest f-stop), otherwise the stars will be soft and blurry.

Here are some lens examples from various manufacturers, this list is certainly not complete, and only includes wide angle lenses:

### FULL FRAME:

Nikon 14-24mm f/2.8  
 Canon 16-35mm f/2.8  
 Sony 16-35mm f/2.8  
 Sigma 14-24mm f/2.8  
 Tamron 15-30mm f/2.8  
 Rokinon (Bower, Samyang) 14mm f/2.8

### CROP:

Tokina 11-16mm f/2.8  
 Tokina 11-20mm f/2.8

### CROP MIRRORLESS:

Zeiss 12mm f/2.8  
 Rokinon 12mm f/2.8

## STURDY TRIPOD & HEAD

You need a tripod for night photography, and since the exposures can sometimes be many minutes long, you want a very sturdy one that will easily support the weight of your camera and lens for long periods of time. Some tripods have a center column that raises up for more height. Do not use this, it turns your sturdy tripod into an unstable monopod. Some tripods let you remove it entirely to save weight.

You'll definitely want a tripod head that uses a quick release clamp that supports using an L-bracket. The L-bracket attaches to your camera and will allow you to quickly orient the camera vertically without having to flop the tripod head to the side, allowing for better stability and overall easier operation.

I use a Really Right Stuff TVC-33 tripod with their BH-55 ballhead.

## REMOTE TIMER & RELEASE

For some reason camera manufacturers have designed limited firmware for the cameras that (usually) only let you choose 30 seconds as a maximum shutter speed. (The Nikon D810A is the only exception I know of for full frame DSLRs, allowing you to choose shutter speeds above 30 seconds in specific increments, but the increments aren't always enough.) Sometimes you need to expose for longer than 30 seconds, particularly when doing long exposures for the foreground. Thus you will need a remote timer for your camera. This can be a wireless or wired remote. It will accomplish two things: it will let you trigger the shutter without actually touching the camera (reducing camera shake), and it will let you control the length of the exposure from anywhere between 1 second and many many minutes. You should get one that will also let you set it up to automatically take multiple photos, called an intervalometer, which you can use for star trail photography (not covered in this tutorial) and star stacking (covered later).

I've found that most of the inexpensive intervalometers, such as the Vello ShutterBoss or Neewer brands, have a weakness in their cable design that breaks easily, so after replacing a few of those, I went with one by Promote Systems that has replaceable cables. The Promote also has different dedicated screens for each mode of operation, including a one-shot mode and a time-lapse mode. This means I can setup the time-lapse mode for star stacking and switch over to one-shot for my long exposure foreground

shots, without having to re-do the time-lapse setting every time like with a cheaper remote.

Some cameras, like many Nikon full frames, have a built-in intervalometer that can be used for shutter speeds of 30 seconds or less.

## LENS HEATER

As the warm air from the day cools at night, any water vapor in the air (humidity) can condense on the front element of your lens, causing “lens fog” and blurry photos. This is particularly a problem where I live on the coast of Maine, in the summer the air is often quite humid next to the ocean, and as the sun sets the cool ocean water chills the air, and condensation is much more likely. Even in the winter your lens can freeze over with ice depending on conditions.

All of this means that you need some way of keeping the dew (or ice) off your lens. Sometimes all you need is a lens hood, which will help keep the moist air away from your lens, or even just a slight breeze will keep the water in the air from settling on your lens. But super wide angle lenses often don't have a lens hood, or have a very minimal hood, and there's not always a breeze, so a lens heater is a great tool to have at your disposal. Keeping the lens warmer than the dew point is all that you need to keep dew off your lens.

Chemical hand warmers, like Little Hotties or Grabbers, can be wrapped around your lens with rubber bands or a cloth like the Lens Muff, but I've never had good luck using this method. They're too finicky and you have to carry around a lot of hand warmers for a long, multiple night trip of astrophotography. So instead, I use electric lens heaters.

It used to be that you had to buy a lens heater designed for a telescope,

such as one from Dew Not or Kendrick, and then figure out some sort of convenient power supply, as the usual battery packs that these heaters were designed for are big and heavy. A cable adapter could be built or purchased to adapt the RCA style plug of the lens heater to a DC style plug of a lithium ion battery, but I recently discovered the new Protage lens heater with USB power plug. That heater plus a small portable battery with a USB socket is all you need, such as the Anker PowerCore 10000. The Protage heater paired with that battery should give you about 5 hours of runtime before the battery is dead. I suggest purchasing 2 heaters and 2 batteries, as any cable is prone to failure so a backup is handy, and it's always a good idea to have a spare battery on hand.







