



D a v e M o r r o w

# Photograph The Night Sky

Your Definitive Guide to Photograph

The Milky Way • Star Trails • The Stars

The Northern Lights • The Moon & Night Sky



# Foreword

This is a book about photography. This is also a book about the night sky. But, most of all, this is a book about breaking down the barriers between what we dream of creating and where we currently stand.

Each time we learn something new we grow a bit closer to our goal, that vision, that dream inside our heads of the art we want to produce.

As artists we must master the tools which we use to create. Without mastery, our tools become our enemies standing between us, and the art we've envisioned in our mind.

With knowledge, practice, and perseverance these enemies start to fall away and our true creativity begins to shine through.

Along the way we will come across other enemies and more resistance, with the greatest being our own self doubt. Doubt, we all have it, but few disregard it and push forward, further down the path, closer to the dream.

Relentless creativity, learning, and hard work only leave small cracks for that doubt to push through.

Destroy the Doubt. Let's Learn. Let's Create.

A handwritten signature in dark blue ink, appearing to read 'Dan', with a long, sweeping horizontal line extending to the right.

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# Introduction

*“There was nowhere to go but everywhere, so just keep on rolling under the stars.”*

*Jack Kerouac, On the Road*

Milky Way, night sky, and star photography can appear quite intimidating at first. Just as any complex task, learning each skill set in a step by step manner cuts down on the confusion and provides an overall effective learning experience.

This book has been designed and written allowing you to efficiently move through each chapter, while mastering all of the skill sets along the way. The best and most effective way to learn, with the least amount of confusion, is to start at the top and work your way to the bottom.

It's best practice to read through this entire book prior to going out and trying these skills in the field for the first time. After your first read, take the book with you when you go out shooting. It will prove to be great reference material.

There are hyperlinks to useful information placed throughout the book. While some of the noted hyperlinks will direct you to different chapters within the book, others are linked to informative web pages and video tutorials which I have created specifically for this book.

All photos contained within are hyperlinked to the full size versions online. Unless otherwise noted, they were all captured using my Nikon D800 & Nikkor 14-24mm f/2.8 lens at 14mm focal length. Feel free to click the photos to see the best color, detail, and resolution.

Since the topics covered below are very specific to teaching night photography, and are not catered towards basic photography skill sets, the hyperlinks within this book allow you to expand your basic photography knowledge as required.

Prior to applying these skills or going out to take some night photos for the first time, it's imperative to remember that no one gets great results the first time performing any complicated task. Mastering night photography is no different. After one or two nights under the stars, you will find yourself learning at a much quicker pace.

Good luck, have fun & enjoy your journey under the stars!



The Milky Way & The Open Road – f/2.8, ISO4000, 30 Seconds



# Scouting & Planning

*“The joy of life comes from our encounters with new experiences, and hence there is no greater joy than to have an endlessly changing horizon, for each day to have a new and different sun.”*

[Christopher McCandless, Into the Wild](#)

Scouting and planning are just as important as any other aspect of photography. Why even go to a location if you don't know what the ever-changing situation is around you? You can improve your chances for great photography opportunities by learning to scout, read the weather, and know how the earth, stars, and celestial bodies move with respect to each other and our planet.

After reviewing the following tools, it will be pertinent to read the [In Depth Planning & Logistics](#) section below which will show you how to effectively put them to use.

## Applications, Websites, and Computer Programs

The following are mobile phone, tablet, and computer applications and resources which I have tested and found to work well for Milky Way, Star Trail and Night Photography. Some are to be used for planning prior to your shoot and others can be used while out shooting.

## Google Earth

[Google Earth](#) - Learn to use this. It will change your life! You can watch the Sun, Moon, and Milky Way, set and rise from any location on the planet, seeing the exact location you will be shooting using the Real Time feature. Google Earth will also allow you to see perspectives and views from certain elevations and locations. This is a huge time saver when planning trips.

## Photo Pills for iPhone

[PhotoPills for iPhone](#) is the best photography planning application on the planet in my opinion. They have a real time Milky Way Planner provided. I highly suggest this app. Please be aware, there is a learning curve associated with this application. It is worth reading the directions and learning everything you can about this powerful tool.

## Google Maps - My Places

[Google Maps - My Places](#) - If you have a Google Account you can save a bunch of locations that you would like to visit in My Places. When going on photography trips, you only want to be thinking about one thing... PHOTOGRAPHY! Get the planning done before you go.

I personally have 'TO DO' Maps which contain locations to visit in the future and regular planning maps for current and past trips. There is no limit to the number of locations which you can save. There is also an option to save information about each mapped location.

## The Photographer's Ephemeris

This is one of the best all around photography planning applications. I use it any time I'm planning a big trip or weekend adventure. Great for sunrise, sunset, Moonrise, Moonset, twilight, and blue hour calculations.

[Download for iPhone & iPad](#)

[Download for Android](#)

[Website](#)

## Star Walk - Night Sky & Milky Way Planner

This application allows you to see where the Milky Way, stars, planets, or any other celestial body will appear in the sky at a certain time and date. You can also use it in real time when you're out shooting. Just hold your device up to the night sky and the application will label all of the stars and planets for you! This is great for learning and scouting.

[Download for iPhone & iPad](#)

[Download for Android](#)



## N.O.A.A

[NOAA](#) has it all as far as weather data goes. I really like their Weather Charts which show Cloud Cover Percentages. This is an example of the [Chart for Forks, WA](#). Even if there are clouds in your area, if there aren't clouds in areas West of you for sunset or East of you for sunrise, you might still get some great light. Also, keep in mind the weather man is just giving educated guesses!

NOAA's [Tide Predictions](#) also prove to be very useful. I use these for hiking and for predicting tides prior to going out for a shoot.

For more about NOAA check out the EXPLORE NOAA Section on their [Site Map Page](#).

We will review these tools in depth below!

[Download for Android](#)

## GOES Weather Satellite

Using the [GOES Weather Satellite](#) you can watch cloud cover. Infrared Satellite reads the temperature of the clouds instead of visually “seeing” the actual cloud cover, allowing it to be highly effective in the dark. Cooler temperature clouds are higher up in the atmosphere while warmer clouds are closer to the ground.

It's also very helpful to watch cold and warm fronts. Cold Fronts circulate counter-clockwise while Warm Fronts circulate clockwise. Where Cold and Warm fronts meet, you have a great chance of seeing turbulent and stormy conditions. This usually yields great photos and nice light if timed correctly.

## Clear Dark Sky Website

[Clear Dark Sky](#) is a really informative website for finding clear and dark skies anywhere in the country. You can start on their [Chart List Page](#) to find a dark sky map for your area.

## Blue Marble Navigator Light Pollution Map

### [Website](#)

When you're looking for a dark area to capture the night sky this Google & NASA collaboration has you covered. Just head on over to their website and look for areas of the map that are completely black. These are areas where you will be able to find dark skies!

## Stellarium - Night Sky Planning Program

### [Website](#)

They save the best for last, right? Well this is the best free, night sky planning program out there. It will take you an hour or so to read the directions and learn how to fully integrate this program into your planning workflow. After the initial learning curve you'll find out why I love this program so much!

# Scouting for Night Photography

Scouting is all about dreaming big and finding new locations which will be exciting to explore, and beautiful to photograph. The world is your playground; pick a location and go for it!

In the following section I'm going to show you my favorite tools for scouting new locations and how to quickly implement them into your own photography planning workflow.

## Step 1: Online Research

I'm constantly exploring online for new places to explore, hike, camp, and take photographs. My favorite tool for doing this is [Google Earth](#).

Using Google Earth, you can place yourself into any landscape on this planet and see what the topography looks like around you.

It's also possible to turn on geotagged pictures which others have taken. These pictures will show up on the Google Earth overlay, allowing you to see what the surrounding landscapes look like.

I don't necessarily look at these pictures to see great landscape photos, but to get an idea of the geography of the location and what possibilities exist off the beaten path. Are there trees, or great views, steep cliffs, or easily accessible vistas? Using these photos you can piece together some knowledge that you wouldn't have had otherwise.

Prior to arriving at a new location, any extra information is better than nothing at all. Time after time, I've been able to find and research locations I didn't know existed by spending a few hours exploring Google Earth.





Graphic 1: Screen Shot, Google Earth – Perspective View



Graphic 2: Screen Shot, Google Earth – Close Up View



**Graphic 3: Screen Shot, Google Earth – Dynamic View**

Using Google Earth, you can explore any location. First, viewing the landscape from a far and deciding if it looks like a place of interest for your shoot. This broad perspective view can be seen in **Graphic 1: Screen Shot, Google Earth – Perspective View**

Next, you can zoom in even further to get an idea of what it would look like if you were actually standing there with your camera in hand, ready to shoot. This close up view can be seen in **Graphic 2: Screen Shot, Google Earth – Close Up View**

One of the coolest features of Google Earth allows you to see the scene change over time on any given date. You can see the sun set, the Moon rise & the Milky Way and stars move through the sky.

Although not perfect, the lighting situations seen in **Graphic 3: Screen Shot, Google Earth – Dynamic View** can provide great information of what your location may actually look like during any time of day.

The views seen in Graphic 1, 2, and 3 come from Mount Rainier in Washington State. In the next chapter, we will go into even more detail on how to plan for a shoot from this exact location!

## Step 2: Fine Tuning Your Search

Now that you've found your location it's time to quickly bring yourself up to date with any knowledge and information you'll need to obtain for this specific area, prior to exploring in real life.

Websites such as [Flickr](#) & [Panoramio](#) provide map features allowing you to explore even more. I prefer Panoramio since it provides topographic Google Maps with a photo overlay.

Hiking and backpacking forums are also a great place to find information on places you may want to explore. Digging through these forums often takes time, but produces some great results.

Being an avid fan of exploring the backcountry and wilderness areas, I prefer to use topographical maps along with the tools provided above.

The best maps I've found while traveling in the United States are [National Geographic's Trails Illustrated Maps](#) which cover most National Parks, National Forests, and wilderness areas in the US.

When traveling out of the United States, you will have to research online and find out who provides the best maps of which areas. There are usually many options.

Using topographical maps you will be able to determine if there is access to your area of interest and how much effort it will take to visit this certain area. When in mountainous regions it's also possible to see where the sun will come through the mountains and valleys, allowing you to plan in depth for a shoot at one of these locations.



Using the [Photographer's Ephemeris](#), a compass, and a topographical map, you can plan for any situation that may arise.

Photos can give you a good idea of how big mountains are or how wide rivers are; but, the only way to really find out about and gage the area is topographic maps.

Not only are these maps great for preparing, but you should also always have a map with you when hiking as part of the [10 Essentials](#).

Maps can lead you to find places which you didn't know existed or never thought of visiting. After finding a location, always sit down, take some time, and review your map. Really get to know your area of interest.

### Step 3: Scouting on Location

Technically, this skill set will take place after you perform all of the tasks in the In Depth Planning & Logistics section below, but for clarity, I've provided it as part of this section.

Once I've scouted extensively for a trip, arrived on location, and set up my camp, or found sleeping arrangements for the night, my next step is to go out for the real scouting mission.

There isn't a substitute for going out to explore your surroundings, hours or even days, prior to your shoot. To get the best shots you'll always want to know the location and compositions which you'll be shooting prior to arriving at night.

There are times when I "gun it" and don't have the time to visit a location before coming back to photograph it at night, but this is rare.

Take your camera out, without the tripod and walk around your area of interest picking out key shots and locations for your actual shoot later on in the night. You should be walking around with the lens which you'll be shooting with later that night. This allows you to get some great ideas for compositions.

This topic and skill set is covered in more detail in the Artistic Flow Chapter of this book.

## Dave's Favorite Scouting Tools

These are some of my favorite free tools which I use for scouting locations. Over the years I've found the ones I really liked and thrown out the rest. These are my favorites in no specific order. Some of them may apply to you, some may not. Click on any of the links to check them out:

- [Google Maps Dual View](#)
- [Google Earth](#)
- [Free USGS Topographical Maps for the United States](#)
- [Libre Map Project Topo Maps](#)
- [Hill Map.com](#)
- [Summit Post Forum](#)
- [Northwest Avalanche Center](#)
- [Cliff Mass Weather Blog](#)
- [Northwest Hikers Forum](#)
- [Panoramio](#)
- [Flickr World Map](#)

## In Depth Planning & Logistics

Using the [Star Photography Applications, Website & Computer Programs](#) provided above, you can efficiently plan for your next photo shoot under the stars. Let's look in depth at some of the best techniques used to prepare for your shoot. Prior to each shoot follow the next steps to ensure a successful night under the stars.

I also provide a [free video tutorial](#) at the bottom of this section covering these topics for those of you reading with an internet connection.

### Cold Weather Considerations

When shooting in cold weather there are a few simple tricks which will make your trip a success. Provided below are 3 problems which can constantly arise, and answers solving them:

- 1. Battery Life** – When shooting in cold ( approx. 0 C / 32 F and below ) conditions your camera batteries will have a much shorter life, even if fully charged. To solve this problem, take 5-7 batteries out with you for a night of shooting. Keep one battery in your camera and the remaining in an easy to access pocket very close to your body. Keeping your batteries near your body allows them to stay warm and hold a charge longer. When your first battery dies, swap it out with one in your pocket and keep shooting. When the battery that just died warms back up it will still have some charge left. You can use it once or twice more later in the night.
- 2. Condensation** – Condensation on the outside of your lens isn't a big deal. Just wipe it off with a cloth or lens rag. The issues arise when condensation forms on the inside of your lens element. You can't do anything about this, but there are ways to prevent it from happening. This problem usually occurs when your

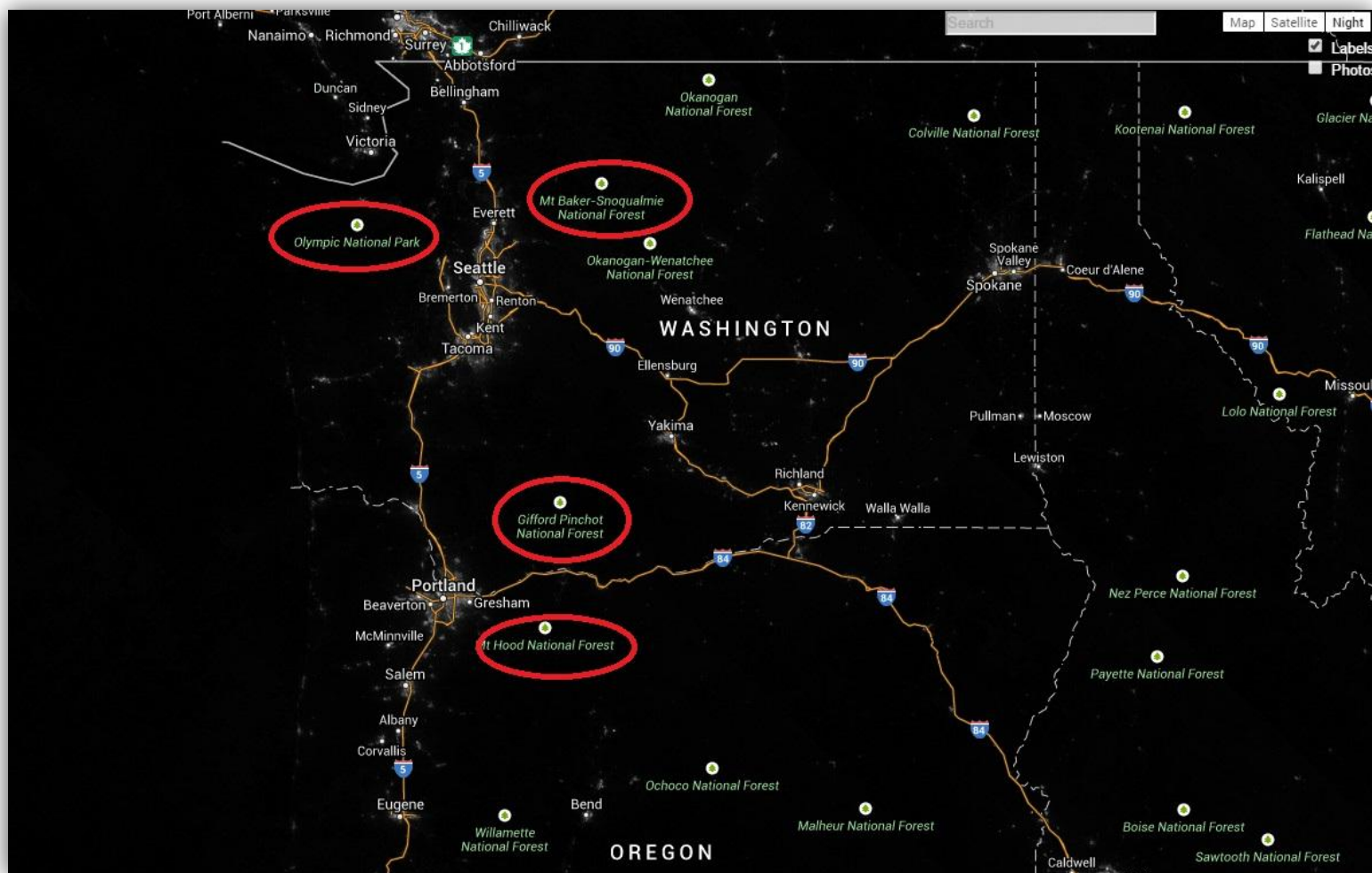


lens is in a warm vehicle or building and then taken outside to shoot in very cold temperatures. By keeping your camera and lenses in the back of the vehicle and as close to the outside temperature as possible, you can cut down on the chances of this happening. If you have a secure roof storage area, this is an even better option for your camera and lens. Just make sure to keep your batteries warm inside the vehicle. If it's damp and cold, then, it never hurts to keep your camera and lens inside a waterproof bag or container with all air removed. Large waterproof camping and boating bags work great for this! The main goal is to keep your camera gear, less the batteries, as close to the outside temperature and as dry as possible.

- 3. Frost or Frozen Condensation on Outside of Lens** – I've seen photographers use hand warmers to keep their lens warm during a night of shooting. I don't prefer this due to the fact that it provides an even greater temperature differential between the inside of the lens and outside air. Since we're all experts at thermodynamics, we know that with temperature differential comes a great chance that condensation will form on the inside of the lens, given that air pressure stays constant. That being said, just wipe the frost off your lens with a dry rag or lens cloth. Using a ridged edge of a glove also works well for reaching hard to remove areas of ice or frost. I haven't had any lenses become scratched from doing this. Try at your own discretion.

## Finding Dark Skies – Avoiding Light Pollution

Without a completely dark location it will be very hard to effectively capture nice shots of the night sky. The darkest locations are far from large cities and provide little, or no, light pollution from houses, buildings, street lights, and vehicles.



### Example 1: Screen Shot, Blue Marble Navigator – Dark Sky Finder 2014 Edition

The first thing you will need to do is find a very dark location, with little to no light pollution. Blue Marble Navigator's Dark Skies Map which is a Google & NASA collaboration is quite useful.

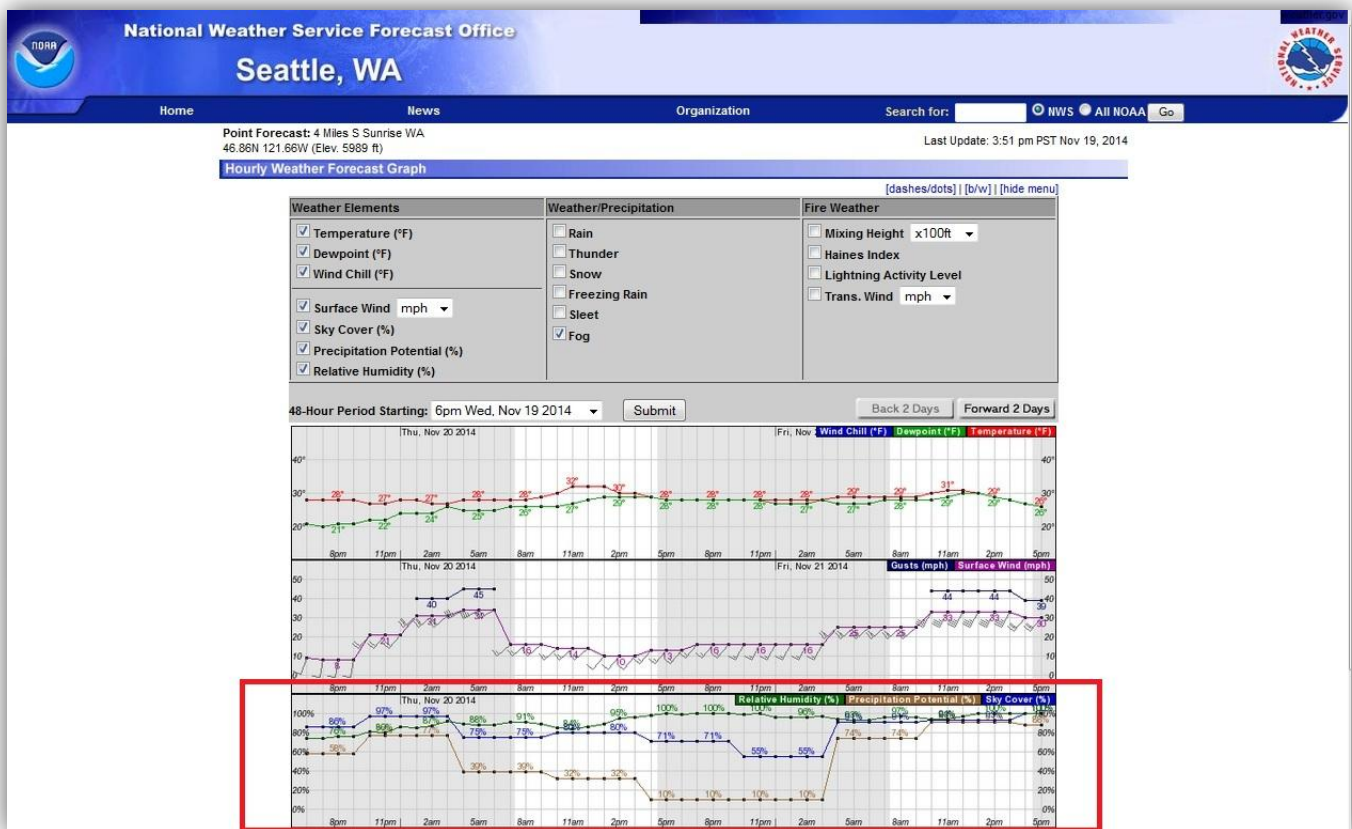
The new Blue Marble Maps ( 2013 & 2014 ) are only provided in black and white. White areas are light polluted, while black areas have little or no light pollution. You want to aim for the black areas on the map. This will provide the best locations for capturing photos of the night sky.

[Click Here & Access the 2014 Blue Marble Light Map](#)

Reference [Example 1: Screen Shot, Blue Marble Navigator – Dark Sky Finder](#) where the darkest areas have been circled in **RED**. These are ideal locations to shoot. Feel free to click the image and view it full size online.

Another great resource is [Dark Sky Finder](#). It provides some great sites to find dark skies, but doesn't cover the extensive area that Blue Marble does.

I prefer Blue Marble Dark Skies Finder since it provides data in a broad worldwide view.



## Finding Clear Skies

Without clear skies it will be impossible to get a clean view of the Milky Way, stars, or Northern Lights.