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- **CAMERA:** Nikon D800E
- **LENS:** Nikon 14-24mm f/2.8

This image is made up of 15 exposures, 10 for the sky at 24mm, f/2.8, ISO 4000 for 10 seconds each. The sky shots were then stacked with Starry Landscape Stacker for the Mac to get lower noise. The foreground is made up of 5 exposures at 24mm. Some of the foreground exposures are f/5.6, some are f/4, some are 60 seconds, some are 120 seconds, all are ISO 3200. The foreground exposures were stacked and averaged in Photoshop to get less noise (although I should have taken more exposures) to avoid foggy exposures because I was using short exposures and wiping off the lens between each shot because I didn't have a lens heater, meaning I was limited with my shutter speeds before the lens fogged up.



# PLANNING MILKY WAY SHOTS

## FINDING THE MILKY WAY

When photographers talk about the Milky Way we usually mean the galactic center, which is the densest and widest part of the Milky Way, and thus the brightest part to our eyes and to the camera. Whether you can see the galactic center depends on your location and the time of year. The brightest part of the Milky Way is near the constellation Sagittarius and stretches up towards Cygnus. In the Northern Hemisphere, the galactic center is visible at night from mid-February to mid-November, although it's really limited even in October.

Choose a location that has interesting foreground elements that work with the Milky Way, perhaps arching over a rugged coastline or mountains, or lined up with a river or road. The Milky Way looks the same every night (not counting for airglow and light pollution) so focus more on framing that uses the Milky Way as a compositional element.



There are many phone or tablet apps available for planning Milky Way shots by showing the location of the Milky Way relative to any point on a 2D map. This is the perfect way to plan Milky Way shots at any spot on earth, if you know the terrain of the location without being there. My favorite one is [PhotoPills](#), available for both iOS and Android. [PlanIt!](#) for Photographers also offers Milky Way planning on both iOS and Android, and [The Photographer's Ephemeris](#) only offers Milky Way planning on iOS.

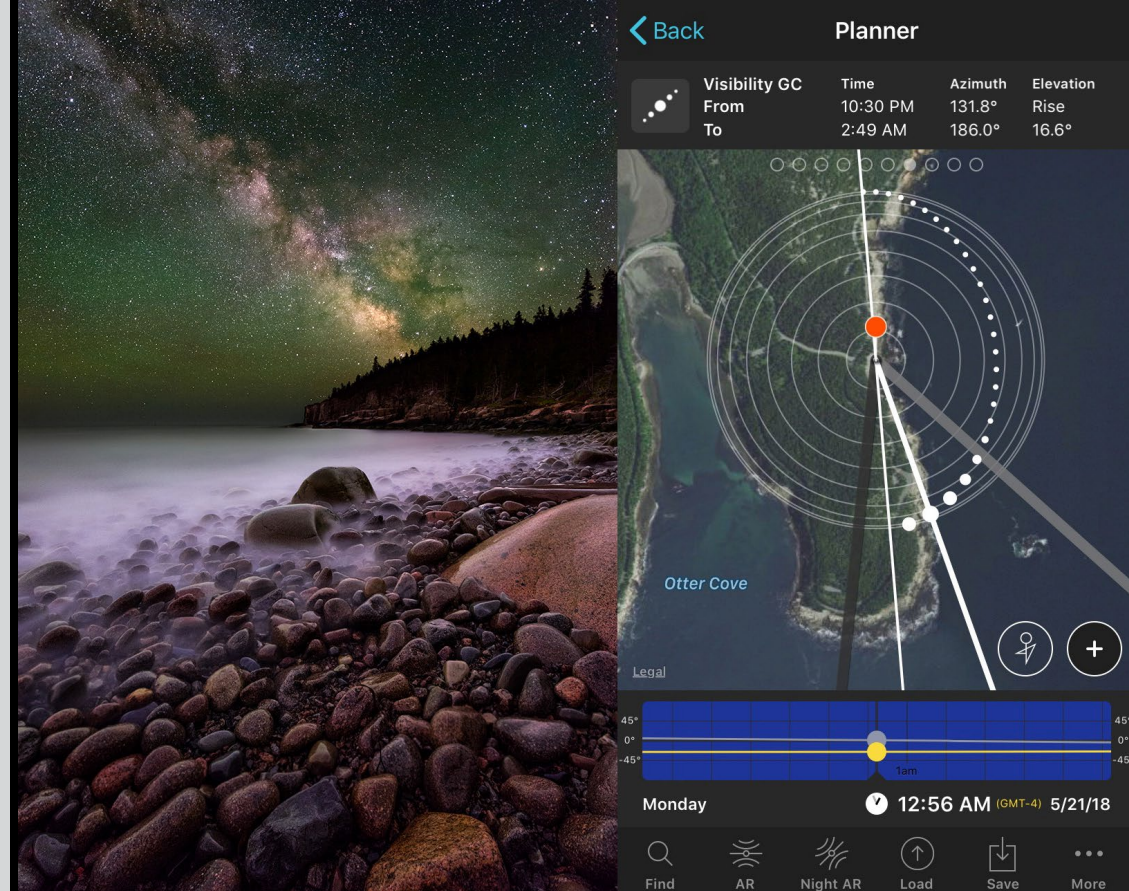
Check out the training available at the [PhotoPills website](#) for details on how to use the app.

You can also use an app like Star Walk, Planets, Star Chart, or Stellarium, to plan Milky Way shots using a map of the night sky that you can rotate around for different angles and times of the year.

## FIND A DARK SKY

A very dark sky is necessary in order to see the greatest detail in the Milky Way, so you want to be far away from the light pollution of cities and out at a time when the moon isn't going to wash out the sky. On the other hand, you can sometimes use light pollution to dramatic effect, and when the moon is low enough in the sky you can use it to light up the foreground. The same apps mentioned above will show you moon rise and set times.

You can head on over to [this site](#) to see NASA imagery of city lights at night, which can help you find dark sky areas.



# FOCUS STACKING

## FOCUS BRACKETING

BLENDING MULTIPLE EXPOSURES FOR DEPTH OF FIELD



Due to the physical limitations of current cameras and lenses (not including something NASA might be able to produce), it is physically impossible to take a single exposure where both the stars and foreground are in focus while having minimal movement in the stars, a detailed sky, and a non-noisy foreground. In order to get an exposure for the stars at 14mm on full frame you need to expose somewhere around 20 or 30 seconds at f/2.8 or better, which means that if you're composing a shot with a near foreground it won't be in focus. So in order to create an image with a well exposed and in focus sky and foreground you can take multiple exposures at different focus distances and ISOs and then blend them together in Photoshop to create the final result. This is an advanced topic and I won't cover the details of it all here, but visit my website, [www.adamwoodworth.com](http://www.adamwoodworth.com), for other tutorials on the subject.



# LIGHT PAINTING

Light painting is a way of lighting your foreground at night by using a flashlight or some other source of light. This technique takes some practice to perfect. You'll probably want to use a diffuse light source because focused bright light can create very harsh shadows. I don't light paint much myself, in fact I've done it maybe three times, but when I do I often use a lens cloth over a flashlight, or bounce the flashlight off of something behind me, in order to cast soft light on the foreground.

The biggest thing you want to avoid is what I call the "car headlight" problem. This is when light painting looks like a car was parked behind your camera, shining its headlights onto the foreground, meaning that the foreground is far too bright compared to the sky and has harsh transitions between light and dark areas that look obviously like a light had been shining on the foreground.

Sometimes light painting is the only way to get a good exposure of the foreground within a reasonable amount of time if the ambient light is so low that it would take too long to capture a good exposure of the foreground. "Too long" is subjective, but one example would be when you're at the ocean and the tide is coming in and would cover you and your camera if you didn't move, or if you're photographing flowers at night and even the slightest breeze could ruin your exposure by blurring the flowers.

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- **CAMERA:** Nikon D800E
- **LENS:** Nikon 14-24mm f/2.8 @ 14mm & f/2.8

Light painting and focus stacking were used to get the foreground field of lupines well exposed and in focus.

Sky exposure: ISO 2500, 25 sec.

Foreground: 5 separate exposures, different focus distances, each at ISO 1000 for 60 seconds. The foreground exposures were light painted with a diffuse light – an incandescent flashlight with a lens cloth covering the bulb.

# CAMERA SETTINGS

So here we are, at the section that I get the most questions about. I'm frequently asked what settings were used for an image, but it is critically important to understand that the camera settings are only part of what makes an image, and the rest of it is what you do for editing in software. Using the exact same settings I use will not give you the same results out of your camera because there is a lot of editing needed after the shot is done. The photos that come out of the camera are the starting point, the rest is crafting the image in the "digital darkroom".