This doesn't mean there can't be a few clouds. Sometimes clouds here and there add to the "interestingness" of the photo, but complete cloud cover won't allow you to see the night sky.

The [Clear Dark Sky](#) website provides some really nice information on this topic, but doesn't cover all of the areas which you could possibly shoot. For this reason, I always find it best to use NOAA while shooting in the United States.

[NOAA \(National Oceanic & Atmospheric Administration\)](#) provides in depth weather forecasting data for all of the United States as shown in **Example 2: Screen Shot, NOAA Website – Sky Cover Charts.**

Here is a great way to go about finding cloud cover percentages using NOAA. I also show you how to do this in the [Scouting & Planning Video Tutorial](#):

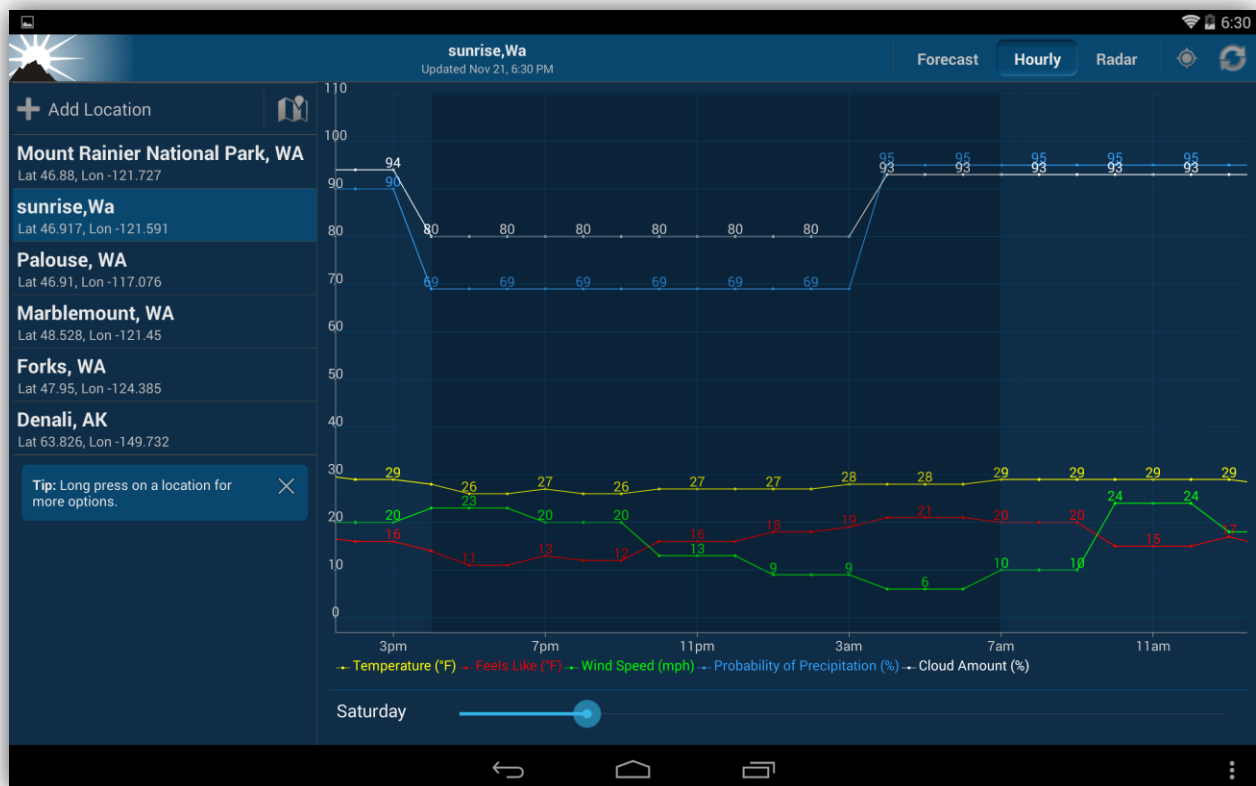
1. Visit <http://www.noaa.gov/>
2. Type in a city and state near where you would like to shoot. It just has to be close. We can re-adjust in the next step!
3. Once you search for your city and state, a new page will come up.
4. Using the map on the new page, zoom out as required, then, click the exact location where you would like to see the weather forecast. [Click Here](#) to see where I've done this for Mount Rainier, Washington.
5. Now, scroll down the same page until you see the Hourly Weather Graph on the right hand side. Click the Hourly Weather Graph graphic.
6. Now you can decide the date, time, weather, and precipitation elements which you would like to view. Use the checkboxes to turn them on and off.

7. Using the Sky Cover Percentage ( % ) you will be able to predict how many clouds will be present at any specific time! Ideally aim for 0-20% cloud cover. 21-60% is also acceptable. Shooting with 80-90% cloud cover is possible, but will not yield many great shots.

In **Example 2: Screen Shot, NOAA Website – Sky Cover Charts** the cloud cover percentages have been boxed in **RED**.

It's always good to check a 48 hour time frame so you can get an idea of the best times to shoot!

Another great way to use NOAA is via the [NOAA Android Application](#) which can be seen in graphic, **Example 3: Screen Shot – NOAA Weather App for Android**. I find the app to be much more user friendly without quite as much detailed information.



**Example 3: Screen Shot – NOAA Weather App for Android**



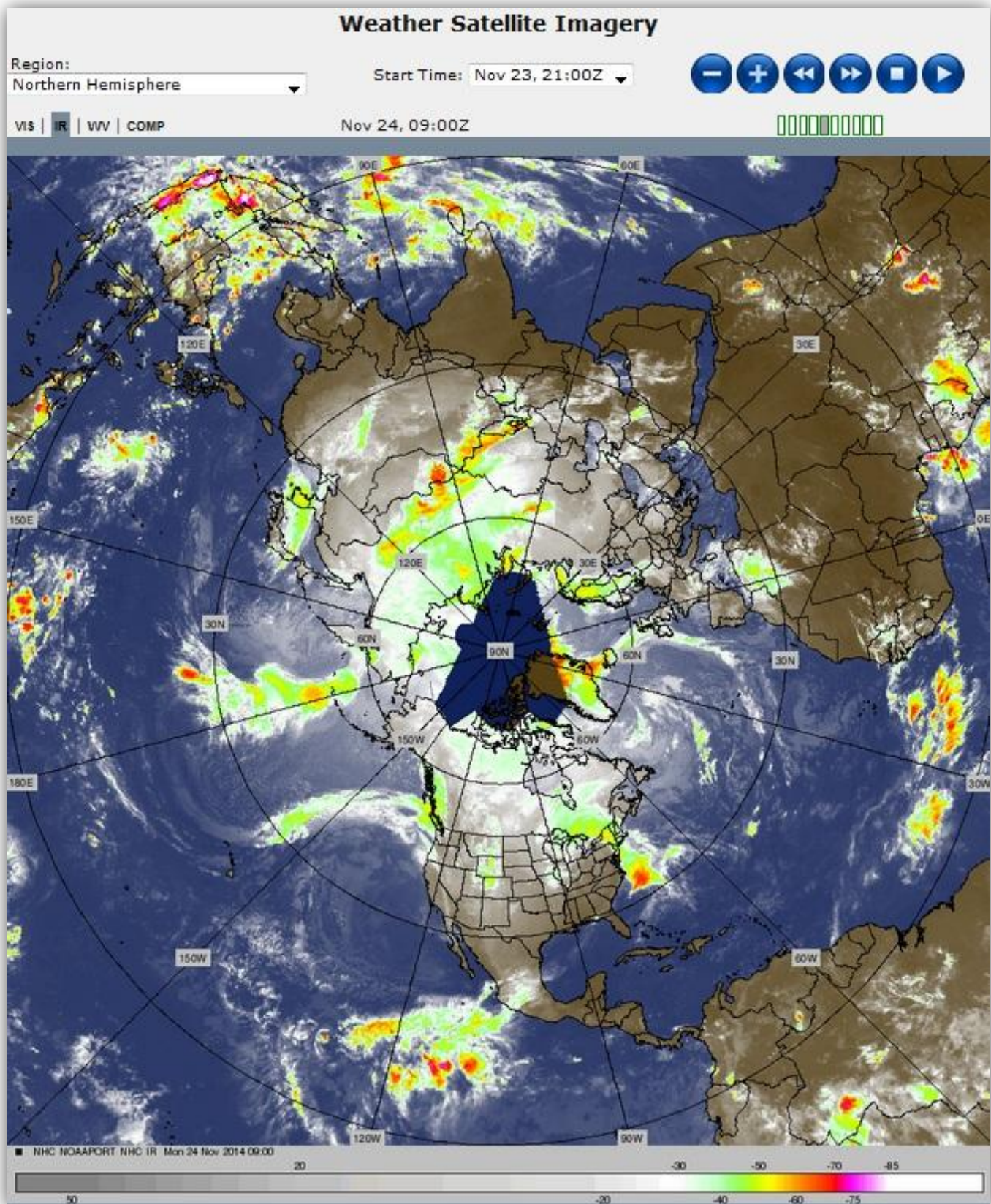
[MeteoStar Weather Satellite Imagery Maps](#) is a really handy weather program for seeing cloud cover on a global scale. You will need to use the IR ( Infrared ) setting on their website to view the cloud cover at night.

Reference the **Example 4: Screen Shot, MeteoStar Weather** Satellite Imagery Maps screen shot for a quick overview.

Unlike visual ( VIS ) satellite images which can only be used to view cloud cover during the daylight hours, IR satellite uses cloud temperature readings to determine cloud movement and cover.

If you're not well versed in IR satellite imagery, the [How to Read a Satellite Image Post](#) will be very helpful! If you want to take your photography planning to the next level, learning this information is really going to help! It's also quite interesting.

[NOAA's Geostationary Satellite Server](#) also provides some great resources.



Example 4: Screen Shot, [MeteoStar Weather Satellite Imagery Maps](#)

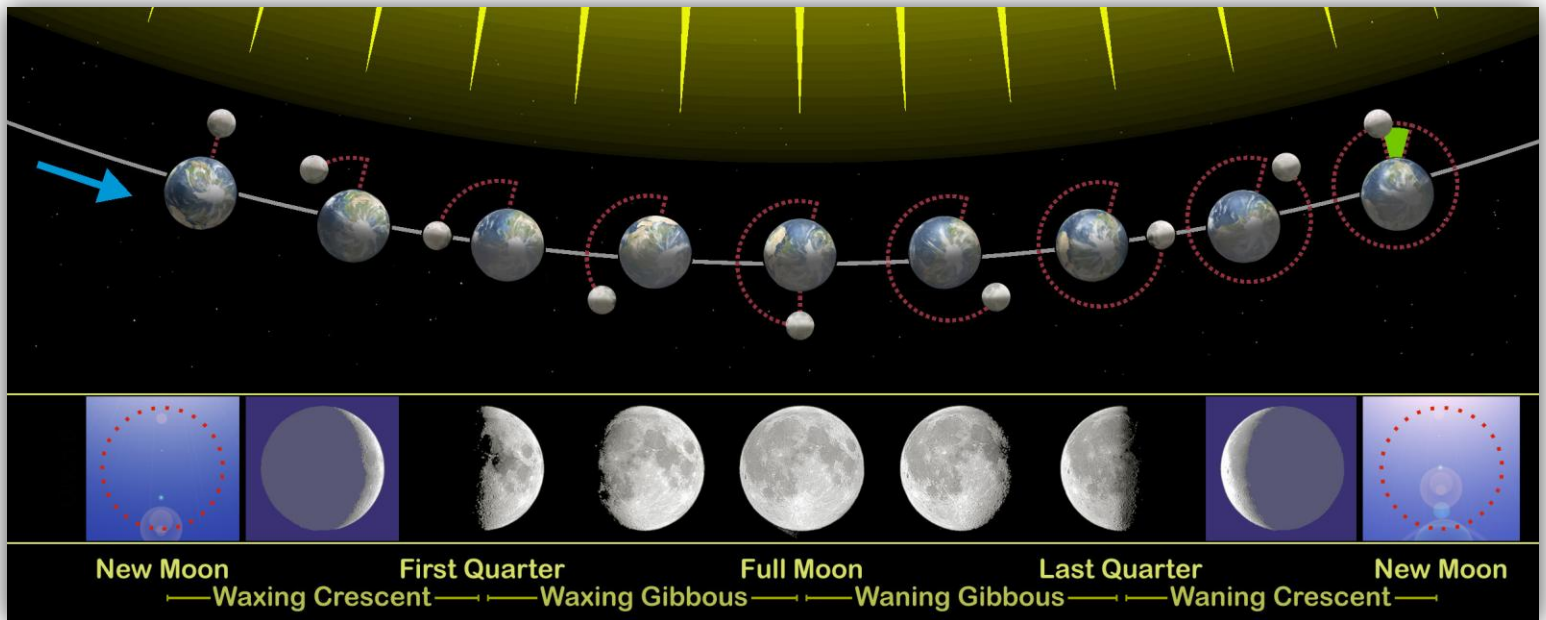
## Celestial Dynamics

*“I would rather be ashes than dust! I would rather be a superb meteor, every atom of me in magnificent glow, than a sleepy and permanent planet.”*

*Jack London*

Celestial dynamics may sound complicated, but trust me, it’s not that bad! Celestial means relating to the sky, and dynamic means to move. Celestial dynamics, therefore, means how bodies or objects move through the sky.

After finding a dark location with little or no clouds per the previous steps, it’s time to find the ideal night for capturing some shots of the Milky Way, stars, and night sky.



Example 5: Moon Phase - [Graphic Credit: Orion 8, Wikipedia](#)



All Times Below are Provided in [24 hour format](#)

*Please reference the **Example 5: Moon Phase - Graphic Credit: Orion 8, Wikipedia***

*Graphic while reading the following content*

Our Moon rotates around our Sun approximately once every 27.3 days. This means we will see approximately the same views of the Moon once each 27.3 days.

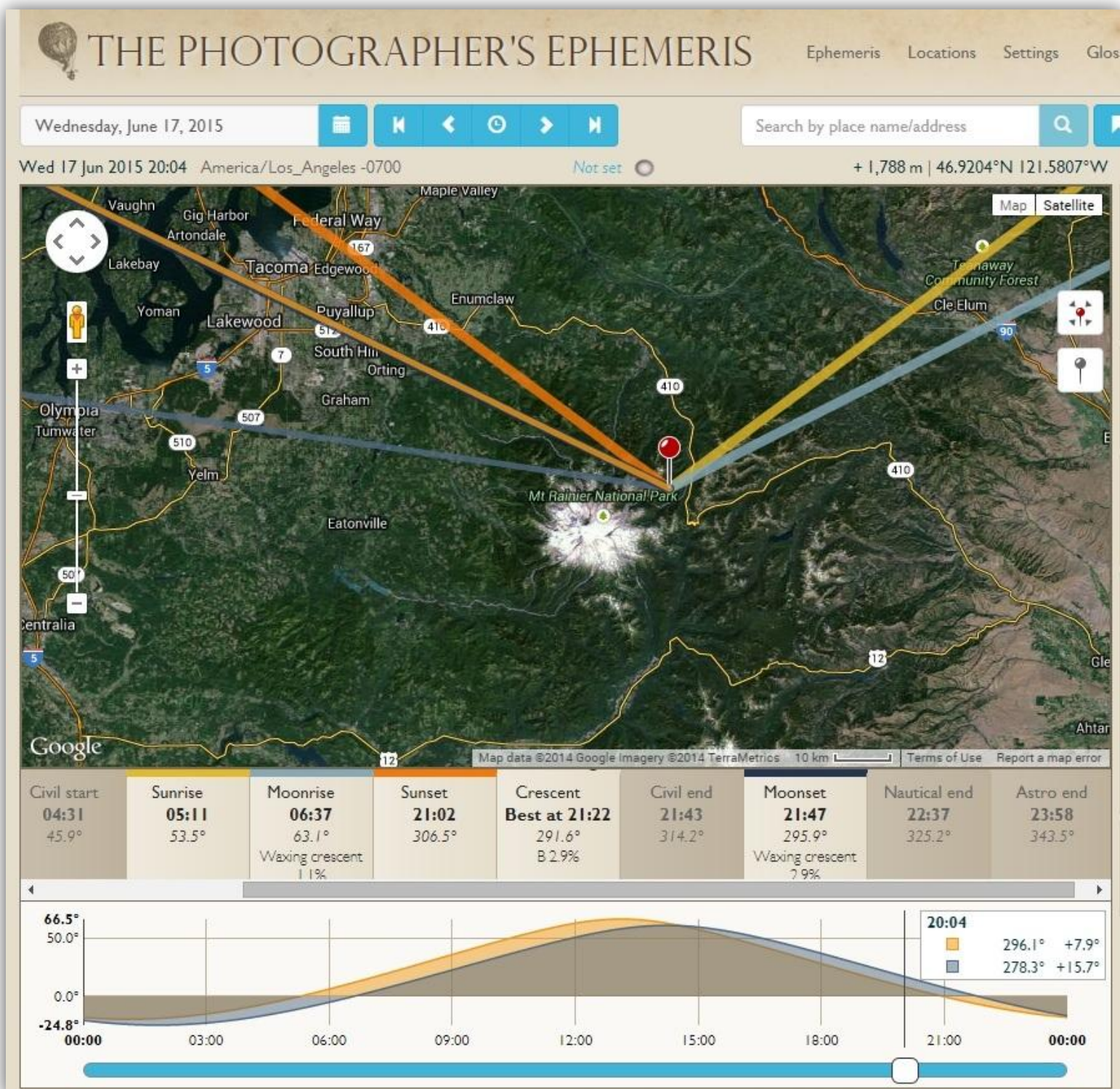
During the New Moon, when the Moon lies directly between planet Earth and the Sun, is the best time to photograph the Milky Way.

Due to the New Moon's location between us and the Sun, there is no light cast on the side of the moon which we can see from Earth. In turn the Earth will receive no Moon light on these nights for a short period of time.

That being said, the night of the New Moon will provide the longest and darkest hours to photograph the Milky Way. There are also 5-6 nights on either side of the night of the New Moon which will also work great for photographing the Milky Way.

During these nights there will be no Moon visible in the sky for a minimum of 1-2 hours a night and a maximum of approximately 10 hours a night. These 10-12 days fall directly before, directly after, and include the night of the New Moon.

Star trail and Northern Lights photography on the other hand are much more forgiving. You can capture star trails or Northern Lights photos with, or without, the Moon visible in the sky. Both situations will yield different and unique results.



Example 6: Screen Shot – The Photographer's Ephemeris



To ensure darkest skies, it's always best to shoot a minimum of 1-2 hours before the rise or after the set of a large celestial body ( Sun & Moon ).

For example, one should wait 2 hours after the sun sets for complete darkness. For the moon, since it isn't as bright as the sun, the time would be shorter.

Usually an hour after the moon sets works just fine. These same rules also apply to sun and moon rise.

During the summer months the nights are shorter, which leaves less room for error when planning your shoot.

During the winter months, the nights are longer, making it much easier to select nights to shoot. To get a better understanding for this concept, the [Mechanism of Seasons Video you Youtube](#) does a great job of explaining.

Use [Star Date to check the Moon Phase](#) for any given month of the year. This can also be found by experimenting with the [Photographer's Ephemeris](#).

## Let's Take a Look...

The easiest way to obtain the conditions noted above is checking [The Photographer's Ephemeris](#). I'll show you my favorite ways to go about using this free program below.

Referencing the **Example 6: Screen Shot – The Photographer's Ephemeris** I was able to find a suitable Milky Way photography night at Mount Rainier National Park for Wednesday, June 17<sup>th</sup>, 2015.

To ensure maximum length of darkness, I selected a night where the Moon set early in the night, preferably right before or right after sunset. In the **Example 6: Screen Shot – The Photographer's Ephemeris** graphic moonset is at 21:47 and sunset is at 21:02.

It was also crucial to ensure that the moon did not rise too early in the morning. The moonrise on this particular morning ( now June 18<sup>th</sup> ) is 07:36 leaving plenty of time to shoot.

As noted before, to ensure darkest skies, it's always best to shoot a minimum of 1-2 hours before the rise or after the set of a large celestial body ( Sun & Moon ). If the sun sets at 21:02, and the moon rises at 02:00 the next morning, this would not give much time to shoot in pure darkness.

With the current conditions as denoted on the **Example 6: Screen Shot – The Photographer's Ephemeris**, the sky will be very dark by 23:58. This is known as the end of Astronomical Twilight. Astronomical Twilight is when the sun lies 12-18 degrees below the horizon and is the last time you can actually “see” any remains of sunlight in the sky.

You can still get some great shots during Civil & Nautical Twilight, but the skies won't be as dark, this means you won't see as many stars.

During Civil Twilight the sun lies 0 – 6 degrees below the horizon, and during Nautical Twilight the Sun lies 6-12 degrees below the horizon.

The twilight conditions noted above happen twice each day; before sunrise and after sunset.

In very Northern and Southern latitudes, the sun doesn't always set or rise. When traveling to these extreme latitudes it's especially important to plan for your trips!

Visit the [Twilight Photography Chapter](#) of the book for more photos and tips.

More information on [Twilight Phases can be found on the Photographer's Ephemeris Website](#).

## Locating the Milky Way & Other Celestial Bodies

Before moving on, another tip. If you show up at a location and can't see the Milky Way with your naked eye, you won't be able to take detailed photographs of it either.

Locations where the Milky Way can be easily seen with the naked eye are going to yield fantastic photos!

The only guaranteed way to ensure you will get shots of the Milky Way, stars, or other celestial bodies, is in depth planning. After planning for a few shoots, you will become familiar with where the Milky Way is located during each month of the year and easily be able to locate it without extensive planning.

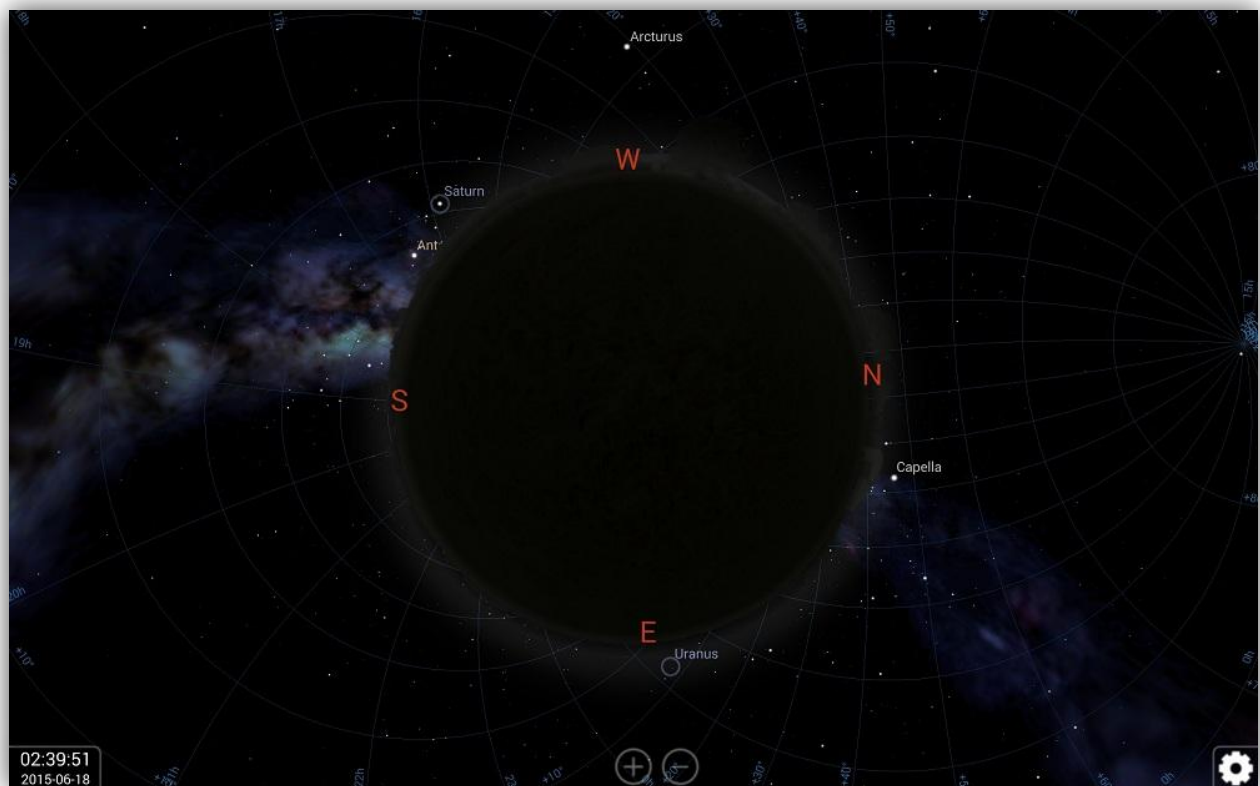
I highly recommend starting out with extensive planning. Not only will it help you to get great shots, it will also help you to learn and predict the dynamic night sky.