## EXPOSURE DELAY

First off, you need to enable exposure delay or mirror lock-up in your camera. These settings create a delay between when the mirror is flipped up and when the shutter is opened. That delay lets the vibrations from the "mirror slap" dissipate before the exposure starts. I use a 1 to 3 second exposure delay.



## WHITE BALANCE

With RAW files the white balance is just a piece of metadata and doesn't actually affect the data in the RAW file. You can completely correct the white balance of RAW files in your RAW editor. But the white balance is important for the JPEG preview that you see on your camera's LCD. Most cameras also calculate the histogram they display based on the JPEG preview, so dialing in a white balance that comes close to what you might want your scene to look like will create a more useful histogram. I'll often use a manual white balance of 4000K, but it will depend on conditions. Perhaps there's a lot of light pollution or intense airglow, for example, which will affect the apparent color of the sky. I will always adjust the white balance as needed later in my post-processing with Lightroom and Photoshop.

## MINIMIZING STAR TAILS

You may be surprised to discover how quickly the stars appear to "move" across the sky in your photos due to the Earth's rotation. This shows up in photos as star trails, instead of looking like pinpoints the stars look like streaks in the sky. In order to minimize star trails you have to limit your exposure to where the trails are acceptably small enough to look like pinpoint stars.

You may have heard of something called the "500 Rule". The idea being that you can calculate the exposure time for minimal star trails by dividing the 35mm full frame focal length into the number 500. Thus, for a 14mm shot, you'd come up with a "500 Rule" value of 36 seconds ( $500/14 = 35.7$ ). However, I find 36 seconds at 14mm to be too long of an exposure, the star trails are far too long. Doing the math, it looks like I tend to follow a "400 Rule" or "300 Rule" (I'm often using 20 to 25 seconds at 14mm when not star stacking, see below), but you'll just need to experiment and find out what works for you. Keep in mind that when using ultra wide lenses the lens

distortion will cause the stars in the edges of the frame to have longer trails than those in the center of the frame.

If you're using a crop camera you'll need to use the 35mm equivalent of your lens' focal length. This is calculated by multiplying the focal length of your lens by the magnification factor of the camera. Nikon DX cameras are 1.5x, Canon crop cameras are 1.6x. E.g., for a 10mm crop lens on a Nikon DX camera, you'd multiply  $10 * 1.5$  to get a 15mm full frame equivalent, then you would divide that value into 400 (or 500).

To capture pinpoint stars, you can use a method known as star stacking, explained below.

## STAR STACKING

You can capture pinpoint stars with low less noise by using a method that stacks multiple short exposures of the stars together, aligning them, and averaging them. You can do this in Photoshop by masking out the foreground completely from each shot, aligning the images, combining them all into a Smart Object and using the "median" stack mode for the Smart Object. However, it's a lot easier to use an application dedicated to star stacking with landscape astro photos. If you're on a Mac, check out [Starry Landscape Stacker](#), available in the Mac App Store ([free trial here](#)). On Windows, check out the free [Sequator](#) program. I've been using this technique with Starry Landscape Stacker and the results are amazing. At 14mm on full frame, I usually take 10 exposures of 10 seconds each at ISO 6400 or higher (or lower depending on the ambient light), and after stacking those exposures the end result has much less noise in the sky. You don't need to shoot 10 exposures, you could try just 5 or so, or you could shoot more than 10, but after 20 or so the sensor pattern noise starts to become a problem, and removing that requires more work.

Note, you cannot stack a bunch of copies of the same exact photo, the

result will be no different than the single photo. Stacking only reduces noise if you have a number of separate photos.

More detail on star stacking is available in my [Star Stacking article](#).

## ISO

The ISO speed will vary with the amount of ambient light where you are shooting, but try ISO 6400 and adjust from there. Depending on conditions, I'll shoot anywhere from ISO 3200 - 12,800 for the stars, and I'll usually drop it to ISO 1600 for long exposure foreground shots (see section below on foreground shots).

## F-STOP

You'll want to use the largest aperture (lowest f-stop number) on your lens that has decently sharp stars. Some lenses will need to be stopped down a bit to reduce bad star flare, but ideally you want to shoot at f/2.8 or brighter.

## LONG EXPOSURE NOISE REDUCTION

High ISO long exposures often result in hot pixels, pixels in the exposure that are clipped to bright red, green, blue, or white. In order to limit the amount of these hot pixels you can use your camera's Long Exposure Noise Reduction (LENR) setting, if your camera has it. With this setting turned on, for each exposure that you take that is over a certain length (usually any exposure over 1 second) the camera will take another exposure at the same settings but with the shutter closed. This is called a "black frame", and the goal is that the exposure will contain most of the same hot pixels as the actual exposure, and the camera can then "fix" those hot pixels in the actual exposure before writing out the final RAW file. This does mean that your exposures will take twice as long but in my opinion it is well worth it. If you

don't do this you'll likely end up having to spend quite a bit of time cleaning up hot pixels manually in your RAW editor or Photoshop.

Note, don't confuse long exposure noise reduction with high ISO noise reduction. Long exposure noise reduction applies to RAW files in camera, but high ISO noise reduction only applies to JPEG files in camera. I suggest turning off high ISO noise reduction so your JPEG previews are more true to the RAW file, for more accurate inspection when zooming in on the JPEG preview on your LCD, otherwise your stars might be blurred by the noise reduction.

## FOCUSING IN THE DARK

As you may have experienced before, focusing in the dark is rather tricky. And if you're focus stacking you will need to change focus multiple times. So how do you do this in the dark? Ultimately the answer is that you will need to practice with your lens and examine the results. Not all lenses focus at infinity when the focus ring is set to the infinity mark. Many lenses will change their infinity point as the ambient temperature and humidity changes, and on zoom lenses the infinity mark may only be accurate for part of the zoom range.

For sharp stars you'll need to find your true infinity focus spot. I highly recommend testing your lens during the day by focusing on something very far away on the horizon. Take note of where the focus mark lands on your focus ring, is it at the infinity mark or somewhere else? You can then just remember that spot, mark it, or tape down the lens. Note that on a zoom lens the infinity spot may vary with the focal length you're using.

The above technique will get you started at least, but using Live View mode you might be able to get perfect focus on the stars, it just depends on your camera and lens as to whether you'll be able to see the stars in Live View.



Find a bright star and aim the center of your lens at it — focusing on a star in the corner may result in soft stars in the middle due to lens distortion. Zoom in on the star in Live View and turn your focus ring until the star is as sharp as possible. This takes some practice! Make sure you start with your focus ring near infinity, if you're too far out of focus the stars will blur so much you won't see them at all in live view.

If you cannot get your lens to capture sharp stars at your widest aperture setting regardless of your focus distance then you may have a lens that is just not sharp with pinpoint light sources, or the lens may need repair.

For foreground exposures you can sometimes use a flashlight and live view to help you focus. On the other hand I often rotate the focus ring to varying points on the lens for each foreground exposure because I know my lens well enough to know where I should rotate it to and how many shots I may need for the depth of field of a given scene, but it always comes down to checking my results in the LCD.

## EXPOSE!

The actual exposure settings will depend on your camera and what you're photographing. My night photos almost always consist of multiple exposures, one for the sky, and additional ones for the foreground at different focus distances and lower ISO for longer exposure durations. The additional exposures for the foreground allow me to capture the foreground with much greater detail and sharpness than using just one exposure for the sky and the foreground. All of these exposures are then blended in Photoshop to create a single image.

For my sky exposures I'm usually shooting at ISO 3200 or higher, 20 seconds for a single sky shot, or 10 seconds for star stacking (and taking up to 10 exposures), 14mm (full frame), at f/2.8.

You'll need to find out what works for your camera. If your lens is slower than f/2.8 you may have to sacrifice some noise and/or star trails by exposing at a higher ISO and/or longer shutter speed. Or if you're zoomed in more you may need to use a shorter shutter speed to limit star trails.

For the foreground exposures you'll want to stay at the same focal length (I'm normally at 14mm on full frame) but the ISO, shutter speed, and f-stop can all vary. Depending on the amount of ambient light in the area, or if I'm light painting, I may be using anywhere between ISO 400 to 1600 or even 3200, for anywhere from 60 seconds to 20 minutes. It really depends on the situation and you'll need to experiment and be knowledgeable of "exposure math" to find out what works for your camera in various situations. I often take multiple foreground exposures, sometimes as many as 8 or 9 exposures, but you can also take a single foreground exposure at a small aperture (high f-stop number) for a very long shutter speed to get a single shot that has the entire foreground in focus. Then you blend the foreground exposures with the sky exposure in Photoshop to create a single image.