One of my favorite free programs that will help you to plan is [Stellarium](#). After an hour or two of experimenting with this program you will be able to easily implement it into your own planning workflow.

Let's Take a Look...



Example 7: Screen Shot, Stellarium – 90 Degree + Field of View



Example 8: Screen Shot, Stellarium – 360 Degree Field of View

Let's continue to look at the same night and location as above using Stellarium. It's nearing 03:00 in the morning on June 18<sup>th</sup> and the Milky Way is bright in the sky. Using Stellarium it's possible to predict which direction it will show up in the night sky.

Using different fields of view gives me an idea of where the Milky Way will be when showing up at any given location. Referencing **Example 7: Screen Shot, Stellarium – 90 Degree + Field of View** you can see a the Milky Way and foreground with a fairly wide field of view.

This field of view is great for seeing how the Milky Way will be seen during certain times throughout the night and how it will move across the sky over a given period of time. Reference the [videos below](#) for a more in depth look.

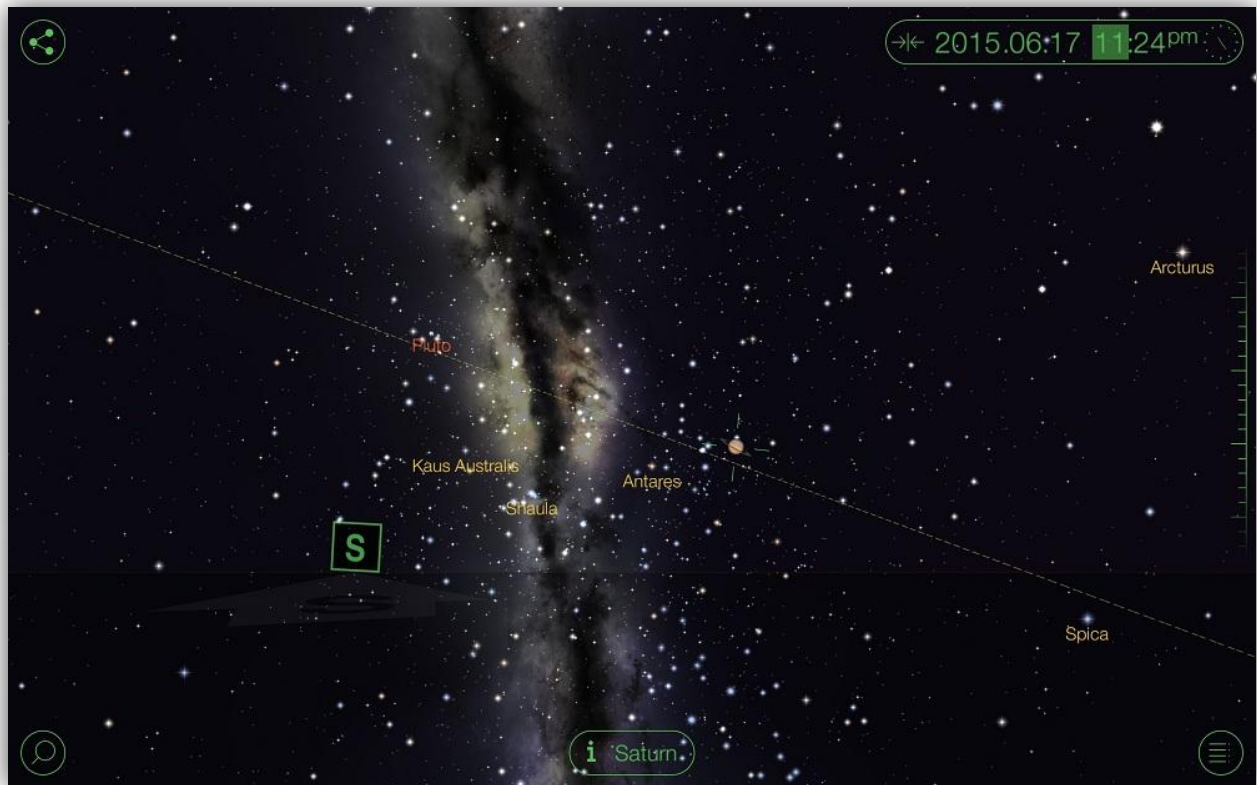
The **Example 8: Screen Shot, Stellarium – 360 Degree Field of View** allows us to see in all directions at the same time. This is great for planning panoramic photos of the Milky Way or seeing how the planet Earth moves as a whole; with respect to the Milky Way, sky, and stars.

[Star Walk](#) is another great and intuitive program that allows you to plan for your shoot. Using Star Walk on your tablet, or mobile device, it is easy to see what the night sky will look like at a given time and place.

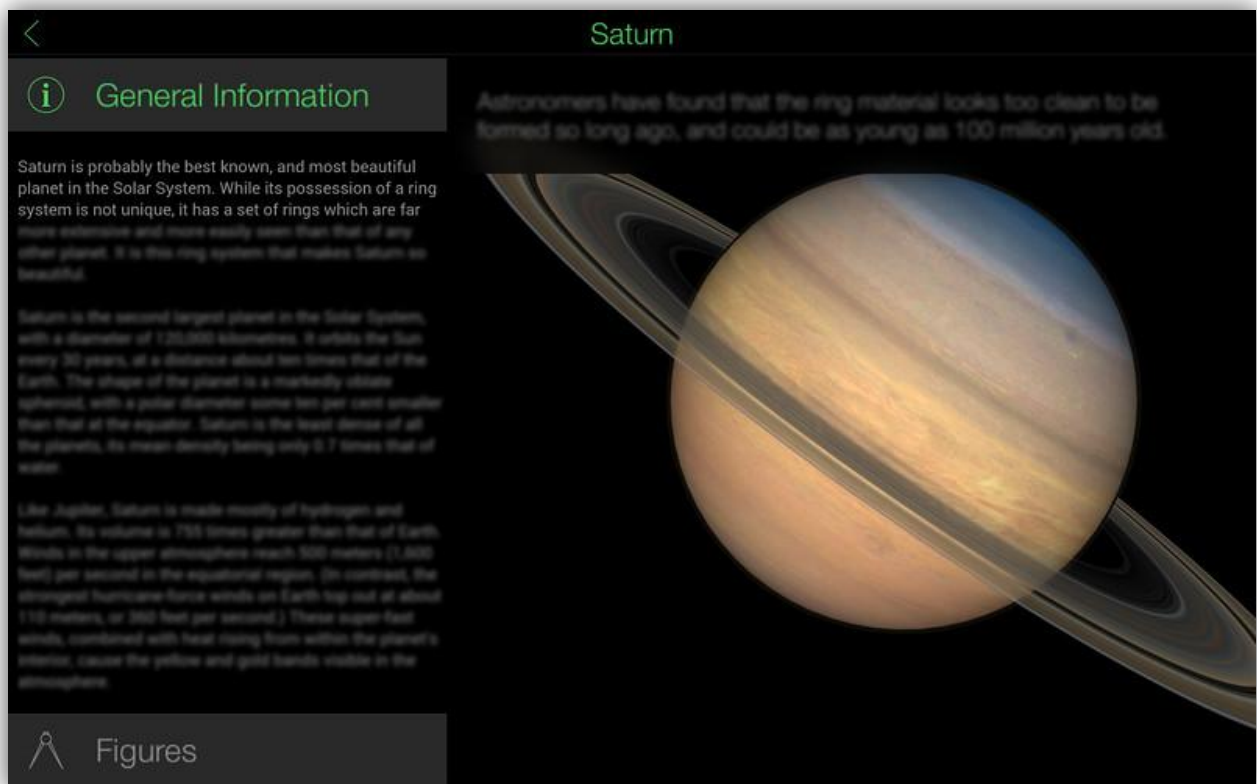
It's also possible to turn the visible horizon on and off in Star Walk, as seen in **Example 9: Screen Shot, Star Walk – Milky Way, No Horizon Shown**. This feature is also available in Stellarium. You can click on major celestial bodies allowing you to view in depth information as seen in **Example 10: Screen Shot, Star Walk – Detailed Planetary Information**.

I use Stellarium at home when doing extensive planning, and Star Walk when traveling or out in the field. It's worth learning how to use both programs.





Example 9: Screen Shot, Star Walk – Milky Way, No Horizon Shown



Example 10: Screen Shot, Star Walk – Detailed Planetary Information

## Meteor Showers

Meteor showers can be a unique event to photograph. As with Milky Way Photography, you will only want to photograph meteors on nights without a visible Moon in the sky. If the Moon is present, the sky will be too bright and the meteors won't be seen.

Being able to effectively capture shots of the meteors directly correlates to your location, time, and date. Reference the [American Meteor Society](#) website for up to date information.

## Video Tutorial – Scouting & Planning for Star and Landscape Photography

I've created a series of free videos which will provide you with all the steps I take to plan for a night of shooting under the stars. These videos will also allow you to visualize the steps discussed in this chapter.

Click the Link Below & Watch the 3 Part Video Series.

[Scouting & Planning for Night Sky Photography Video Series](#)

# Focusing Your Lens at Night

Prior to focusing your lens correctly, it is impossible to effectively perform any type of night photography. That's why this section has been placed first. After learning these skills, you will be able to learn any of the other material provided below. Focusing is by far the most important skill learned in this book. It doesn't matter how well you perform any of the other skills, without a well focused lens, your photos will not turn out the way you visualized them.

## Let's get started...

Since the stars are very far away in respect to our planet, we can focus at infinity, or very close to it, and capture perfectly, sharp star photos. Most lenses have an “∞” symbol that is used to mark the approximate infinity focal point. Focusing your lens to this infinity symbol does not mean it will take a perfectly sharp photo. This proves true for any type of photography. Most lenses need to be adjusted slightly more to ensure sharp focus, but “∞” is a great place to start.

There are multiple options for focusing at night. Each of these methods work well for all types of night photography and some even work for landscape photography.

Over time you, will be able to perform any of the following five methods provided below. There are also more advanced methods of focusing, such as [Focus Stacking](#), which is covered later in this book. Feel free to mix and match these techniques after learning them or create new methods of your own.

# Focusing Tips for Photographers with Live View Camera Functionality

Unlike an actual photograph that uses long exposure times to capture the light in a dimly lit scene, Camera Live View can only instantaneously capture the light in this same scene. Due to this fact, live view struggles to “see” in low light conditions.

The following settings are great for focusing in low light, but are only for focusing and should not be used for shooting. Once you’ve focused using the techniques below, adjust your camera back to the settings which you would like to shoot at and fire away:

1. Set your camera to Manual Mode or Aperture Priority Mode. For my Nikon D800 using Live View in Manual Mode seems to pick up more light than Live View in Aperture Priority Mode. Try both and see which works best for you!
2. With Live View turned on, open your aperture to the widest possible value, meaning number under the “f” is the smallest it can get. In doing so, more light is able to pass through your lens. This enables Live View to better “see” the low light scene in front of you.
3. Some Live View Modes will better “see” the scene using high ISO values. This is different for each camera. Try increasing your ISO to 500 when focusing and this may brighten the scene in your live view window. I use this technique with my Nikon D800.
4. After focusing, return your camera to the “shooting settings” as provided in the tutorials below.

By performing these steps simultaneously when focusing, you may notice that your Live View screen gets much brighter and it’s now easier to focus or see the low light scene in your Live View window. This all depends on camera make and model, but it’s always worth a try since it may work well for yours.

# Methods for Focusing at Night

For each of the following methods you should be using the widest angle lens you own, at its widest focal length( field of view ). Also open your aperture to the widest setting, meaning the number under the “F” is the smallest possible.

For example, if I was shooting with my 14-24mm f/2.8 lens, it would be set at 14mm and f/2.8. The lens settings provided above are the most forgiving. This is why they are best to use the first time through.

Once you have gone through the entire book and learned more about each of the topics, go ahead and use any lens you like.

## Method 1: Preset Your Focus Point During the Day

It's easier to focus during the day than at night, for both you and your camera's auto-focus software. Since focusing is one of the hardest parts of night and low light photography, getting this step out of the way during the daytime is always best practice.

If you're ever stuck finding focus this trick will solve 99% of your problems.

1. Set up your camera during the day with the lens you will be using to take your night and low light photos. You can do this at your house or anywhere else that's easy to access. It doesn't have to be at the location where you plan on taking night photos.
2. Adjust your lens to focus at infinity or a far away horizon. I use my camera's Live View Mode, zoomed in, and focus on the furthest horizon in my composition. This will ensure that you've focused at infinity. You can also focus by looking through your camera's view finder.



⇒ **TIP:** If you decide to use Live View for this step, try finding your initial focus using Auto Focus. Next, manually make the final adjustments, if required, using the focus ring. I find that Auto Focus usually does very well during the day, but sometimes needs manual input in low light.

3. Take some more practice shots at an aperture of f/8 - f/11 and make sure the entire photo is in focus.
4. If it isn't focused, repeat Step 2 and Step 3.
5. Now your lens is focused at infinity.
6. Using a permanent marker, mark both the focus ring, and the barrel of the lens (non-rotating part of lens). Tape works as well, but may fall off over time. This is a reference point that you will be able to use when returning to shoot at night or in low light. Now you can easily return to this “infinity mark” on any future shoot to find sharp focus.

## Method 2: Live View Focusing at Night

In the case that you forget to focus during the day, or just don't want to, this is another excellent option. This only works for photographers that have Live View Mode on their cameras.

1. Turn on your Live View in shooting mode, and adjust your lens focus ring to the “∞” marker. Next use the “+” (zoom button) on your live view to zoom in on the brightest star in the sky.

⇒ **TIP:** If you have a built in camera level, by all means, turn it on. A level horizon never hurt anyone.

2. Once you've zoomed all the way in on this star, slightly turn the focus ring on your lens clockwise, then counterclockwise. You will see that the star you have zoomed in on gets bigger, then smaller, then bigger again. You will also notice that the star moves slightly side to side.
3. Turn your focus ring until the star is the smallest it can be, prior to growing larger again. The star is now in focus. You are also focused at infinity.

⇒ **TIP:** The star you have zoomed in on may look blurry in Live View, this is okay. You should only be worried about finding the focus point where the star is smallest, as noted in Step 2 and 3.

4. Turn off your live view, take a practice shot, and make sure all of the stars are in focus.
5. In the case that the stars are still not in focus, repeat Steps 1 – 3 until they are.

## Method 3: Focusing at Night with Artificial Light

Focusing with artificial light can be used in addition to any of the other 4 methods, given you are close enough to shine a light on the subject you want to focus on. It can also be used by itself. Using Live View works very well for this. You can also look through your camera's view finder and manually focus on the subject. To do this:

1. Turn on your camera's Live View or look through your view finder.
2. Shine your light source on the subject of focus.
3. Manually focus your lens on the lighted subject.
4. Upon focusing, you can turn the light off and take the photo. Another option is to leave the light on using the skill sets taught in the [Light Painting Section](#) below. It's best practice to learn about light painting after mastering the focus and shooting techniques.

## Method 4: High Contrast Focusing

At times there is a very high contrast ( abrupt transition from light to dark ) between the subjects on the landscape's horizon and the sky. Effective use of this method depends on the time of night and the amount of light pollution present where you're shooting.

This method works best during the time of day when the ground ( directly below the horizon ) is very dark, but there is still some light from the recent rise or set of a large celestial body ( Sun and / or Moon ). It also works well any time of night when the ground is dark and there is significant light pollution near the horizon.

Perform the following steps to focus using my High Contrast Focusing Method:

1. Turn on your camera's Live View in shooting mode and adjust your lenses focus ring to the "∞" marker. Next use the "+" ( zoom button ) on your live view to zoom in on the high contrast distant ( 30+ feet away ) horizon or object. Another option is to look through the camera's view finder and manually focus. I believe Live View works much better.

⇒ **TIP:** You should be able to see the high contrast line where horizon transitions to sky.

2. Once you've zoomed in all the way on this horizon, slightly turn the focus ring on your lens clockwise. Then, counterclockwise. You will notice this high contrast line becomes blurry ( less contrasted ), then get's sharper again ( more contrasted ). You want to find the lens focal setting where the line is most contrasted and sharp.
3. Turn off your Live View and take a practice shot. Make sure all of the stars are now in focus.
4. In the case that the stars are not in focus, repeat Steps 1 – 3 until they are.

## Method 5: Trial and Error

The last option is to focus your lens at the “∞” marker and take a practice shot. After taking this shot, check the photo to see if it’s in focus. If it’s not in focus, turn your focus ring slightly and take another practice shot. By using this method a few times you can hone in and finally focus your lens so the stars will be sharp. This will sometimes take 8-10 practice shots. That is why it’s my least favorite method.



Stars Twinkle at Twilight Over Crater Lake in Oregon – f/4, ISO800, 35 Seconds



# Finding Composition

*“The real voyage of discovery consists not in seeking new landscapes but in having new eyes.”*

*Marcel Proust*

Composition is by far my favorite topic in photography. Anyone can learn to dial in their camera's settings to capture all of the data required to produce some high quality star photos. It takes much more practice, thought, and most of all imagination to create unique and beautiful photos which rise above the rest.

It's easy to get stuck in a flow of shooting the same type of compositions on a consistent basis. There isn't anything wrong with this. Habits can provide great results allowing our brains to stop concentrating on the mundane to work solely on the task at hand.

It's my personal goal to add new habits to my workflow on a consistent basis, allowing myself to constantly learn and evolve in composition and overall photographic skill.

You can do this as well by adding some of the following compositional skill sets to your current repertoire. Over time these new ideas will also become habits, allowing you to grow and become even more creative along the way.

## **So, what makes a photo look beautiful?**

Why do some photos grab their viewers attention and others do not? Let's study the facts and set ourselves up to take some beautifully composed photos of the night sky!

As a photographer and artist, I've always been inclined to study the great painters for tips and tricks on composition, depth, and most of all the feelings and emotions that their paintings evoke.

From studying these great painters, I've nailed down some of the reoccurring themes that are often present in their works of art. These themes can also be applied to photography or any art in general.

There are a few different topics which I personally recommend applying to your photography when shooting out in the field and post processing at home on your computer.

## Let's discuss...

### Transitions

Transitions can come in an array of different forms. The entire point of a transition is to easily move your eye through a painting, photo, or piece of art without you knowing it is happening.

Master landscape painters, [Albert Bierstadt](#) and [Thomas Cole](#), do this better than anyone I have ever seen. From studying their paintings, I've broken down the basics of why their art is so beautiful and applied these concepts to my own photography workflow.

Here are the transitions I apply to my photos. If you can apply one or two of the following transitions to your own photos, it will really help the viewer's eyes to start moving and continue to move through your work of art. This can be done in the field and in post processing.

## Color Transitions

*Reference the [Adobe Kuler Color Wheel](#) When Reading this Section*

Color transitions can move your eyes through a photo by drawing them from warm to cool colors, or from one complimentary color to another.

Complimentary colors are colors which lie across from each other on the color wheel and provide contrast when shown next one another. Good examples are yellow and violet, red and green, or blue and orange.

These colors tend to work well together in art, painting, and photography, but only in small doses. You don't want to overwhelm the eyes with color. There is a fine line between perfect and overboard. Finding this balance comes from practice.

In the [RGB / Light Color Model](#), primary colors are red, green, and blue. Secondary colors are yellow, magenta, and cyan.

Your eyes will tend to move from primary colors to secondary colors, and from warm to cool colors and vice versa. This is something we naturally do without even thinking about it.

You'll notice that these primary and secondary colors mentioned above lie across from each other on the Color Balance sliders in Photoshop.

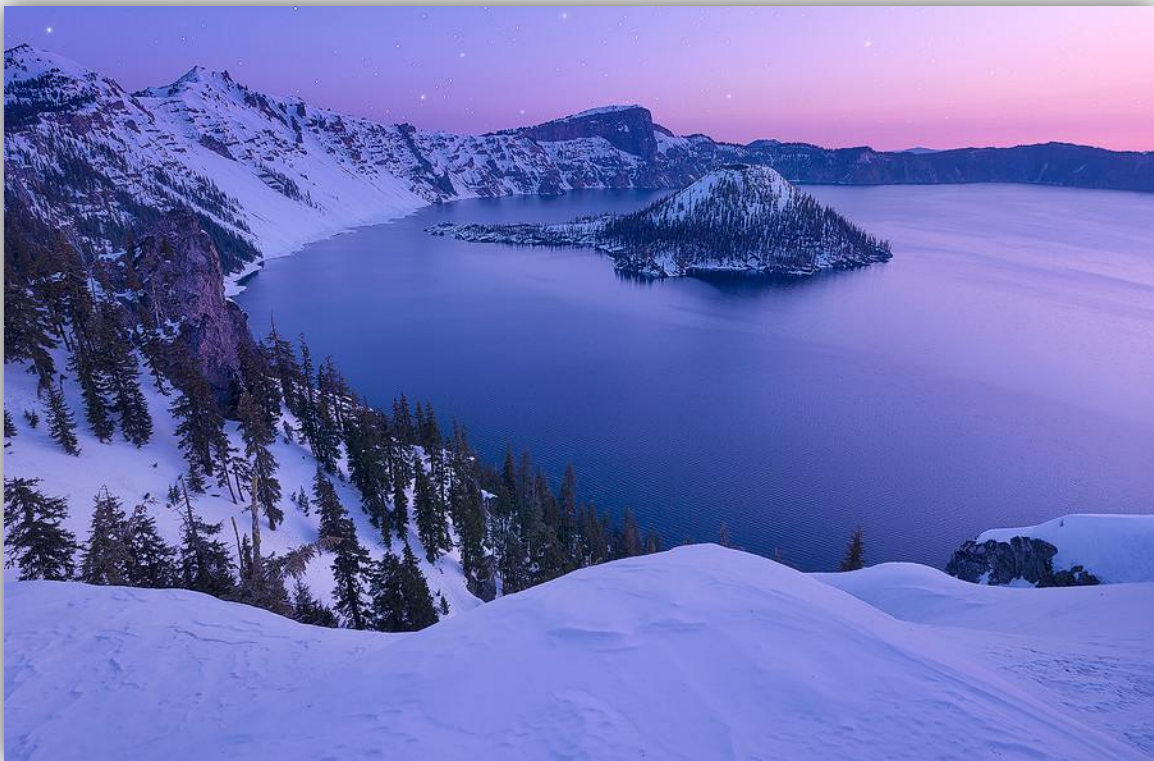
Colors can also add mood or emotion to your photos. Red and orange provide feelings of energy or happiness, while certain colors of green and blue create calm or relaxed moods.

I like to use blues, purples, and magentas in my night photos to bring a calm and peaceful feeling to the photo. You can see the noted color scheme in **Photo 1: Twilight at Crater Lake, Oregon – f/2.8, ISO2500, 30 Seconds** below.

In this photo I wanted the viewer's eyes to start in the bottom of the photo where the color is cool and slowly move to the top where the color is warm. These subtle colors also give a calm or relaxed mood to the entire picture.

## Light Transitions

Any photographic composition which can move the viewer's eyes from a dark area to a light area or vice versa will almost always work well. This can be done both in the



**Photo 1: Twilight at Crater Lake, Oregon – f/2.8, ISO2500, 30 Seconds**

field and in post processing.

You can easily combine light transitions with the color transitions from above. Nature usually provides cool tones in dark areas of a landscape and warm tones in light areas of a landscape. Your job is to capture them and emphasize these key points while shooting and post processing.



Although it is much easier to do in landscape photography, these same key elements can be found in night photography. It's up to you and your imagination to decide how you want others to “move through” your photos!

**Photo 1: Twilight at Crater Lake, Oregon – f/2.8, ISO2500, 30 Seconds** is a great example of both color and light transitions, while



**Photo 2: Night in the North Cascades - f/2.8, ISO5000, 30 Seconds**

**Photo 2: Night in the North Cascades - f/2.8, ISO5000, 30 Seconds** is a great example of color transitions.

## Time Transitions

Often taken for granted, the ability to bring movement into still frame photos provides an added dimension of excitement. It's not easy to bring the feeling of dynamic



movement into a landscape photography scene. After training your eye to “see” this type of transition, you will start finding them everywhere.

I constantly look for ways to bring movement into my photos. Let’s take a look at a few examples.

The first example can be seen in **Photo 3: The Milky Way Rising, Nevada – f/2.8, ISO4000, 30 Seconds**. When capturing this photo, the composition I liked the most was strongly weighted to the left-hand side.

To fix this I sat by the lake for 4 hours and photographed several shooting stars. The one I liked best worked its way into the top right-hand corner of my composition.



**Photo 3: The Milky Way Rising, Nevada – f/2.8, ISO4000, 30 Seconds**

This brought dynamic movement and balance to the entire scene. The second exam-



**Photo 4: Star Trails Over Crater Lake, Oregon – Ref: [Star Trails Tutorial](#)**

ple of dynamic movement in a landscape scene is shown in **Photo 4: Star Trails Over Crater Lake, Oregon – Ref: [Star Trails Tutorial](#)**

Capturing star trails in this scene, I was able to bring the essence of time into a still frame photo. You almost get the feeling of hours passing and stars flying through the sky. Without star trails this photo would have been very dull to look at; with them, it's an entirely new perspective.

To capture photos like this, reference the [Star Trail Photography Tutorial](#) below.

## Contrast Transitions

Another great way to move a viewer's eye through your photos are contrast transitions. Contrast transitions start with low contrast and end in high contrast areas of the

photo. This can be captured in the field or added in post processing. The hard part is knowing when and where to use it.

Without a direct light source, extremely harsh contrast won't look natural. If the sun or moon is shining directly on an object, there is a good chance that high contrast will look natural.

I often use contrast transitions in my photos, but in a very subtle manner. The goal is to provide these transitions in your photo without letting the viewer know you are doing it!

In **Photo 5: The Milky Way Rising, Oregon – f/2.8, ISO3200, 30 Seconds**, the bottom of the scene is very dark and contrasted. Due to this fact your eyes can easily start at the bottom of the photo and move up to the sky. This is because the sky appears soft, and doesn't provide much contrast.

Naturally your eyes move from high to low contrast areas. The same holds true from low to high contrast areas.



**Photo 5: The Milky Way Rising, Oregon – f/2.8, ISO3200, 30 Seconds**



## Detail Transitions

The great landscape painters of the Hudson River School, namely [Albert Bierstadt](#) and [Thomas Cole](#), were masters of detail transitions. A detail transition starts with an area of extremely high detail and moves your eyes through the photo or painting to areas of low and soft detail.

Looking at any landscape in nature or art, you may notice that objects closer to you are seen in vivid detail. On the other hand, objects in the distance, although just as sharp, do not appear highly detailed.

Detail transitions are a great way to provide depth in your photos. When given a strong foreground subject, it's almost always a good idea to provide emphasis on the detail. Otherwise, there isn't a point of showing off the strong foreground subject.

On the contrary, massive mountain peaks in the far distance can be shown with significantly less detail. So long as we know the peaks are there, our brains will fill in the rest. Art evokes the feeling, our brain creates the back-story. We know the massive landscape exists in the distance and that's all that matters.

In Photoshop you can add detailed transitions using techniques such as high pass sharpening on the foreground, and a very subtle Gaussian blur on the far distant background if required.

It's key to experiment with each of these settings to optimize the look and feel you create in each photo. Over sharpening or over blurring your photo will cause it to look anything but natural. Find a happy medium and you are set.

As shown in **Photo 6: Twilight at Mount Rainier, WA – f/5.6, ISO1000, 25 Seconds**, the foreground detail is crisp and sharp. The landscape in the distance, including the trees and Mount Rainier, are not quite as sharp.

This really adds an extra dimension to the photo, drawing your eyes through the entire scene. Click & view full size!



**Photo 6: Twilight at Mount Rainier, WA – f/5.6, ISO1000, 25 Seconds**

## The Human Element

In the digital internet age we view thousands of photos from around the world while sitting at a computer. This is great, but it's often hard to place, or imagine, ourselves in that actual location. What would it be like if I was there? Where would the adventure next lead me?

The human element is a great way to add interesting detail to any photo. It transforms the viewer from looking at the photo to feeling as if they were part of the photo.

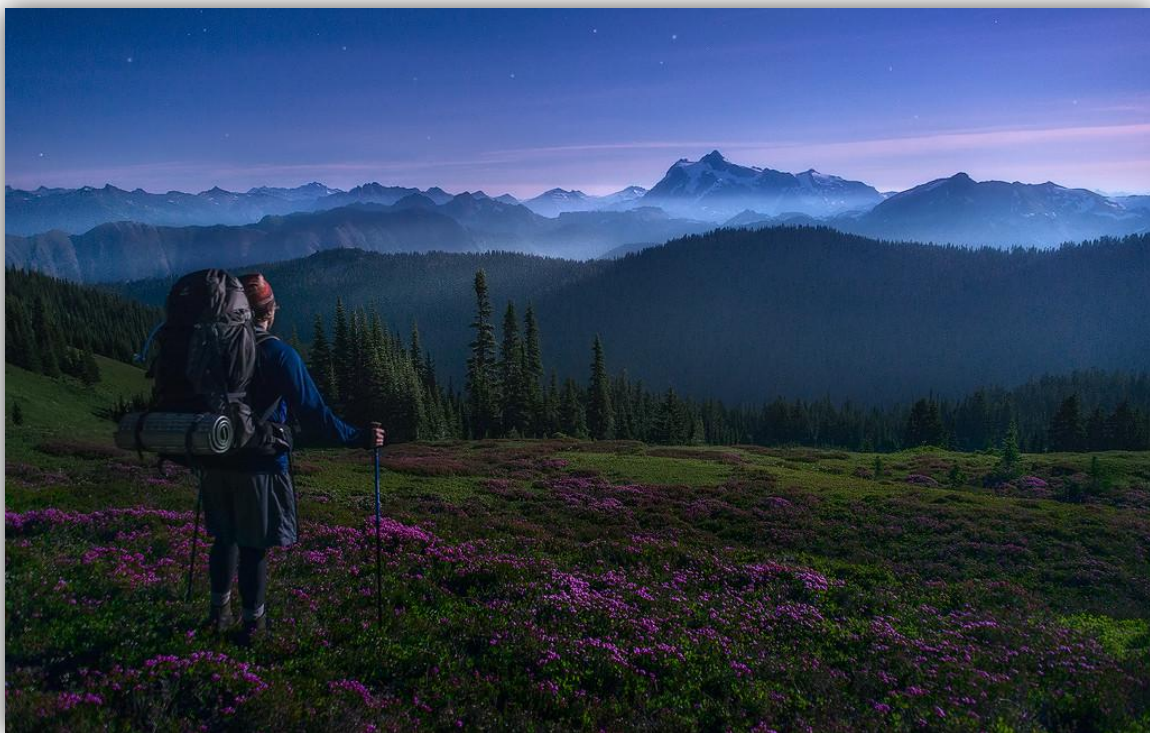


There is a fine line between leaving a beautiful picture solely to nature or stepping in and adding the human element.

I have very few pictures of people in [my portfolio](#). When adding them, I want the effect to be profound.

**Photo 7: Self Portrait, Backpacking in the North Cascades, WA – f/2.8, ISO800, 4 Seconds** was taken on a multi-day solo backpacking trip in the North Cascades of Washington State. In the high alpine areas shown in this scene there aren't many trees or large foreground objects. One of the only options was to add myself to the photo.

The human element in this photo, not only adds to the scene, but it also sparks the viewer's imagination. The human element can be key to a great composition.



**Photo 7: Self Portrait, Backpacking in the North Cascades, WA – f/2.8, ISO800, 4 Seconds**

# Tips & Tricks for Great Composition

*"The magnificent beauty of the natural world is a manifestation of the mysterious natural laws that will be forever obscured from us."*

*Albert Bierstadt*

I don't believe there is a right or wrong way to take a picture, but there are good and bad results. On average, some pictures will appeal more than others for no significant reason.

There has to be a reason that the masses like certain works of art but pass by others. What are these reasons and how can you apply them to your own photos?

Here are a few of my favorite tricks that can be applied to any photo. Just remember, these are just tricks; if you don't apply them to each and every one of your photos, no big deal. They are great to keep in your back pocket just in case!

## The Golden Ratio

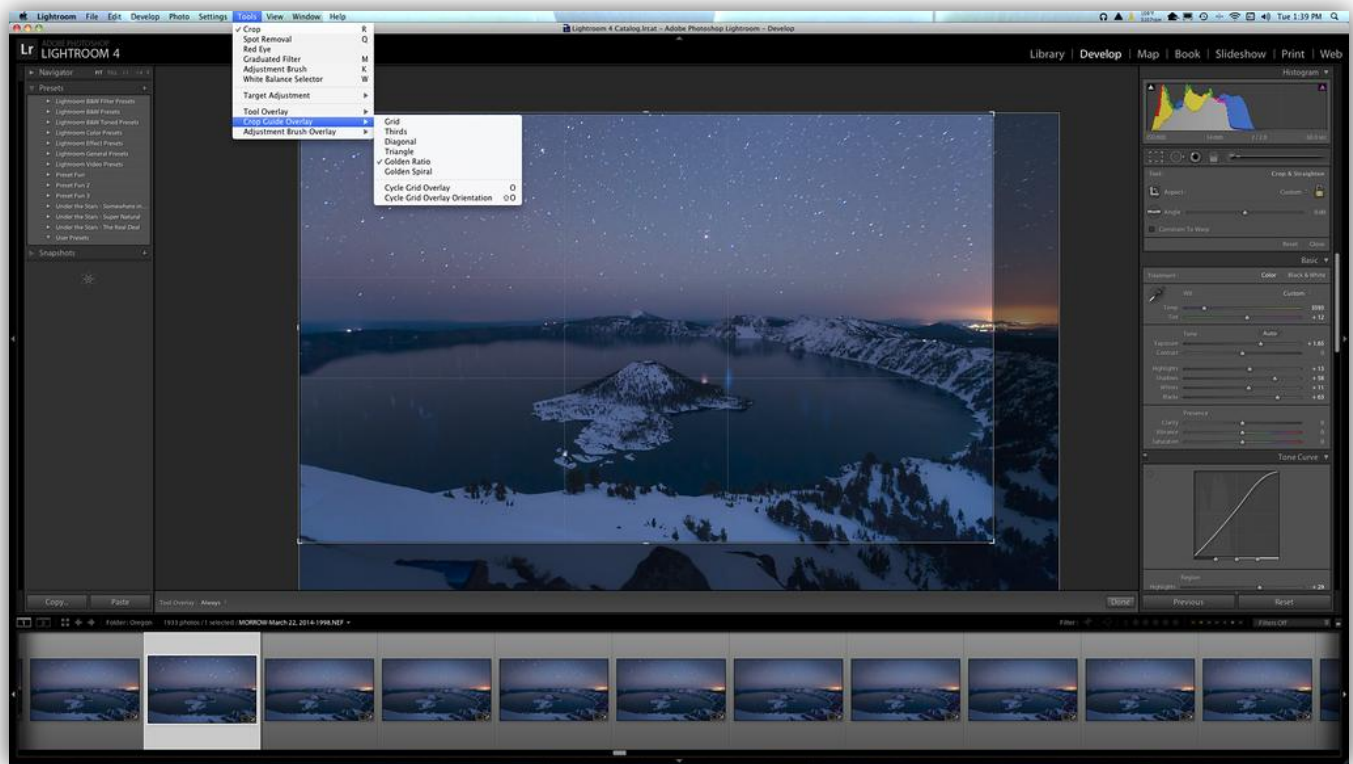
*"Without mathematics there is no art."*

*Luca Pacioli*

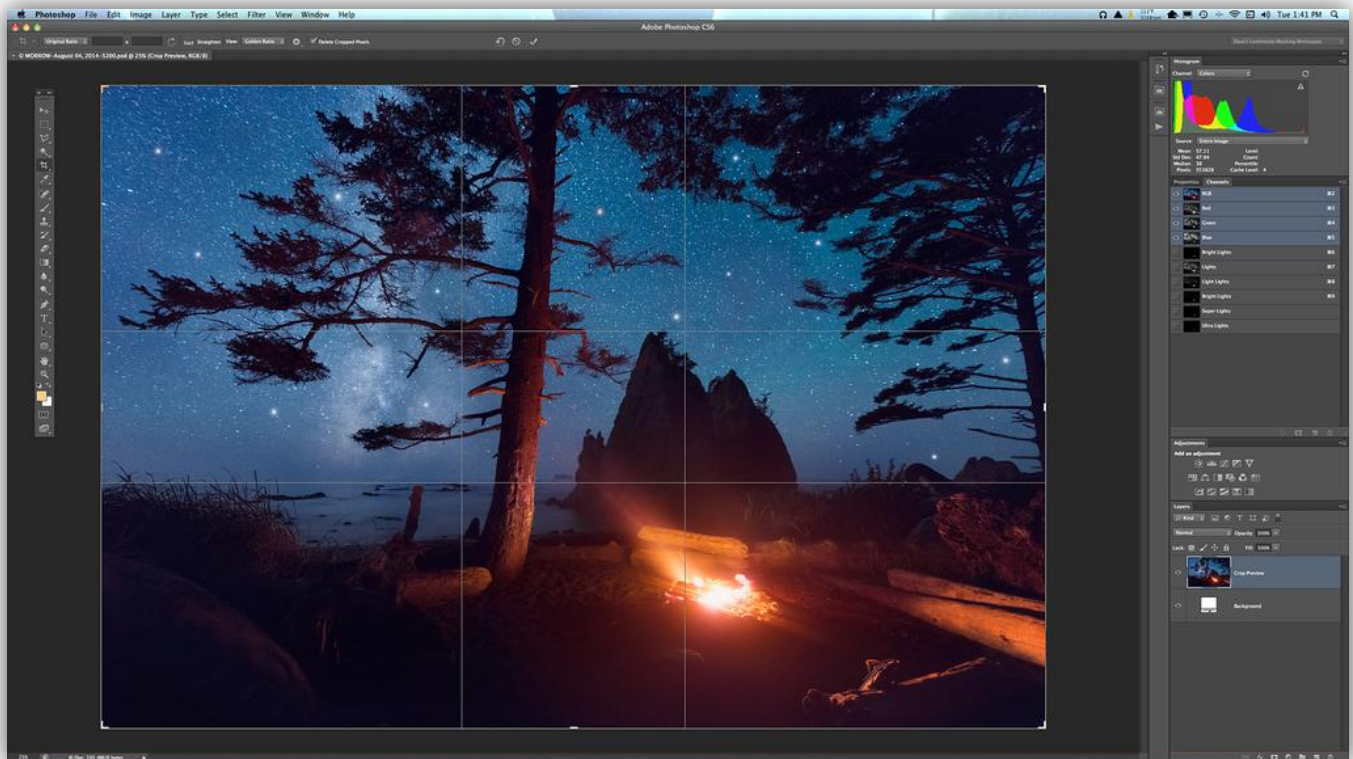
One of my personal favorites, the [Golden Ratio](#), is also known as Phi. Lightroom & Photoshop now have Golden Ratio Crop Factors which are great for post processing.

When out in the field, I like setting up my compositions to have interesting points which lie on the horizontal or vertical Golden Ratio Lines.

You can find these by getting an idea of where they lie on your photo in Lightroom & Photoshop. Next, apply them in this same way out in the field to make life easier!



Screen Shot – Golden Ratio Crop, Lightroom 4



Screen Shot – Golden Ratio Crop, Photoshop CS6

For more on this topic, reference one of my favorite books, [The Golden Ratio: The Story of PHI, the World's Most Astonishing Number](#). The [Wikipedia page](#) on the topic also provides some fantastic information.

## **Video Tutorial – Cropping with the Golden Ratio**

The following free video tutorial will show you how to set up the crop features shown in the two screen shots above. Click the link below to access the video.

[Cropping with the Golden Ratio in Lightroom & Photoshop](#)

## **Reflections**

Reflections are a great way to add “interestingness” to any photo. In extremely dark locations, you will find that stars reflect in still bodies of water. You can use reflections to move the viewer’s eye through your photo in any way you like. This is also a great way to add detail in areas which would otherwise be boring.

## **Left to Right Eye Movement**

Many of us grew up reading in a left to right direction and continue to do so every day. Due to this fact, it’s very natural for our eyes to move in a left to right manner when looking at anything. Why not make it easier for viewers to easily move their eyes through our photos in the same manner?

I like to put important foreground subjects in the bottom left of my photos whenever possible. Next, using leading lines, I draw the viewers eyes out of the top right of the

photo. You can also create the same effects by moving the viewer's eyes from left to right using the transitions which we discussed above.

It's easy for my eyes to move this way and I assume you will find the same to be true for your eyes.

## Let's Test It Out...

First, I'll show you a photo where your eyes are forced to move from right to left. This is due to a strong subject in the right-hand foreground. Next, I'll show you a photo where your eyes are forced to move from left to right for the same reason (noted above). Take a mental note of which image is easier for you to look at.

For me, it's the second image. In this picture the strong foreground subject is on the bottom left and the strong background subject is in the top right.

My eyes can easily enter the photo on the bottom left and exit on the top right. This is how they move in daily life. It's easy for them to repeat this process when looking at photos.

Photos provided on next page...





Right to Left Eye Movement



Left to Right Eye Movement

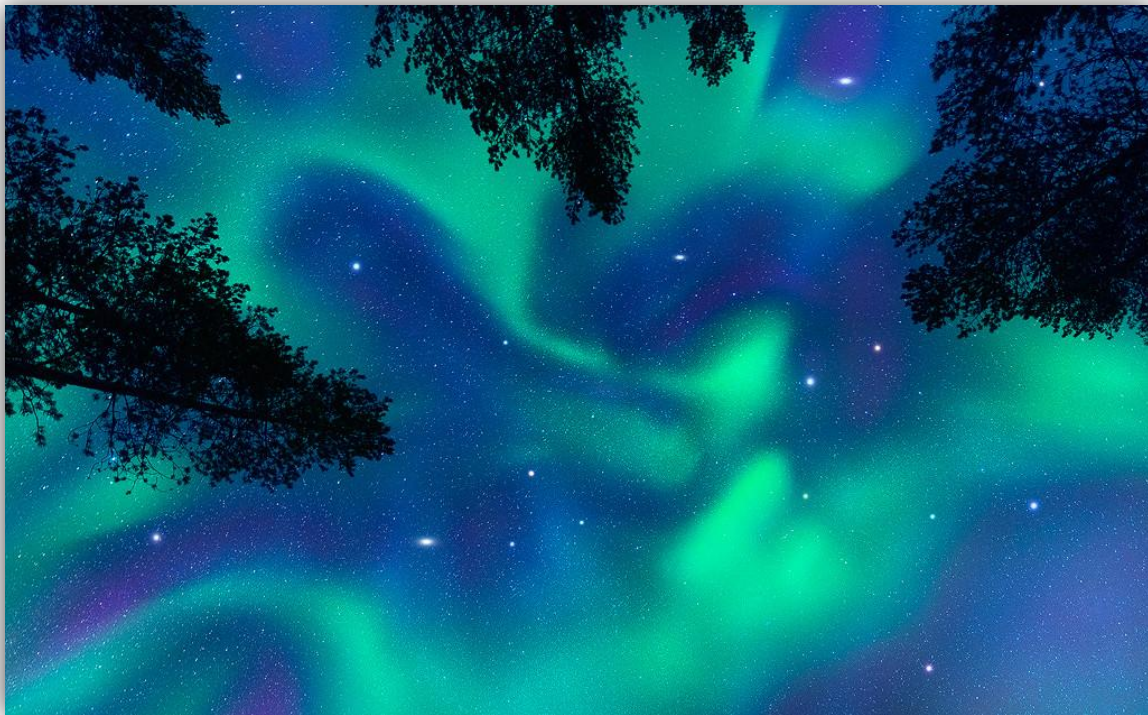


## Look Up

It is easy to get caught shooting the same horizon level landscapes shoot after shoot. One of the best tactics for mixing things up and increasing your creative flow is looking up.

Since we don't go through life looking up in the air, many beautiful sights are missed on a daily basis. When creating art, we shouldn't constrain ourselves to the same limits and concepts we do in our daily routines.

Next time you're out shooting, look up, there's a whole new world up there! I implemented this technique in **Photo 8: Northern Lights in the Pine Forests of Norway – f/2.8, ISO1200, 20 Seconds**.



**Photo 8: Northern Lights in the Pine Forests of Norway – f/2.8, ISO1200, 20 Seconds**

# Artistic Flow – The Formula for Creating Beautiful Images

*"If you do what you've always done, you'll get what you've always gotten."*

*Tony Robbins*

## **You'll Learn the Following from Mastering this Section:**

1. Improved Concentration & Clarity while Shooting.
2. Great Compositions & Overall Better Results.
3. Improvement in Artistic Flow.
4. Enhanced Creativity.
5. Complete Control Over Your Photos, Compositions & Artistic Process.

Take some time and think about the following situations. What caused them, and how will you set yourself up for success on a consistent basis in the future?

1. Have you been out shooting and felt like every shot and composition you captured was amazing, everything was flowing, and nothing could possibly go wrong?
2. Have you ever been out shooting and struggled to find any compositions, you were over thinking, and nothing was going right at all?