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**WOODWORTH**

- **CAMERA:** Nikon D800E
- **LENS:** Nikon 14-24mm f/2.8 @ 14mm
- **SKY:** One shot at ISO 3200, f/2.8, 20 seconds
- **FOREGROUND:** One shot for the lighthouse at ISO 1600, f/5.6, 4 minutes



# EDITING BASICS

Taking pictures is only half the process of photography. The editing process is where you clean up the photos, blend them together (if you're doing focus stacking), and craft your final image. If you rush through this part and don't develop a personal style and your photos will reflect that rushing. I will not be getting into the fine details of editing in this book, but I will cover some basics to get you started.

## WORKFLOW

If you're going to be blending multiple exposures (focus stacking) in Photoshop you should make basic edits in Lightroom (or Camera Raw) first. At a minimum you should correct white balance, adjust sharpening (see below for how to not sharpen the noise), remove chromatic aberration and any other lens corrections. You may want to check "Enable Profile Corrections" to fix distortion and vignetting, but I often only fix vignetting. You may want to add vignetting back to the photo later as a creative effect, but getting rid of the lens vignetting first will allow you the greatest room for editing.

After making the basic edits, you can then export the exposures into Photoshop and blend them together to create your single image. Once blended, you can then continue editing in Photoshop to craft your final image.

## WHITE BALANCE

Chances are you'll need to adjust the white balance of your photos. You can use the white balance to make the colors look more natural, but you can also use it for creative effect to shift the mood of the photo. Remember, when you shoot RAW you can completely correct the white balance in software, you don't have to worry about the adjustment causing artifacts in your photos.



Hold down the option key (Mac) or alt key (Windows) while dragging the Masking slider to see a mask overlay on your image showing where the sharpening will be applied.

## SHARPENING

Sharpening is one of the most important steps in digital photography that is often overlooked. For night photography you can use it to sharpen up the stars a little bit and sharpen the foreground details, but the most important thing is make sure you're not sharpening the noise in the photo.

By default, Lightroom (or Camera Raw) will sharpen the entire image. You will want to adjust the Masking slider in the Sharpening section of the Detail panel so that blank parts of the sky are not being sharpened. If you don't do this, then the noise in the sky will be sharpened, which will make it more prominent. Hold down the option key (Mac) or alt key (Windows) while dragging the Masking slider to see a mask overlay on your image showing where the sharpening will be applied. The white parts of the overlay are the areas that will be sharpened. So you want the blank parts of the sky to be

black so that the noise in the sky isn't being sharpened. You can also do this while zoomed into your image to see the full detail of the mask, which will let you fine tune it.

## CLARITY & DEHAZE

The clarity slider in Lightroom (or Camera Raw) is a good tool for bringing out detail. When used on the sky exposure, positive clarity will really make the stars pop. But be careful when using it, you can easily add too much clarity and cause ugly halo artifacts, particularly around the horizon. If this happens you can just back off on the clarity, or you can only brush in clarity where you want it with a local adjustment brush or gradient. Or use global clarity and brush the clarity away from where you don't want it using negative clarity. The Dehaze slider offers fun effects as well, but you should also use it with care.

## NOISE REDUCTION

With such high ISOs needed to capture the night sky without star trails you'll probably find that your images need some noise reduction, especially if you are not using star stacking. Your RAW editor should provide some noise reduction, in fact the noise reduction in Lightroom (and Adobe Camera Raw) is quite good, but you can also use plug-ins for Photoshop or Lightroom such as Nik Dfine or Topaz Denoise. I often find myself using just the noise reduction in Lightroom and Adobe Camera Raw, and only occasionally reaching for a plug-in.



# GO SHOOT!

Now that you've learned all the basics to landscape astrophotography it's time to find a dark sky and capture the stars! Good luck and have a blast!

And don't forget to check out my [website](#) for workshops and video tutorials on editing Milky Way photos!



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## WOODWORTH

- **CAMERA :** Nikon Z 7
- **LENS:** FTZ lens adapter with Nikon 14-24mm f/2.8
- **SKY:** Star stacked blend of 20 shots taken at ISO 6400 for 10 seconds to capture pinpoint stars, which were then stacked with Starry Landscape Stacker for low noise.
- **FOREGROUND:** Focus stack of two exposures, both at ISO 1600 for 10 minutes, with one focused for the stars (horizon) and one focused on the foreground grass.