Everything happens for a reason, like it or not. Targeting actions leading up to good and bad scenarios will allow us to consistently recreate good outcomes and stay away from bad outcomes. Without targeting the actions which produce good and bad re-

sults, we are just guessing. Since guessing doesn't provide consistent learning and improvement, we must find out what works and discard what doesn't.

Becoming an expert on the steps which allow you to perform at an optimal level, not only improve your photography, but also improve life in general. I know it has for me!

You can apply these same thought processes & concepts to anything.

Since this is a book about photography, we will only discuss the former of these scenarios.

## **Let's Take a Closer Look...**

Over time I've narrowed down the simple steps which allow me to create beautiful images on a consistent basis, maximizing my artistic flow both in the field and in post processing. I continue to tweak and improve upon these methods with every shoot. This should be a never ending process that allows you to improve on a consistent basis. Find out what works, throw away the rest, and never stop learning!

Provided below is my shooting routine. I do this each and every time! Removing all the logistics from a shoot allows me to get in the flow and take great images.

Feel free to model my routine and tweak it to create something that is fine tuned for your own photography workflow.

### **Arrive Early**

I arrive to my shooting location a minimum of 1-2 hours before the time I plan on creating images. For example, 1-2 hours before sunrise, sunset, or night photography. Granted this can't happen every time, but 95% of the time it's possible, and I do it without fail.

Arriving early allows me to walk around the location with my camera in hand and take practice shots of different interesting compositions. During this “pre-shoot” my tripod isn’t used. I’m walking around and taking practice shots to pre-visualize the compositions which I’ll come back and shoot later on. On average I do this for 30 minutes to 1 hour.

I’ll pick 10-15 different compositions I like and take practice shots of them as denoted above. These don’t have to be perfectly captured images as far as aperture, ISO, and exposure settings. They should give you an idea of the actual composition you will be coming back to capture later.

For Milky Way and night photography I often arrive a few hours prior to sunset and try to previsualize my night compositions per the steps above.

This time also helps me to clear my mind and get into the flow of shooting & creating.

## Review Your Compositions

After capturing 10-15 prospective compositions, it’s time to sit down and review each prior to the actual shoot. Out of these 10-15 compositions I’ll pick 3-5 I like the most. These are the compositions I’ll return to during the “real shoot”.

I’ve often found that some compositions that were taken in the heat of the moment, during sunrise or sunset, don’t look so great once reviewing them back at home.

Taking practice compositions and reviewing them before the actual shoot will allow you to separate the photos that are great from the ones that aren’t worth your time.

Using this method keeps me from wasting time capturing compositions I don’t like during the “nice light” of sunrise or sunset. We will cover more on this topic below.



## Artistic Flow

By allowing myself to take practice shots for an hour before the actual shoot, not only have I narrowed down some amazing compositions, I've also gotten into the flow of shooting. This preparation time allows my body and mind to switch gears from what I was doing into the new task at hand, creating beautiful photos!

Why do you think sports teams warm up before games? They have to prepare not only their body, but their mind for the real game. This thought process should apply to any task you want to perform at an optimal level.

Now that I've spent an hour preparing myself for the shoot in all aspects, mentally and physically, it's time for the main event!

## The Shoot

Now, the time is right, the light may be perfect, or the Milky Way is just coming up over the horizon. After completing the steps above, I'm prepared to capture and create beautiful images.

Remember those 3-5 compositions I picked out earlier? Well, it's time to photograph them in the ideal conditions.

During this time, I methodically go to each composition selected above and work on that composition until it's perfect, just as I had envisioned during the "pre-shoot". Sometimes I'll spend 10-20 minutes working on a single composition.

You'll always want to start out shooting your favorite composition first, working your way down the list to your least favorite. Capturing your favorite composition first will boost confidence and push you over the edge into the area some call "The Zone".

You're no longer consciously thinking about what's going on, instead intuition and ingrained skill sets have taken over. Now, you're creating beautiful art.

It's okay if you don't make it to each composition on your list. The goal is to come away from the shoot with 1-2 images that you love.

You might make it around to each of these 3-5 compositions. Now that you have the confidence of already capturing great images; it's easy to move around to other compositions. You could also experiment on some new ideas that you may have had while shooting.

## Final Words of Advice

The entire point of the section is to mentally and physically step away from all the mundane chores and logistics associated with photography. This allows us to concentrate on the only thing that really matters, creating great images.

Using this workflow time after time I perform these steps without even thinking about them. I always tweak and improve my routine as I learn. It's a dynamic ever-changing process.

Training yourself to follow a workflow which yields great results will not only help to create great images, but also provide a much more enjoyable photographic / artistic experience. Now, you have complete control!

**Let's return to the basics, learn what works, and create fantastic results!**

# Milky Way Photography



The Milky Way Rising Over the Pacific Ocean – Olympic National Park, Washington || f/2.8, ISO5000,  
30 Seconds

# Gear & Equipment

Below I've provided the minimum equipment necessary to get started in the field of Milky Way Photography. Also noted is some additional equipment which will make your life much easier, but isn't required.

## Minimum Gear Requirements

1. Tripod, the sturdier & taller the better. I also highly recommend an L-Bracket, but it isn't 100% necessary.
2. A Camera with Manual Mode functionality. Manual Mode means you can independently and manually adjust the ISO, Aperture, and Exposure time by hand. Check out the [Night Photography Camera & Lens Suggestions](#) section below for more details on camera makes and models.

***The next few items will extremely improve your star shots but are not 100% necessary***

1. A [timer / intervalometer](#), especially if you do not have a full frame camera (35mm sensor). This is key for taking exposures longer than 30 seconds. Most DSLR cameras will take up to a 30 second exposure without a timer. You can also set your camera on ["B" or Bulb Mode](#) and hold down the shutter button manually ( for longer than 30 seconds ).
2. A wide angle lens with a very "wide / fast" aperture. A "wide / fast" aperture means the number under the "F" is small. The smaller the number shown under the "F", the wider the lens can open. This will allow your camera's sensor to pick up as much light as possible in the shortest amount of time. For full frame cameras, wide angle lenses between 14mm and 20mm are recommended. For crop sensor cameras, wide angle lenses between 10mm and 17mm are recommended. Apertures of f/2.8 – f/4 are required. I highly recommend an f/2.8 lens!



3. A full frame camera ( 35mm or larger sensor size ) with high ISO shooting capabilities. A full frame sensor provides a larger surface area to “capture” the light of the stars. Using a full frame camera will help to reduce the amount of noise in high ISO images in turn providing higher quality RAW files.



Light Painting on the Olympic Peninsula of Washington State – f/2.8, ISO3200, 25 Seconds



# Camera Settings

To be clear and concise on all of the settings for Milky Way Photography, I've provided in a list below. You may have to jump back and forth between this section and the ones below it to get the best understanding.

Each of the titles below has been hyperlinked to the sections of the book which describe them or Wikipedia where they are defined. If you're not exactly sure what the main titles mean, click for full definitions.

**Camera Mode:** [Manual](#)

**Image Format:** [RAW](#)

**Metering Mode:** I find Matrix Metering on my Nikon D800 to work the best for night photography. Canon calls this same function Evaluative Metering. As an experiment, when shooting star photography, I tried all the different metering modes my camera has to offer and Matrix clearly won. You should do this experiment as well and see what works best for your camera setup.

**White / Color Balance:** This setting is up to you. I like to select the "K" or Kelvin setting and obtain a nice and natural looking night sky color. The best way to do this is trial and error. Lower values of K on your camera will produce cooler blue tones, which seem to look much more natural than the yellow or orange tones that warmer or higher K values produce. For reference, I find K values of 3500 to 4500 to work best on my Nikon D800. Always remember that you can readjust all of these settings at home while editing the photo. I think it's easier to find a nice white balance in the field.

**Focal Length:** Anywhere from 14-24 mm ( out of 35 mm / full frame ). The larger your focal length, the shorter your exposure times will have to become per the [500](#)

[Rule](#), so wider is always better. For full details on crop and full frame sensor focal lengths reference the [Selecting Exposure Time for Milky Way Photography Chapter](#) below. You can try other focal lengths, but the above noted values seem to provide the best results!

⇒ **TIP:** Shooting with a high resolution / high megapixel camera allows you to shoot at a wide focal length and crop your photo as necessary in editing. I usually shoot at 14mm, and crop my photo at home if the composition is too wide.

**Focus:** Reference the [Focusing at Night Section](#).

**Aperture:** f/2.8, or whatever your widest aperture value is will best capture the Milky Way. I prefer to shoot in the range of f/2.8 through f/4 for star photography. Reference the [Final Adjustments – Aperture, ISO & Exposure Time](#) chapter below for full details.

**Exposure Time:** Select your exposure time using the [Selecting Exposure Time for Milky Way Photography Chapter](#) below.

**ISO:** Select your ISO setting using the [Final Adjustments – Aperture, ISO & Exposure Time](#) chapter below. For reference, I usually shoot between ISO2500-5000 for Milky Way photography, using a Nikon D800 camera.

**In Camera Noise Reduction:** All cameras handle noise differently and **some** have built in noise reduction settings. Due to this fact it will be your job to test out your in camera noise reduction functionality and see what works best for your given case. I turn off Long Exposure Noise Reduction and leave High ISO Noise Reduction on Normal for all night images. The [Imagenomic Photoshop Plugin](#) works far better than any camera's noise reduction settings. I would suggest using Imagenomic!

# Selecting Exposure Time for Milky Way Photography

## The 500 Rule

**Print / Reference the [500 Rule Chart](#) provided below while reading the following paragraphs**

Some photographers like to use the 600 rule. I believe the 500 Rule is much more conservative and provides a sharper image. The reasoning for this has been provided below. Always keep in mind, the 500 Rule is just a rule of thumb to make life easier! It's not exact science, don't make it too complicated. Experiment and see what works!

The 500 Rule is used to calculate the maximum time a photo can be exposed without exhibiting star trails behind each star in the photo. In turn, you will be able to select an exposure time that will keep your Milky Way photos sharp, without creating star trails.

**We are only calculating exposure time here... nothing more, nothing less!**

A few concepts to keep in mind. First off, the 500 Rule calculated exposure time is only a function of lens focal length. ISO and Aperture do not effect the 500 Rule calculated exposure time or vice versa. I will cover the aperture and ISO settings below, but first we need to calculate exposure time.

## The 500 Rule Equation

Since the stars are always moving with respect to us here on Earth, technically the stars in your photos will always have trails, no matter how short the exposure time.

The 500 Rule ensures these trails are small and unnoticeable when printing, viewing online, or in any other format.

To obtain the maximum exposure time you can shoot, without exhibiting “trails” behind the stars in your photo; take the number 500 and divide it by the focal length you will be shooting at. You can also reference the 500 Rule Chart below which was created using the equations below.

**If you're not shooting with a 35mm / full frame camera, first, you will have to calculate your camera's crop factor using the equation below. The Crop Factor for a 35mm or full frame camera is 1.**

⇒ **Technical Note:** If you don't know what your camera's sensor size is (for the equation below), the instruction booklet that came with it will provide that information. In the case that you don't have the booklet, “Google” your camera's brand and model for more information.

$$\text{Crop Factor} = \frac{35\text{mm}}{\text{Your Camera's Sensor Size ( mm )}}$$

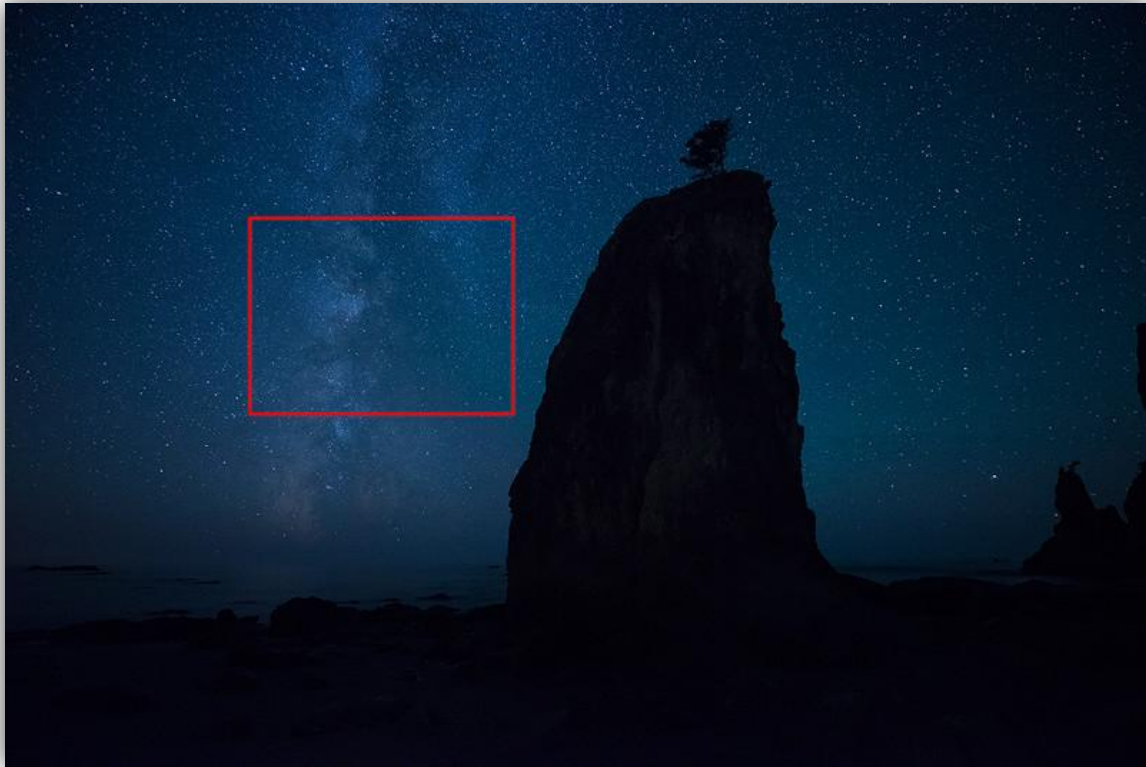
Next, using the crop factor calculated above and the focal length you will be shooting with, calculate the maximum exposure time your camera can capture, prior to exhibiting star trails.

$$\text{Maximum Exposure Time ( Seconds )} = \frac{500}{\text{Focal Length ( mm )} \times \text{Crop Factor}}$$

If you exceed the calculated maximum exposure time provided by the 500 Rule your picture will exhibit star trails.

## Example Photos & Discussion – The 500 Rule

Provided below are a few example photos showing the correlation between exposure



**The 500 Rule 1: RAW File, Straight Out of the Camera**

time and star trails in your photos. The following examples zoom in at 100 percent crop to the **red box** as shown in **The 500 Rule 1: RAW File, Straight Out of the Camera**. Click on any of the photos to see them full size online for best viewing!

Keep in mind that different cameras and lenses will distort images differently. That being said, it's always best to check for star trails near the center of the photo where there is less distortion. The more expensive your wide angle lens, the better it handles distortion.





The 500 Rule: 20 Second Exposure @ 100% Crop



The 500 Rule: 25 Second Exposure @ 100% Crop





The 500 Rule: 30 Second Exposure @ 100% Crop



The 500 Rule: 54 Second Exposure @ 100% Crop

After taking some time to look at the photos above, there are two things I want you think about.

1. As the exposure time increases it's possible to see that the stars start to elongate and increase in size, just as the 500 Rule suggests they should.
2. You will notice that the shorter exposure times provide an overall sharper and more contrasted / detailed image especially in the star clusters of the Milky Way.

Since the entire sky is moving relative to us here on Earth, a long exposure exceeding the 500 Rule Maximum will not only cause the stars to elongate and trail, but actually induce a blurry effect throughout the entire sky.

## **Think About It This Way...**

The same effect can be seen in long exposure photography of clouds and water. As the exposure time increases, each pixel will display the average of the light, detail, and color which they have captured over the elapsed shooting time.

The same thing happens as the stars and Milky Way move across the sky. The 500 Rule provides a baseline maximum exposure time, prohibiting this blurring effect from becoming too dominant. In turn the stars, sky, and Milky Way stay sharp in your photos.

You'll notice that the images at 20, 25, and 30 second exposure times seem to pop off the page with much more contrast and definition than the image at 54 seconds. In the 54 second exposure, the Milky Way has become so distorted that it's starting to become soft, blurry, and undetailed in the sky.

Now it is possible to see why selecting the correct exposure time is so important for sharp, contrasted, and well defined images of the night sky!

## The 500 Rule Chart

### CAUTION - READ ME

For those of you that are not shooting with full frame cameras make sure to take this into account. I have provided a chart that gives a few common sensor sizes / crop factors and their maximum exposure times per the 500 Rule. This will also help you understand how the rule works.

Feel free to print out this chart and keep it in your camera bag when going out to shoot the night sky.

Clicking the chart will take you to the full resolution version online.

## 500 Rule Chart Included on Next Page

The 500 Rule from DaveMorrowPhotography.com						
Focal Length (mm)	Sensor Size Full Frame (35mm)	Max Exp. Length (seconds)	Crop Sensor 1.5X (mm)	Max Exp. Length (seconds)	Crop Sensor 1.6X (mm)	Max Exp. Length (seconds)
8	8	63	12	42	13	39
9	9	56	14	37	14	35
10	10	50	15	33	16	31
11	11	45	17	30	18	28
12	12	42	18	28	19	26
13	13	38	20	26	21	24
14	14	36	21	24	22	22
15	15	33	23	22	24	21
16	16	31	24	21	26	20
17	17	29	26	20	27	18
18	18	28	27	19	29	17
19	19	26	29	18	30	16
20	20	25	30	17	32	16
21	21	24	32	16	34	15
22	22	23	33	15	35	14
23	23	22	35	14	37	14
24	24	21	36	14	38	13
25	25	20	38	13	40	13
26	26	19	39	13	42	12
27	27	19	41	12	43	12
28	28	18	42	12	45	11
29	29	17	44	11	46	11
30	30	17	45	11	48	10
31	31	16	47	11	50	10
32	32	16	48	10	51	10
33	33	15	50	10	53	9
34	34	15	51	10	54	9
35	35	14	53	10	56	9



## Fine Tuning Exposure Time

Selecting exposure time with the 500 Rule should only be used as an approximation for selecting your exact exposure time. For different camera and lens setups, your exposure time may vary up or down by a few seconds before you start to see star trails in your photo.

It's best practice to use the 500 Rule first and get a rough estimate for exposure time. Next, use the following steps and continue refining this exposure time until you get the exact results you're looking for.

⇒ **TIP:** A longer exposure picks up more light. In turn, you will see stars that are farther and farther away from our planet. Light sources that are closer to our planet will appear even brighter at longer exposure times.

Perform the next steps allowing you to obtain the fine tuned exposure time for your given camera and lens setup:

1. Set your camera to “M” or Manual Mode.
2. Set your camera's aperture to the fastest / widest setting ( number under the “f” is the smallest possible ). Adjust the focal length to the widest / smallest possible length. For example, I would shoot at 14mm and f/2.8 on a Nikkor 14-24mm f/2.8 lens. Your lens should also be focused per the instructions provided in the [Focusing Your Lens at Night Section](#).

⇒ **Technical Note:** Opening your aperture to the widest possible value will allow the most amount of light to hit your camera's sensor in the least amount of time. In turn, your camera will capture the most star light prior to exhibiting star trails per the 500 Rule. We will cover this topic in more detail below.

3. Set your ISO to the range of 2000-3000. If your ISO does not go this high, set it to the maximum possible.

⇒ **TIP:** The goal here is to adjust exposure time and find the best possible setting for Milky Way photos. These are only practice shots, they may be very noisy due to high ISO. This is okay so long as you can tell if the stars in your photos exhibit star trails or not. We will select ISO later in this section.

4. Take a practice shot at the exposure time selected per the [500 Rule Equation](#) and / or the [500 Rule Chart](#) above.
5. In photo review mode ( after taking the shot ), zoom in on the photo that you just took and see if there are any star trails behind the stars.

⇒ **TIP:** The stars may be very bright or dark depending on your ISO and camera / lens setup. As long as you can see if there are star trails or not, that's all that matters.

6. If no star trails exist, increase your exposure time by 2 to 3 seconds and take a practice shot. Repeat this step until you start to see very small star trails in your photo.
7. Once you see very small star trails, reduce your exposure by 1 - 2 seconds. Next, verify that these trails no longer exist by zooming in on the stars in photo review mode.

Upon performing the steps above, you have found the maximum exposure time your lens and camera can capture at the given focal length without exhibiting star trails. We can refer to this as the Fine Tuned 500 Rule Maximum Exposure Time.

Take a physical or mental note of this number so you can continue to use it in the future.

In the case that you want to use a different focal length, or different lens, you can repeat the same process again. Eventually you will become an expert at this skill and it will only take a minute or two each time, maybe less.

Always remember, the 500 Rule is only a function of focal length. When changing your focal length, your 500 Rule maximum exposure time will also change.

## Final Adjustments – Aperture & ISO

Once you've nailed down your exposure time per the section above, it's time to make the final adjustments by selecting the aperture and ISO that best fits your shooting scenario.

### Aperture Selection

The goal of Milky Way Photography is to allow the most star light to hit your camera's sensor within the Fine Tuned 500 Rule Maximum Exposure Time obtained above. To do so, set your aperture at the widest possible setting that your lens will allow. The number under the "f" should be the smallest possible.

In doing so, more star light will propagate through your lens opening and hit your camera's sensor. More light hitting your camera's sensor allows stars to show up brighter in your photos.

I shoot all of my Milky Way shots at f/2.8 using my Nikkor 14-24mm f/2.8 lens. You can experiment with different aperture settings, but I've always found the widest aperture setting to work best for Milky Way photography. Given the entire photo isn't in focus, you can use my [Advanced Focus Stacking Techniques](#) provided below.

### ISO Selection

Now that we have narrowed down all of the other Milky Way Photography camera settings, the only one left is ISO.

**ISO is the only destructive / noise inducing setting.**

This is why we selected exposure time and aperture prior to selecting an ISO setting.

There is no reason to degrade picture quality by increasing ISO ( to obtain a brighter image ) when you can keep the same picture quality and increase the brightness using a longer exposure, given your photo is not exhibiting star trails.

**Never increase your ISO to obtain a brighter photo prior to increasing your exposure time to the Fine Tuned 500 Rule Maximum as denoted above.**

Follow the next steps to select an acceptable ISO setting for your photo. All of your other settings should still be the same, as calculated above.

Upon performing these steps the first time you won't have to do it every time you go out to take photos of the Milky Way. In the following steps, experimentation is key to finding the best fit ISO setting:

1. Adjust your camera to ISO800 and take a practice shot. This practice shot will most likely be dark. If it is, move on to step 2.
2. Increase your ISO one stop, or to the next larger value, such as ISO1200. Take another practice shot. Most likely this shot will still be very dark. If it is, move to step 3.
3. Continue to increase your ISO until you start to see the Milky Way very visibly in your photos.

⇒ **TIP:** There is no need to over-expose your star photos. They can be fairly dark just like the night sky that surrounds you. The best method is to match the brightness of your photos to the landscape and stars you're looking at. The camera picks up much more data than is actually displayed on the preview screen. This data can be brought out in post processing. Reference [Example Photos](#) below for RAW picture data analysis.

4. Once the Milky Way is clearly visible in your photos, you have found an ISO setting that works well for the given composition and situation.
5. Depending on the camera make and model, you may notice a lot of noise in your photo. You may also notice that you have increased your ISO to the maximum setting and the photo is still not bright enough. Other than adjustments in post processing, there is nothing else that can be done about maxing out your ISO prior to having a bright enough photo. This is where it truly helps to have a full frame camera.

There are many methods to combat this noise using Photoshop. I cover these methods in my Star Photography Post Processing Video Tutorials.

## Example Photos & Discussion – RAW Picture Data

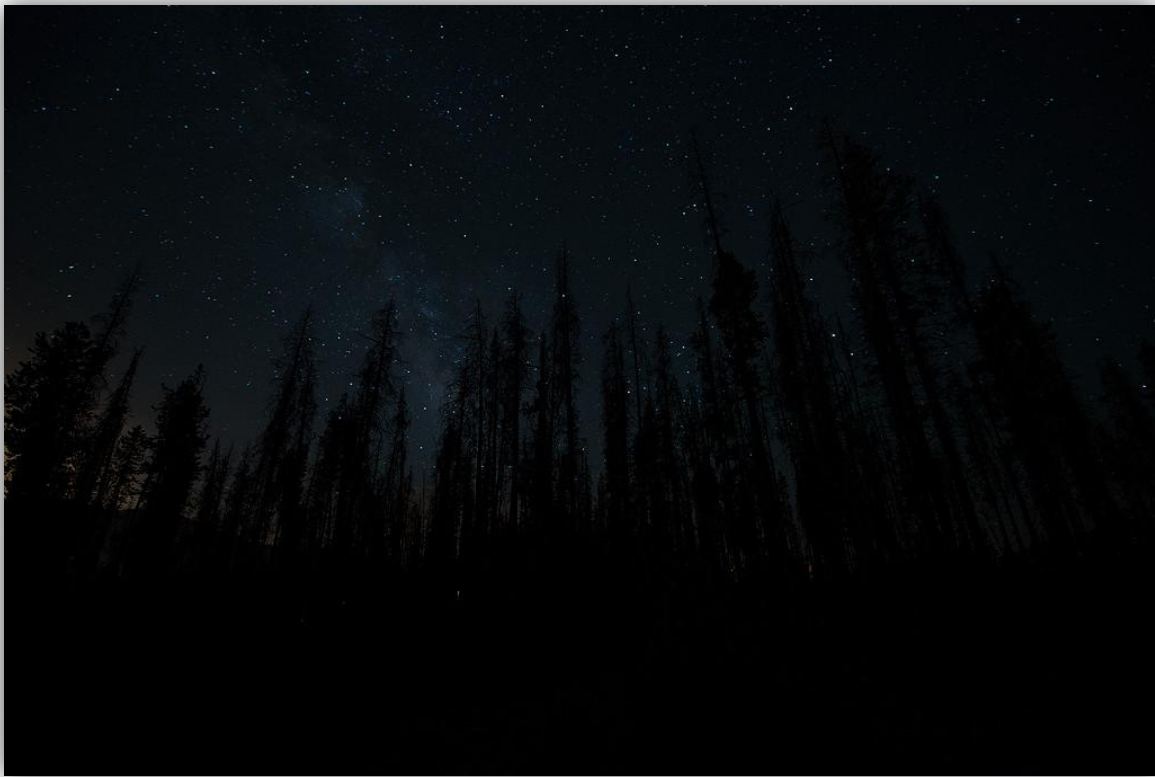
As stated above, there isn't a need to increase your ISO to the point where your photo is well exposed when viewed on the back of your camera's review screen. Let's take a look at some example photos and I'll show you why.

**RAW Picture Data 1: RAW Picture File - As It Looked in View Finder on the Back of the Camera** is straight out of my camera with no adjustments in post processing done so far. As you can see it is very dark. This is also what the photo looked like on the back of my camera after I took it.

Many photographers would say that this is much too dark and that I'll never get a nice photo out of it. This doesn't tend to be the case for new model full frame cameras.

Upon testing my camera hundreds of times in the field I know exactly which exposure will produce a nice photo. You should do these experiments as well. It will take some time, but in the end you'll end up having to take fewer photos, and come away with better results. I'll show you how to do this below!



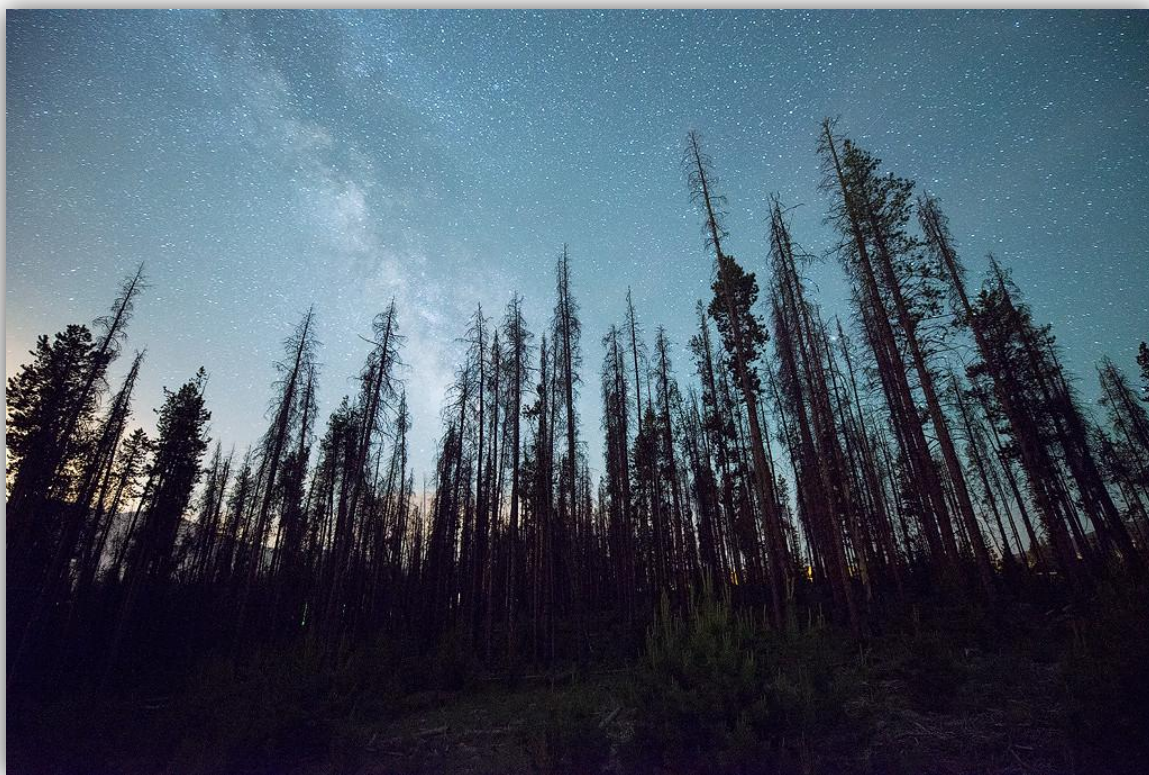


**RAW Picture Data 1: RAW Picture File - As It Looked in View Finder on the Back of the Camera**

Next, let's take a look at this same exact RAW file with a slight exposure increase adjustment in Lightroom as seen in **RAW Picture Data 2: The Same RAW File with 4 Stop Exposure Increase in Lightroom**

The purpose is to show you just how much data is contained in a RAW file that looks so dark on the back of your camera screen. Always remember that the image seen on the back of your camera review screen is a JPEG rendering of a RAW image file. It can't show all of the data contained within the file. You can only view all of this data on your computer.

Only trial and error will allow you to see just how much data you can pull out of each file prior to degrading it too badly. This all depends on your camera make and model. From experience, I know the [Nikon D800 can pull nearly 4 stops of data/light](#) out of



**RAW Picture Data 2: The Same RAW File with 4 Stop Exposure Increase in Lightroom**

any image before degrading it too badly. The amount of data which can be pulled out of any picture will decrease as the ISO values increase.

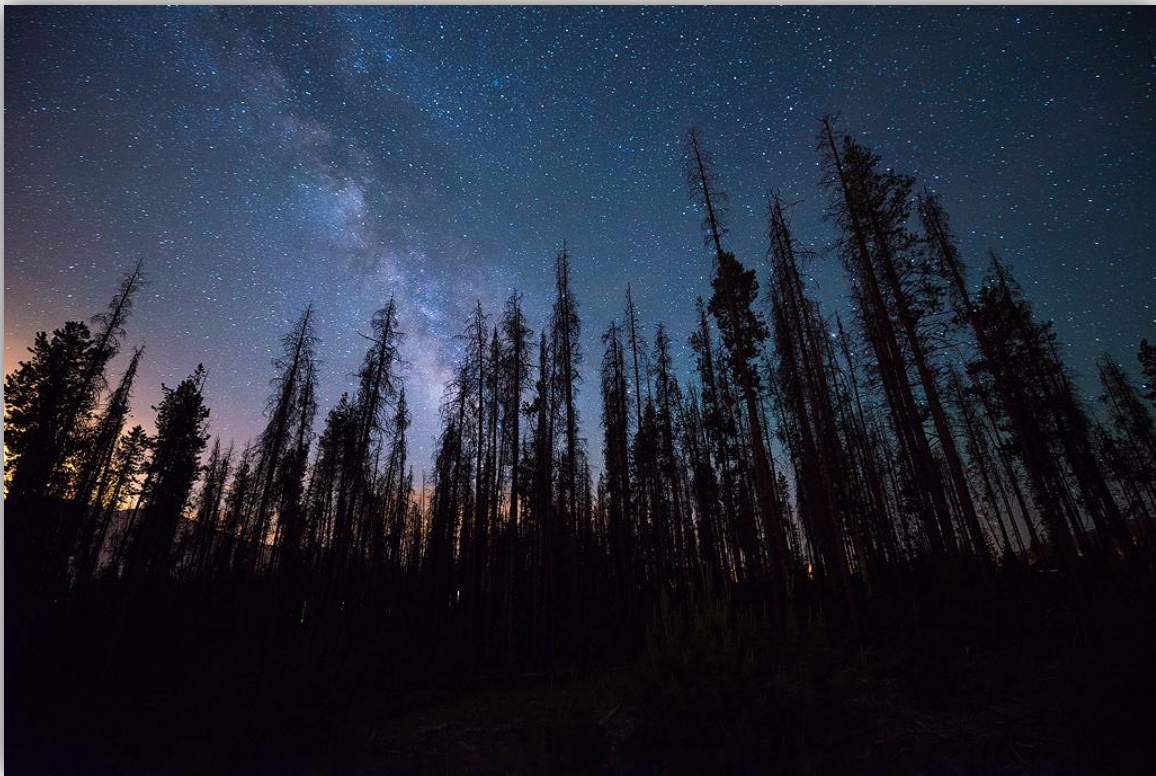
The photo above has been “maxed out” for exposure without destroying / degrading the image too badly. This example allows you to see just how much data can be captured in a single RAW file.

A single “dark looking” RAW file contains a massive amount of data that can’t be seen on the back of your camera when out shooting. It is imperative for you to know the bounds of your camera and the data that it can capture!

Test the limits of your RAW files [using this simple technique provided in the Northern Lights Tutorial](#) below.

It's important to note there isn't a reason to increase your ISO to a higher value just to see the photo clearly on the back of your camera. It's better to have a dark photo with less noise, than a well exposed photo with an increased amount of noise. You can always increase the brightness in post processing, but you can't always remove the noise.

Let's take a look at **RAW Picture Data 3**, and see what a few simple adjustments in Lightroom can do to this photo prior to moving into Photoshop. As described in my



**RAW Picture Data 3: The Same RAW File Adjusted in Lightroom Prior to Editing in Photoshop**

Star Photography Post Processing Video Tutorials each RAW file should be adjusted in a RAW image processor such as Adobe Lightroom or Adobe Camera RAW prior to editing in Photoshop. This allows all of the RAW image data to be extracted from the photo providing overall great results in post processing!



At times I'll "double process" the same RAW file in Lightroom. I'll process a single RAW file once to obtain certain characteristics, export that photo as a TIFF file, then, reprocess the same file once again to obtain different characteristics. I'll export this RAW file as well, and blend both together in Photoshop. Check out the video below and see this concept in action.

## **Video Tutorial – Double Processing in Lightroom & Photoshop**

Double processing is one of my favorite post processing tricks. You can use this technique to process your RAW files as many times as you like and blend these different versions together. See the video notes after following the link for even more information.

[Photoshop Digital Blending & Double Processing for Landscape Photography](#)

## **Test Your Camera Settings & Compare the Images**

The first time you go out to take star photos, try several different ISO values. Some should be lower, providing a dark exposure with less noise. Some should be higher, providing a regularly exposed photo with more noise.

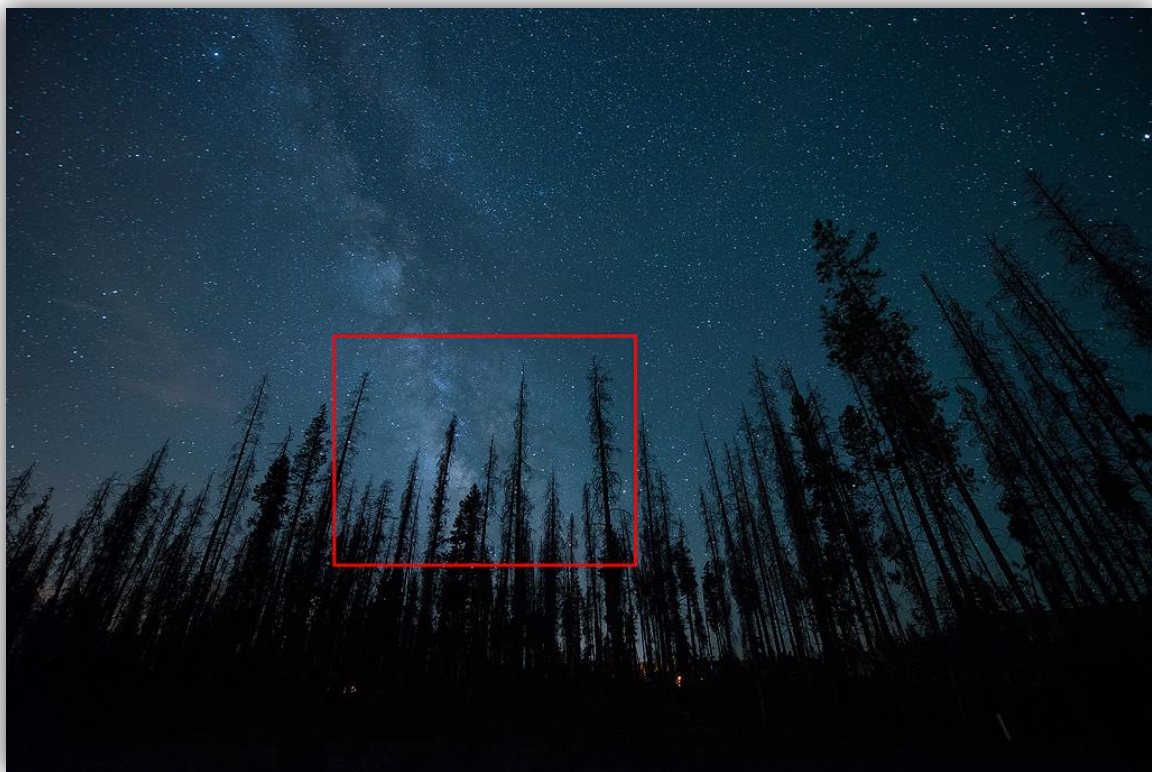
After your shoot, take a look at each of these examples on your computer and test them out in post processing. If the darker / less noisy exposure works well in post processing, now you know there isn't a need to increase your ISO to far beyond this value. Your goal is to capture all of the required data in your picture file while inducing the least amount of noise.

It's all about taking multiple shots and experimenting. This allows you to understand how your camera / lens setup operates in accordance with the 500 Rule, ISO settings, and which settings yield the best results in post processing.

Once you have this down it becomes second nature and you will find it quite easy to capture nice shots on a consistent basis.

Here is a quick example of the same composition with different ISO values. This example shows you the ISO threshold as it starts to severely degrade image quality.

Each photo is shown at 100 percent crop( as denoted by the **RED** box in the graphic **RAW Picture File, Prior to Editing**). Below are examples of the exact same composition at different ISO values. I've labeled each one so you can see where the ISO noise starts to severely degrade the image quality. These are cases for the Nikon D800, but should be tested with your own camera setup as well. Click the example photos to view them full size online.



**RAW Picture File, Prior to Editing**



The following photo is from my portfolio and is not part of the example noted above.



The Milky Way Rising Over the Great Wall of China – f/2.8, ISO3200, 32 Seconds





ISO 3200, Acceptable



ISO 4000, Acceptable





ISO 5000, Acceptable



ISO 6400, Border Line Acceptable





ISO 10,200 Not Acceptable



ISO 25,600, Not Acceptable





The Milky Way Rising in Southern Oregon – f/2.8, ISO3200, 30 Seconds



On the Road in Eastern Washington's Palouse Region – f/2.8, ISO5000, 30 Seconds



# Post Processing / Editing for Milky Way Photography

Post processing and editing in the digital photography world is just as important as capturing the images. You can be the best photographer in the world, but, if you're not able to translate your vision from a RAW image file into the final work of art, then all is lost.

By reading this book you will have all of the skill sets required to capture and create some outstanding images in the field.

For those of you that would like to learn all aspects of Milky Way Photography I've provided you with a special offer for some of my top selling post processing / editing tutorials & products.

These video tutorials will walk you through all aspects of my post processing workflow for Milky Way Photography, explaining each step in an effective and powerful, yet easy to understand manner! You will also receive a RAW image file allowing you to work along with me at home.

As a Thank You for purchasing this book I've provided some exclusive special offers & discounts. These offers can only be redeemed via the link provided below.

If you're interested in taking your star photography post processing to the next level, click the link below & head over to the Special Offers Page to take advantage today.

**[Click Here & Redeem Your Special Offers!](#)**

# Final Words of Advice for Milky Way Photography

Play around with the big three: aperture, ISO and exposure time until you're getting the shots you like. Each of these settings directly reflect on each other and the amount of light that hits your camera sensor. A slight change could make all the difference in the number and brightness of stars you see in your photos.

## The Three Most Important Lessons from the Milky Way Photography Chapter

1. ISO degrades image quality, exposure time and aperture do not.
2. Use a lower ISO and under expose your star photos in turn reducing noise.  
Bring back the dark details and increase brightness in post processing.
3. [Test your camera and know its limits!](#) This is the most important concept of all!

# Star Trail Photography



Star Trails in Big Sur, California || f/2.8, ISO1200, 12 Minute Exposure

# Gear & Equipment

Below I've provided the minimum equipment necessary to get started in the field of Star Trail Photography. Next, I'll describe each in full detail and teach you how to use them.

## Minimum Gear Requirements

1. Tripod, the sturdier & taller the better.
2. A Camera with Manual Mode functionality.
3. A timer / intervalometer. This is especially important if you do not have a 35mm full frame camera. This is key for taking exposures longer than 30 seconds or multiple shots over an extended period of time as we will be doing below.
4. Star trail photography is much more forgiving than Milky Way photography. A "fast" ( number under the "F" is small ) lens is still recommended. The smaller the number under the "F", the wider the aperture in your lens will open, allowing the most light to propagate through it in the least amount of time. In turn more light will hit your camera's sensor, providing a higher quality image at night. I would recommend an aperture no slower than f/4 for this style of night photography. Aperture settings of f/2.8 - f/4 are recommended.
5. Three to five fully charged batteries. You will be shooting over a time ranging from 30 minutes to 3 hours.



# Camera Settings

To be clear and concise on all of the settings for Star Trail Photography they have been provided in a list below. You may have to jump back and forth between the sections to get the best understanding.

Some of these settings are the same as they were for Milky Way Photography. I've provided them again for ease of reading.

Each of the titles below have been hyperlinked to the sections of the book or locations online which describe them. If you're not exactly sure what the main titles mean, click for full definitions.

[Camera Mode:](#) Manual

[Image Format:](#) RAW

[Metering Mode:](#) I find Matrix Metering on my Nikon D800 to work the best for night photography. Canon calls this same function Evaluative Metering. As an experiment, when shooting star photography, I tried all the different metering modes my camera has to offer and Matrix clearly won. You should do this experiment as well and see what works best for your camera setup.

[White / Color Balance:](#) This setting is up to you. I like to select the "K" or Kelvin setting and obtain a nice and natural looking night sky color. The best way to do this is trial and error. Lower values of K on your camera will produce cooler blue tones, which seem to look much more natural than the yellow or orange tones that warmer or higher K values produce. For reference, I find K values of 3500 to 4500 to work best on my Nikon D800. Always remember that you can readjust all of these

settings at home while editing the photo. I think it's easier to find a nice white balance in the field.

**Focal Length:** For star trails any focal length will work. The larger the focal length (zooming in with your lens), the longer your star trails will appear over a shorter amount of time ( [Reference - Selecting Exposure Time for Milky Way Photography](#) ). If you don't want to wait around all night to capture a star trail scene, a zoom lens will be your best choice. If you're interested in capturing a full, wide angle star trail scene showing a long star trail transition across the sky, a few hours will be required. The best way to see this in physical form is to go out and try some test shots in the field. This will show you how different lenses or focal lengths exhibit different star trail lengths over a given period of time. Another good reference is the [500 Rule Chart](#) & [500 Rule Equation](#) which will show the direct correlation between star trails and focal length in a mathematical manner.

**Focus:** Focus at infinity per the [Focusing at Night Chapter](#) above. If you really like something in the foreground then take two shots. One shot to capture the star trails and a second capturing the foreground. I cover the later of these skill sets in the [Advanced Night Photography Skills Chapter](#) below.

**Aperture:** f/2.8 – f/5.6. The aperture setting is not as important in star trail photos as in Milky Way photos. You can experiment to see what works best. I prefer to shoot at f/2.8 for star trail shots.

### **Exposure Time:**

**Full Frame Camera:** 30 – 60 seconds works well to capture star trails per [Method 1](#) as described below. The longer the exposure the more “far away light” your camera will capture. A longer exposure picks up more light at a greater distance from our planet. In turn you will see stars that you wouldn't

have with a shorter exposure time. On the other hand, light sources closer to our planet will appear even brighter at longer exposure times. This applies for any type of night photography. Using a longer exposure will allow you to keep your ISO low, reducing noise, and providing a higher quality image.

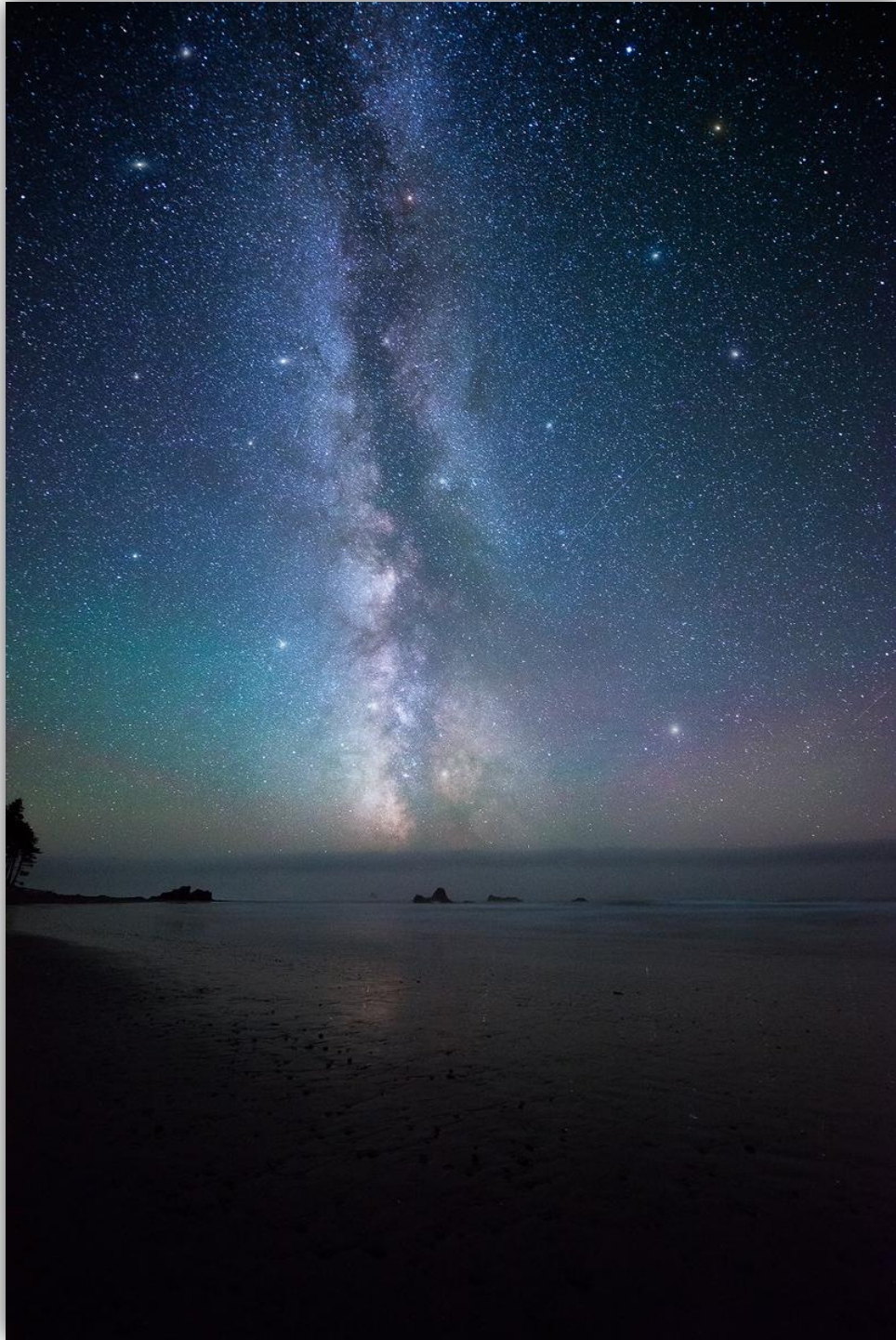
**Crop Sensor Camera:** 30 - 120 seconds works well when shooting per the instructions provided in [Method 1](#) below. Since crop sensor cameras don't handle high ISO as well as full frame cameras, the exposure time may need to be increased. Don't be afraid to try out 120 second exposures and see how they work using a lower ISO and in turn providing higher overall image quality.

**ISO:** ISO settings for star trail photography depend on how much ambient light is present in the scene you are shooting. It works well to shoot star trails when the Moon is visible in the sky. Make sure to shoot in the opposite direction of the Moon. The Moon light allows you to capture well exposed star trail shots while keeping your ISO fairly low. Try starting at ISO 300, increasing as required to approximately ISO 800. Increase your ISO until your image is correctly exposed.. Reference the tip below and the [Selecting Exposure Time for Star Trail Photography](#) Chapter below.

**TIP:** If your shot isn't bright enough, and you can still increase your exposure time, always do this instead of increasing your ISO too far beyond 800.

ISO is the worst case method of increasing the brightness of your star trail shots since it is the only setting that degrades image quality. For those of you shooting with a crop sensor, it's best practice to stay within the range of ISO 160-500.

Trying higher ISO values such as 800 will never hurt. It's all about getting a nice exposure, without much noise.



The Milky Way Rising Over the Pacific Ocean – Olympic National Park, WA || f/2.8,  
ISO5000, 30 Seconds



# Selecting Exposure Time for Star Trail Photography

I highly recommend [Method 1](#) for the best quality of star trail photos. [Method 2](#) can also be used but degrades the photo quality as described below. The following section discusses both Method 1 and Method 2, but goes into much more detail for Method 1 since it is preferred and recommended.

## Method 1 ( Preferred ): Multiple Exposures

The preferred method for capturing star trail photos involves using multiple exposures, each capturing small star trails over an elapsed period of time. The camera settings for each of these overlaid exposures is exactly the same. The only thing that changes is the position of the stars relative to the Earth.

Next, each of these images can be batch processed in Adobe Lightroom or Adobe Camera RAW then imported into Photoshop and processed as described in the [Star Trails Post Processing Chapter](#) below. Reference the [Camera Settings Chapter](#) above for the best settings.

## Why is this the Best Method?

Using multiple exposures will allow you to keep your exposure time and ISO fairly low, in turn reducing noise. Almost all cameras, when pushed to take very long exposures ( 3+ minutes ) start to exhibit what is known as long exposure noise. Many cameras have a Long Exposure Noise Reduction setting ( L.E.N.R ) on them which works well, but not quite as well as using the Multiple Exposure Method 1. The L.E.N.R settings are discussed in more detail in the Method 2 Section directly below.

## Method 2 ( Second Best Option ): Single Exposure

Another method for capturing star trail photos is a single long exposure, captured over a few minutes of elapsed time. In most cases single exposure star trails won't be able to transverse the entire composition of the photo. Instead, these star trails will resemble long streaks of light in the sky. Follow these steps to try this method.

1. You will need to turn on your camera's Long Exposure Noise Reduction setting. Find this setting by looking in your camera instruction manual or online. Not all cameras have this setting, but nearly all full frame cameras do.
2. After doing so, focus your lens per the steps in the [Focusing Your Lens at Night Section](#).
3. Next, select your composition and try an exposure time of 3-4 minutes with an ISO of 600-800 and take a picture.
4. If your picture is too dark, increase the exposure time. If your trails aren't long enough, increase the exposure time. This is all personal preference.
5. Increase and decrease the ISO as required if there is too much noise in the photo.

Method 2 is all about trial and error, finding which settings work best and which don't. Eventually you will start to see photos you like!

# Selecting Number of Exposures

## Elapsed Shooting Time

All of the topics covered in the following section are used for shooting with the [Method 1 \( Preferred \): Multiple Exposures](#) skill set since it achieves the best quality photo.

Since your location on Earth, your lens and camera model, composition, and the desired effect ( long or short trails ) will directly effect the number of exposures required, it is impossible to provide a chart showing the exact settings as was done with the 500 Rule above.

The only real way to perfect this skill set is going out and taking practice shots until you get the desired results.

The number of exposures required for star trails directly correlates to the percentage of the composition that is taken up by the night sky.

For example, if your composition is half sky and half foreground, then your stars would have to move across half of your photo to produce star trails across the entire sky.

If your composition is only  $\frac{1}{4}$  night sky, and  $\frac{3}{4}$  foreground, then the stars only have to move across  $\frac{1}{4}$  of your photo. In turn this requires less elapsed shooting time and a smaller number of exposures.

## Methods for Calculating Elapsed Shooting Time / Number of Exposures

1. [PhotoPills](#) provides a nice tool within their application that will allow you to calculate the elapsed shooting time required to capture star trails for a given composition.
2. Another option is to set your camera up [using a timer](#) and let it run for 3-4 hours. No matter your composition, this method will capture enough single exposures to produce some nice star trails. Most likely you will have more photos than required. These can be discarded later on.
3. Trial and Error – After taking multiple star trail images with different lenses and compositions you'll start to get a good idea of what works and what doesn't. This proves to be the best overall method for perfecting star trail photography. This is the method I use most often.

## Camera Timer Settings

All of the topics covered in the following section are used for shooting with the [Method 1 \(Preferred\): Multiple Exposures](#) skill set.

I highly suggest using a camera timer or intervalometer. Otherwise you will be pushing the shutter button again and again for hours. Some cameras have an interval timer mode built into them, this works as well.

After calculating the [elapsed shooting time per the steps above](#), adjust your camera timer to mimic these settings. Input the following settings into your camera timer / intervalometer.



**Exposure Time:** The length of each exposure. For example, you may choose an exposure time of 36 seconds.

**Time Between Each Exposure:** I would suggest using 1 second between each photo. For example, if the time between exposures was 1 second, your camera will take a photo, wait 1 second, then take the next photo. This will continue until your elapsed shooting time ( described below ) has ended.

**Elapsed Shooting Time / Total Number of Exposures:** The total length of time that your camera will be taking photos or the total number of photos you would like your camera to take. Since these are dependent on one another and the time between each exposure, only one needs to be input into your camera timer. For example, you may want to take 100 exposures at 30 seconds each, with 1 second between each shot.

# Editing / Post Processing for Star Trail Photography

After taking some star trails photos using Method 1, you can post process them as described below. I've also provided a video tutorial showing these steps.

1. Load all your images into a RAW photo processor of your choice such as Lightroom or Adobe Camera RAW.
2. Adjust a single exposure out of the series to get the white balance, darks, lights and all of the other settings to mimic what you would like to see in your final image. Now, sync all of your other images to match this image. This is very easy using the "Sync" option in Lightroom after all of the photos are selected.  
⇒ **TIP:** You can use my [Star Photography Lightroom Presets](#) to perform this function with the click of a button. Just select all of the images you would like to process, then click one of my presets, and you're done!
3. Export all of your files to JPEG, TIFF or whatever other format you like.  
⇒ **TIP:** If you choose TIFF and plan to export a few hundred picture files you will need a really fast computer with significant RAM.
4. Layer all of the files on top of each other in Photoshop. Adobe Bridge performs this very well with the "Load Files into Photoshop as Layers" function.
5. Select all of the picture layers in Photoshop except the bottom one.
6. Change the blend mode to lighten for all except the bottom image in the stack.  
[Click for full details on Photoshop Blend Modes](#)
7. You should now see a picture that mimics one long star trail for each star location.
8. After you've blended all of your star trails together using the steps above, compress them into one layer and save the file within Photoshop.

9. Now you're ready to start editing this base image in the manner you choose.

## **Video Tutorial – How to Create Star Trails the Easy Way with Lightroom & Photoshop.**

Learn how to perform all of the basic skills provided above in a free video tutorial.

Click the link below and access this tutorial.

[Star Trails Post Processing Video Tutorial](#)

## Final Words of Advice for Star Trail Photography

The hardest part of star trail photography is calculating the correct length of elapsed shooting time. If your elapsed shooting time isn't long enough, then star trails will not cover your entire composition.

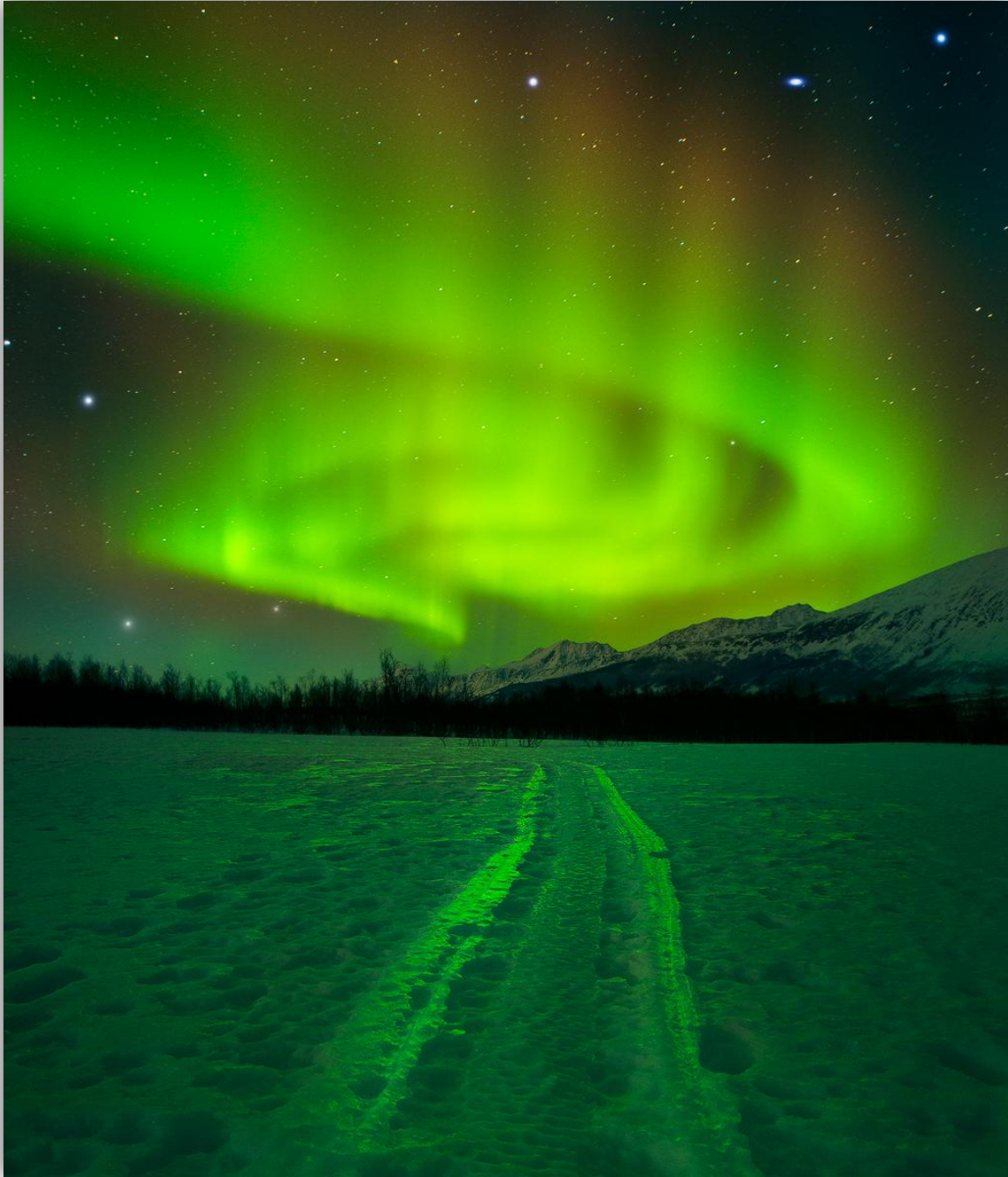
It's always best to take more shots and discard them later than to end up short. It's also necessary to nail down the correct balance between ISO and exposure time. You will improve greatly at both of these skills after one night of shooting.



Star Trails on Second Beach, Washington – Captured with Method 1 as Described Above



# Northern Lights Photography



The Northern Lights Dancing Through the Skies of Norway – f/2.8, ISO3200, 8 Seconds

# Planning

The most important, and often overlooked, step in all of photography is planning and scouting. Reference the In Depth Scouting & Planning Chapter above along with this chapter to get the best results.

## Step 1: Find Dark Skies

Use the steps in the [Scouting & Planning Section](#) of this book to find dark skies.

## Step 2: Find Clear Skies

Use the steps in the [Scouting & Planning Section](#) of this book to find clear skies.

## Step 3: Check the Aurora Activity Level

Next , check the aurora activity for the night of your shoot. There are many different location dependent resources for finding this information. I've provided a few of these below.

The aurora activity index ( [Kp-index](#) ) ranges from 0-9, with 0 being the lowest amount of activity and 9 being the greatest. Kp-index ratings of 5 or greater are considered a storm.

Aim for nights with KP-index of 2 or greater. Otherwise you won't see much of the aurora in the sky.

Provided below are a list of great websites which will help you to learn more about aurora activity and obtain the current forecast.

### [Space Weather Live OVATION Auroral Forecast](#)

This is a really nice visual website which provides the current aurora forecast as well as other interesting facts. This will assist you in capturing a photo of the Northern Lights.

### [NOAA POES Auroral Activity Website](#)

This site provides aurora forecast predictions, as well as basic information, which will allow you to be better informed prior to going out on your shoot.

### [Iceland's Vedur Aurora Forecast](#)

If you're going to be shooting in Iceland this is the site for you. You can also use the aurora activity predictions from this website when visiting Norway, Sweden, Greenland, or anywhere else in the vicinity. Obviously it will be most accurate when shooting in Iceland.

### [Space Weather Aurora Forecast](#)

This is another great website providing the aurora forecast for a multi-day time frame. Space Weather's website is worth spending some time visiting.

# Gear & Equipment

To capture images of the Aurora, there are only 2 minimum requirements. If you would like to capture high quality images, which will look much better in terms of detail and color, then the items in the minimum requirements and recommended gear lists are required.

## Minimum Gear Requirements

1. Camera with Manual Mode functionality. This means you can manually adjust the exposure time, aperture, and ISO settings.
2. Tripod - The sturdier the better. I currently use a Really Right Stuff setup which works great.

## Recommended Gear

Although this gear isn't required it will make your experience, as well as the quality of photos you produce, much better. These are in addition to the items listed above:

1. Full Frame / 35mm Camera with Manual Mode Functionality and high ISO capability. Cameras that handle ISO up to 3000-5000 without producing much noise are recommended.
2. Wide angle lens with a fast aperture. A minimum speed aperture of f/2.8 - f/4 is recommended for photographing the Northern Lights. For full frame cameras it's preferred to have lenses in the range of 14-24mm to capture a wide angle of the landscape and night sky. For crop sensor cameras approximately 10-17mm is recommended.
3. 2-3 fully charged batteries.



# Camera Settings

Since the aurora is dynamic and constantly moves through the sky, your camera settings ( ISO & Exposure Time only ) will also need to be dynamic, changing as time passes. After a night of practice you will be an expert, until then, reference the following settings.

**Camera Mode:** Manual

**Image Format:** RAW

**Metering Mode:** I find Matrix Metering on my Nikon D800 to work the best for night photography. Canon calls this same function Evaluative Metering. As an experiment, when shooting star photography, I tried all the different metering modes my camera has to offer and Matrix clearly won. You should do this experiment as well and see what works best for your camera setup.

**White / Color Balance:** This is all up to you. I like to select the "K" or Kelvin setting and obtain a nice and natural looking night sky color. The best way to do this is trial and error. Lower values of K on your camera will produce cooler blue tones, which seem to look much more natural than the yellow/orange tones that the warmer or higher K values produce. For reference, I find K values of 3500 to 4500 to work best on my Nikon D800. Always remember that you can readjust all of these settings.

**Aperture Settings:** It's very easy to select an aperture when shooting the Northern Lights. Just open your aperture to f/2.8 or as wide as possible if it doesn't go all the way to f/2.8. I don't recommend opening your aperture any wider than f/2.8. With very wide apertures it becomes hard to focus at night.

The key is to allow the most amount of light to hit your camera's sensor in the least amount of time, allowing you to keep your ISO at a lower value and inducing less noise. More on the ISO and noise topic below.

Shooting at f/2.8 your entire landscape will usually be in focus given that it's a vast landscape. If you take a practice shot and your photo is not completely in focus you can use my [Focus Stacking Techniques](#) provided below to obtain overall sharp focus in your images.

**[ISO](#) & [Exposure Settings](#):** I grouped these together due to the fact that you'll need to change them at the same time. These settings directly reflect on one another. After a few hours of photographing the Northern Lights using the skill sets provided below you will easily be able to adjust both of these settings simultaneously, obtaining great results.

## Ask Yourself the Following Questions Prior to Selecting ISO & Exposure Time.

### **Question 1: How Quickly is the Aurora Moving Through the Sky?**

With high level aurora activity the Northern lights can move through the sky with great speed. To capture all of the nice color and detail in this scene, without your photo looking like a "blob of color", you'll need to shoot at a much shorter exposure time than if the aurora was moving slowly through the sky.

**Think about it this way...** If the aurora is moving very quickly through the sky, and you take a 30 second exposure, instead of seeing the instantaneous view that your eyes see, your photo will pick up the entire movement of the aurora through the sky over that 30 second time frame. The detail, color, and light will become the average of the 30 second exposure for each pixel.

As seen in long exposures of water or cloud, all of the colors and movement mix together. This is not the goal for photographing the Northern Lights. We want vivid color and sharp detail.

Keeping your exposure time between 3-25 seconds will work very well for shooting the northern lights. When the aurora is moving quickly, try 3-7 second exposures. When it's not moving as quickly try 10-25 second exposures.

You can increase or decrease these times as you see fit, they are only rules of thumb.

## **Question 2: How Bright is the Aurora in the Sky?**

*This tutorial assumes that you are already well versed in the basic technical aspects of the photography histogram. If you would like to brush up on your histogram knowledge prior to reading the rest of the tutorial, Ken Rockwell's Website provides some great explanations for both [Color Histogram](#) and [Luminance Histogram](#). I will refer to each below.*

Since the aurora changes color, speed, and brightness throughout the night, you'll also need to constantly adjust your camera settings to match this dynamic situation.

All of the other settings have now been adjusted. It's time to select an ISO value.

Since ISO is the sensitivity of your camera's "film", or in these days sensor, increasing your ISO will also increase the brightness of your image provided none of the other settings are changed.

Follow these steps and select an ISO value:

1. Start out shooting with an ISO of 400-800 and take a practice shot.
2. If your practice shot wasn't bright enough, increase your ISO to approximately 1200 and take a practice shot.
3. If the photo still isn't bright enough, continue to increase your ISO until it is. I usually shoot in the ISO range of 800-4000.

Your image should not be well exposed (in terms of the histogram), you are shooting at night, so the image can also be dark. You can bring out most of this dark detail in Photoshop.

Always watch your histogram to make sure you're not losing any dark detail off of the left-hand side or "blowing out" any highlights, meaning the histogram isn't dropping off the right hand side.

Let's look at and analyze a few example images so you can see exactly what I'm talking about.

The following images are straight out of my camera ( RAW Files ), and exported to JPEG format for display. This is how the images looked on the back of my camera screen after taking them.



## Example 1: Overexposed Image



Camera Settings: f/2.8, ISO2500, 10 Seconds

When you're taking photos of the aurora it's very important to watch your Color Histogram even more than your luminance histogram. It is very easy to "blow out" or overexpose the **green channel**, which makes your photo lose color and detail. This can be seen in the Green Channel Histogram above.

When photographing the Northern Lights it's better to underexpose the photo as not to blow out the **green channel**.

Watch the Luminance Histogram to make sure you're not blowing out or overexposing the photo as a whole.

## Example 2: Well Exposed Image



Camera Settings: f/2.8, ISO2000, 10 Seconds

The image above is what most would call well exposed. All of the color channels and luminance channels fall within the left-hand and right-hand bounds of the histogram. This means we're not losing any detail in the dark areas or blowing out in highlights in the light areas.

This photo would work very well in post processing as I'll teach you below.

Can we improve this image? YES! It can easily be improved upon. I'll show you why in the next example.

### Example 3: Optimally Exposed Image



Camera Settings: f/2.8, ISO1000, 10 Seconds

Many would say this image is underexposed and much too dark. I disagree! This is exactly the image I was looking to capture.

Here's Why:

1. The aperture was at its widest possible setting allowing the most amount of light to be captured by the camera's sensor in the least amount of time.
2. The exposure time of 10 seconds was the longest I could go while keeping nice detail in the Northern Lights.

3. I managed to drop the ISO by half ( compared to Example 2 ) from 2000-1000 which keeps the noise much lower.
4. Looking at the color and luminance histograms to the right-hand side of the photo we can see that no dark details were lost and no highlights were overexposed.

## **Why is this the Optimal Image?**

Five years ago this image would have been too dark and Example 2 would have been preferred! New full frame digital cameras such as the [Nikon D800](#) / [D810](#) can easily recover up to 4 stops of light from nearly any image. This means that you no longer have to "bracket" photos, taking multiple exposures of the same composition to compensate for dynamic range.

The only time it's necessary to bracket photos ( for the Nikon D800/D810 Cameras noted above ) would be cases where the scene being captured had a dynamic range of greater than 4 stops. This is rarely the case for landscape photos and never the case for night photos.

I can take a photo such as the one above, and using the exposure slider within Lightroom, brighten the entire photo up 4 stops prior to seeing any noise being induced in the photo.

I will process my single RAW file ( in Lightroom ) for one part of the photo, export it, then process the same RAW file for another part of this photo and export it.

[Click Here for an Example Video Showing the Concept Discussed Above](#)



These two exported files can be blended together in Photoshop to create a nicely exposed overall image. I call this technique [Double Processing and provide a video on it above](#).

The goal is to know the limits of your camera / lens, and take advantage of what they can do!

Rarely is there a need to take bracketed photos anymore ( for night photography ), all the data/detail is there, we just need to bring it out in post processing!

## Action Required – Test Your Camera Setup

All photographers should do this test & see how many stops of light/data their cameras can recover in post processing.

This trick / test works well for both night or landscape photography and will reduce the number of photos you need to capture in the field. The results are amazing!

Here's How:

1. Take your camera outside on the next sunny day and take a shot towards the sun. Also, include a landscape or subject in the foreground.
2. Expose the photo for the sun only, ensuring it isn't blown out. The rest of the photo will appear very dark / or even black in your preview screen.
3. Take this photo and load it into Lightroom or any other RAW file processor.
4. Using the Exposure / Brightness adjustment slider, increase the brightness of the entire photo until you start to see the image degrade in the darkest areas of the photo. This image degradation will come in the form of noise, or a slightly magenta/green color cast.

5. At this point, check your exposure slider to see how many stops of brightness you have increased this photo.
6. Make a mental note of this value.
7. Now you know how much light / data you can pull out of a single RAW file!

## **Bracketing and taking multiple exposures makes photography much more complicated when it isn't necessary!**

Next time you're out shooting, expose for the brightest parts of the scene. Now you know how many stops you can recover in post processing!

When in doubt, take an extra shot, increasing the exposure by the number of stops which you calculated above.

This method cuts down on the number of photos you need to take, and makes life much easier when shooting and editing your photos!

Now that you rarely have to take multiple exposures for dynamic range, doesn't mean you shouldn't be taking multiple exposures for [depth of field](#). If you need an extra exposure to create an overall better quality photo, by all means take it!

## **Less digital storage space, more efficiency, overall better photos!**

## Final Words of Advice for Photographing the Northern Lights

The only guaranteed way to become good at anything is trying it for yourself and seeing what works. After a few nights practicing under the night sky you will easily grasp each of the concepts discussed above.

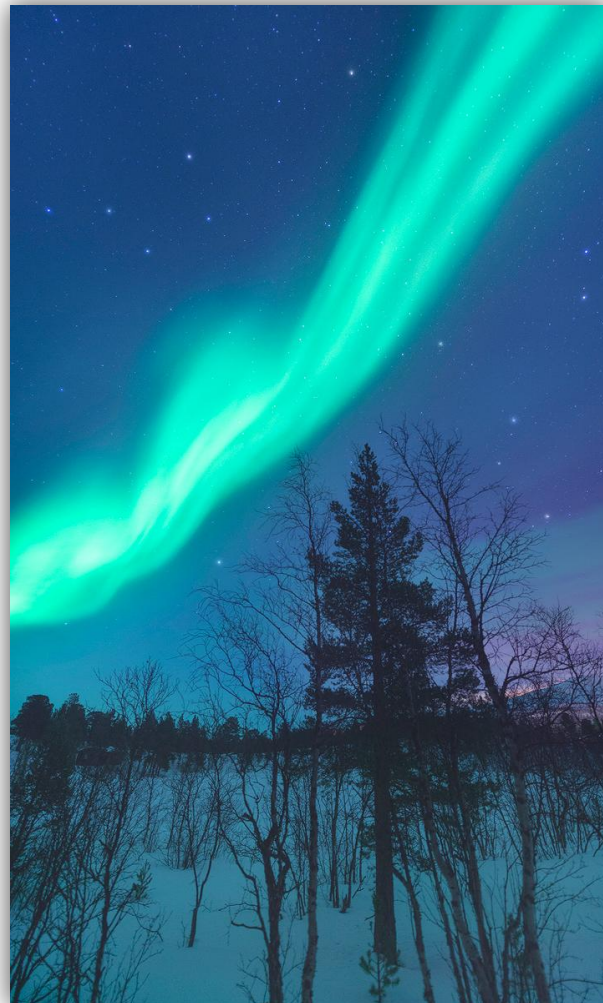
Remember, never increase ISO to obtain a brighter image prior to opening your aperture to the widest possible value ( f/2.8 works great ) and dialing in the maximum exposure time while maintaining nice detail in the Northern Lights.

**Increasing ISO degrades image quality, adjusting aperture and exposure time do not!**

# How to Edit / Post Process Your Northern Lights Photos

Now that you have captured some awesome images of the Northern Lights it's time to edit those images in Lightroom ( or Adobe Camera RAW ) and Photoshop. I've provided another tutorial on this topic which includes a free video, click the link below to watch!

[Click Here & Watch the Free Video Tutorial](#)



The Aurora Dances Near Abisko Sweden – f/2.8, ISO2000, 10 Seconds



# Moon Photography



The Super Moon Rising Over Seattle – Time Lapse Blended into Still Frame || f/8, ISO800, 4 Seconds  
for Moon Exposure & f/8, ISO250, 20 Seconds for City Exposure

## Gear & Equipment

You can photograph the Moon with almost any equipment. It all depends on the look you're going for. For those that would like to capture detailed pictures of the Moon's surface with close up views, a lens of 200mm or greater is recommended. If you would like the Moon to be a small glowing dot in the sky, use a wide angle lens.

### Minimum Gear Requirements

1. Tripod, the sturdier and taller the better.
2. A Camera with Manual Mode functionality.
3. A lens that will provide your desired look and feel to the photo. More on this below.

# Camera Settings

To be clear and concise for Moon Photography camera settings, they have been provided in a list below. You may have to jump back and forth between this section and the ones below it to get the best understanding.

Some of these settings are the same as they were for the other chapters. I've provided them again for ease of reading.

Each of the titles below has been hyperlinked to the sections of the book or locations online which describe them. If you're not exactly sure what the main titles mean, click for full definitions.

[Camera Mode](#): Manual

[Image Format](#): RAW

[Metering Mode](#): I find Matrix Metering on my Nikon D800 to work the best for night photography. Canon calls this same function Evaluative Metering. As an experiment, when shooting star photography, I tried all the different metering modes my camera has to offer and Matrix clearly won. You should do this experiment as well and see what works best for your camera setup.

[White / Color Balance](#): This is all up to you. I like to select the "K" or Kelvin setting and obtain a nice and natural looking night sky color. The best way to do this is trial and error. Lower values of K on your camera will produce cooler blue tones, which seem to look much more natural than the yellow/orange tones that the warmer or higher K values produce. For reference, I find K values of 3500 to 4500 to work best on my Nikon D800. Always remember that you can readjust all of these settings.

**Focal Length:** For Moon Photography any focal length will work. For larger focal lengths you will have to decrease your exposure time to compensate for the Moon's movement across your lenses' field of view. For example, when zoomed in at 400mm, the Moon will very quickly move across your composition, but at 14mm it would take hours for the Moon to move across your composition.

**Focus:** Focus at infinity per the [Focusing at Night Chapter](#) above. If you really like something in the foreground then take two shots. One to capture the Moon and a second to capture the foreground. I cover the later of these skills in the [Advanced Night Photography Skills Chapter](#) below.

**Aperture:** f/2.8 – f/11. If you're going to shoot the Moon included with a broad landscape on a wide angle lens such as a 14-24mm, then it's possible to use lower aperture values in turn lowering your ISO. For wide angle shots of the Moon apertures from f/2.8 to f/8 will work great.

For zoom shots of approximately 200mm or greater it will be necessary to photograph at f/8 to f/11 ensuring all of the Moon's detail is captured. It's all about experimenting and finding what works best for your specific compositional and lighting situation ( along with your camera make and model ). There isn't a right or wrong aperture setting to use here. It's all about obtaining the results you want. In depth understanding of Aperture, ISO, and Exposure Time will be required to capture quality images of the Moon.

**Exposure Time:** Your exposure time directly depends on the lens you will be shooting with. When shooting with zoom lenses of 200mm or greater you will have to decrease your exposure time and increase your ISO to compensate for the Moon's movement across your composition. For example a 30 second exposure taken at 200mm would show the Moon as a complete blur across the sky. Exposure time se-



lection is all about experimentation. We will cover this in the [Selecting ISO & Exposure Time](#) chapter below.

**ISO:** ISO for Moon Photography all depends on how much ambient light is present in the scene. It also depends on the lens you're shooting with. When shooting with zoom lenses of 200mm or greater you will have to increase your ISO significantly allowing you to decrease exposure time and capture all of the Moon's detail. When shooting with wide angle lenses it's possible to keep your ISO much lower. We will cover this below.

## Selecting ISO & Exposure Time

Selecting exposure time for Moon Photography all depends on the look you're going for. Using the following steps you can narrow down an exposure time and start capturing some nice image of the Moon. You will have to jump back and forth between your exposure and ISO settings while performing the following tasks.

Since the dynamic lighting situation for Moon Photography is always changing it's impossible to provide exact settings in the following section. What has been provided is a descriptive thought process which will point you in the right direction.

The goal is to keep your ISO low ( reducing noise ) while simultaneously keeping your exposure time short enough that the Moon isn't seen moving through your photo. For those shooting with wide angle lenses it will be much easier to find an exposure time. The Moon won't appear to move as quickly across wide angle photos. For those shooting with zoom lenses, it will be slightly harder to narrow down your ISO and exposure time.

## Selecting Exposure Time

Find your focus and composition as taught in the [Focusing Your Lens at Night](#) and [Finding Composition](#) chapters of this book. Next, follow these steps:

1. Select a focal length.
2. Select an aperture setting per the [Camera Settings](#) section above. You may have to tweak these while selecting ISO and Exposure Time given the image doesn't have enough detail. Especially for close crop compositions using zoom lenses.
3. Set your ISO to 1000. This is only a practice shot. Using an ISO of 1000 should ensure that your image is bright enough to follow the next step.
4. Now select an exposure time. Since I don't know the exact situation which you're shooting it's impossible to give precise numbers. The goal is to select an exposure time where the Moon is sharp and doesn't move across the composition. Start out at an exposure time of 15 seconds as a baseline.
5. Take a practice shot per the steps above. Just remember this step is only determining exposure time. Don't worry about how bright or dark the image is. So long as you can see the Moon, it's okay.
6. If the Moon in your practice shot is blurry, decrease your exposure time by half and take another practice shot. Continue to do so until the Moon is sharp and doesn't move across the sky in your photo. Experiment and see what works.
7. If the Moon is sharp and not shown moving across the sky, increase your exposure time to the maximum amount possible prior to seeing the Moon become blurry.
8. Use the methods in the steps above to narrow down your exposure time until your exposure times are the longest possible, without the Moon moving across your composition or becoming blurry. This exposure time will change if you change focal lengths.

9. Now you have found the maximum exposure time which you can shoot for a given focal length and still capture a sharp photo of the Moon.

## Selecting ISO

All of your other settings have been determined, it's time to select an ISO value. Just as we discussed in the Milky Way Photography Tutorial, ISO is the only noise inducing camera setting. This is why it's always best practice to select ISO last.

Your other settings should still be the same as we had found in the Selecting Exposure Time section above. Follow the next steps to select your ISO:

1. Readjust your ISO down to 100.
2. Take a practice shot.
3. If your shot isn't bright enough, increase your ISO until it is.
4. You should only increase your ISO until the Moon in your photo is well exposed. Watch your histogram ensuring that no parts of the Moon are blown out. Other parts of the photo may appear very dark. The goal here is to capture the correct exposure of the Moon. This is especially important for focal lengths and lenses of 200mm or greater.
5. If your ISO is too high and induces too much noise, it may be necessary to open your aperture to a wider value. Wider means the number under the "f" in the aperture setting is getting smaller.
6. Experiment by dropping your ISO and your aperture until you're starting to get shots you like per the steps above without much noise.

## Final Words of Advice for Moon Photography

More than any of the other sections in this book, Moon Photography will require a great amount of experimentation. Having an in depth understanding of Aperture, ISO, Exposure Time, and how they directly reflect on one another will be key to capturing some nice images of the Moon.

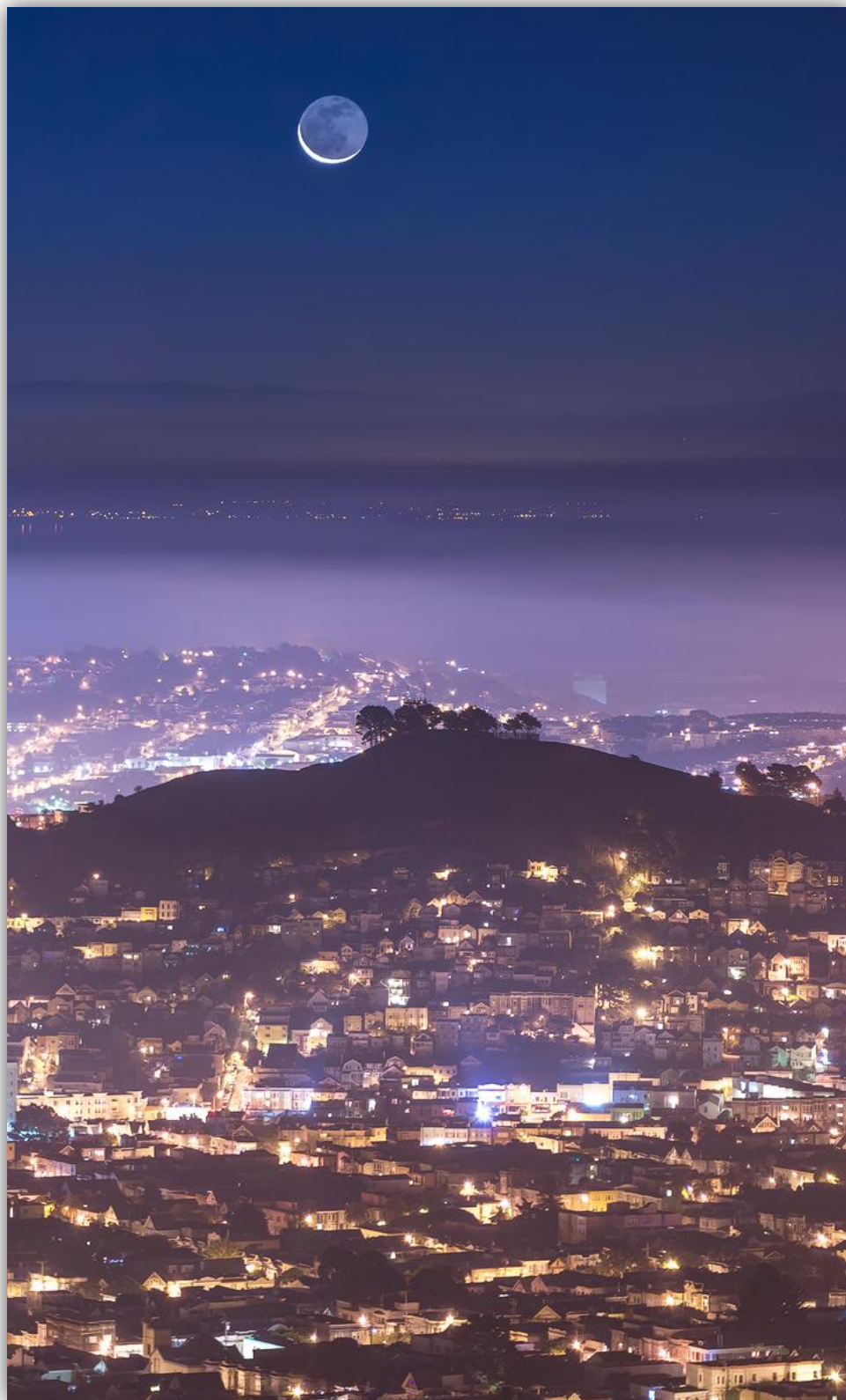
Always remember, ISO is the only noise inducing setting, so always select this last. Only compensate with higher ISO as your last resort!

After a night or two photographing the Moon, using the steps above, you will easily understand all of the skill sets required and start to capture some amazing images.

As for everything photography related, experimentation is key! Learn the key concepts, find out what works best for you, and continue to improve upon and tweak this process until great images are being produced.

You can combine the skill sets from this chapter with the [Exposure Blending](#) and [Focus Stacking Techniques](#) provided below to obtain the best results!





The Crescent Moon Rising Over San Francisco at Twilight – f/8, ISO1000, 2 Seconds

# Twilight Photography

Shooting at twilight can provide some of the best color and light out of the entire day. Whether you're looking for a dark and moody shot with cool blue tones and twinkling stars in the sky or bright vivid pastels that evoke emotions of the new day, shooting at twilight provides more color and variety than any other shooting time.

There aren't any given rules or guidelines for shooting at twilight such as were provided in the sections above. Instead you will have to mix and match all of the skill sets taught in the Milky Way Photography, Star Trails Photography & Moon Photography chapters to capture some beautiful twilight images.

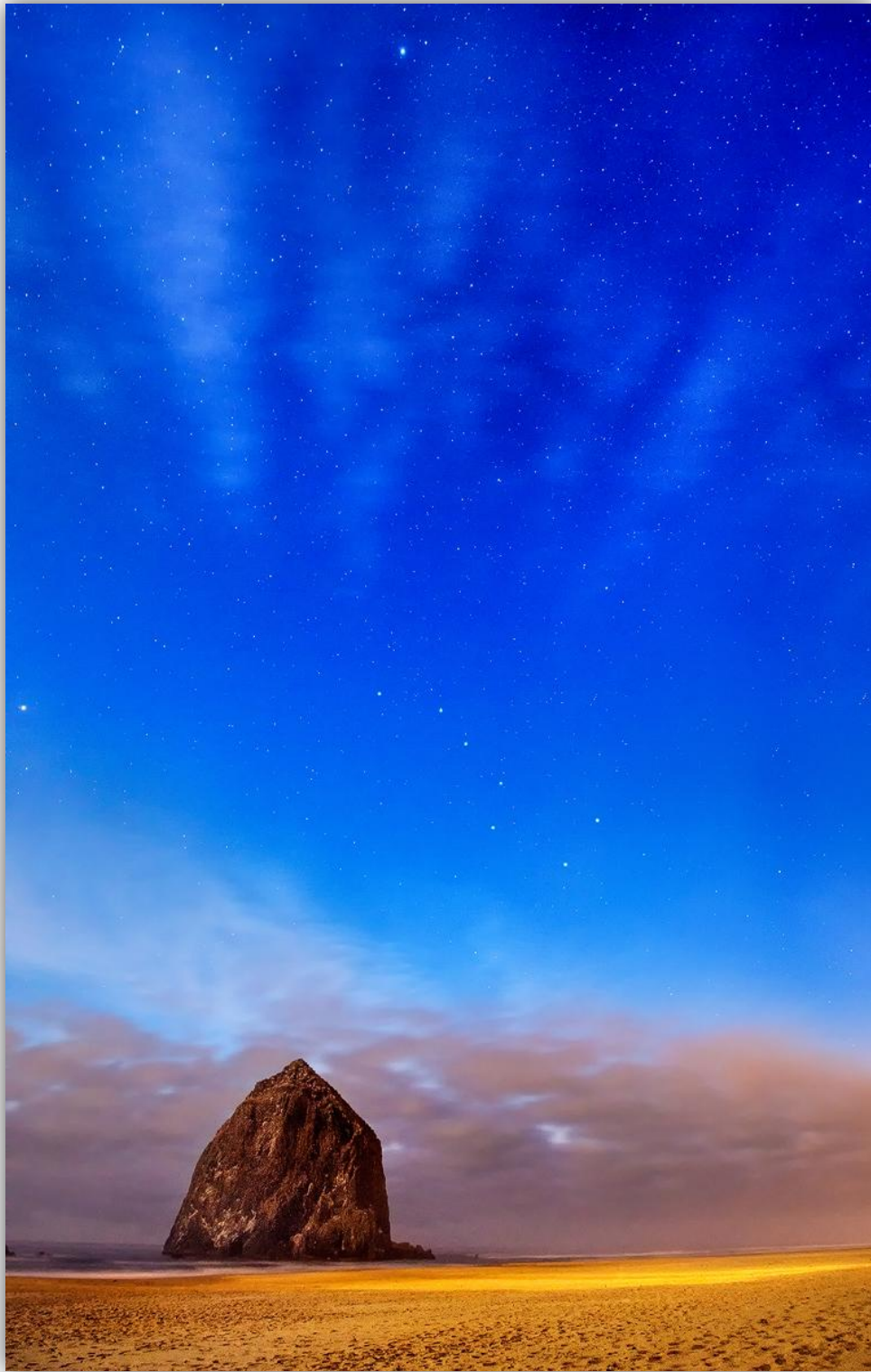
For in depth explanations of the following twilight hours reference the [In Depth Planning & Logistics Chapter](#) above. Twilight happens twice every day, once before sunrise and once after sunset.

## Astronomical Twilight

During astronomical twilight the sun is still 12 - 18 degrees below the horizon. During this time it's very hard for our eyes to see much color on the horizon and twinkling stars will still be seen in the sky.

This is a great time to capture moody shots which still exhibit small stars and faint morning light. Although your eyes can't see the color and light of the coming day yet, a camera can usually pick it up with a long exposure.

Moonlight may also add some extra detail to your images during the Astronomical Twilight Hours as has been exhibited in the following photo.



The Big Dipper Under a Crescent Moon – Oregon | | f/4, ISO800, 28 Seconds

## Nautical Twilight

During Nautical Twilight the sun is 6 - 12 degrees below the horizon and it is still fairly dark outside. Most stars can still be seen in the sky during this time and some color is present in the form of blue and purple hues.

Nautical twilight is a great time to start capturing long exposure photos without having to use a neutral density filter.



**A Cormorant Fisherman in the Rainy Twilight – Xingping, China | | f/2.8, ISO4000, 0.5 Second**

As seen in the photo above, Nautical Twilight may cause you to push your camera to its limits. In this photo I had to increase the ISO & drop the exposure time to  $\frac{1}{2}$  second which allowed me capture the raindrops in the early morning light.

The beautiful blue hues of the twilight hours were used to compliment the yellow and orange flame. We discussed this topic in the [Color Transitions](#) section above.



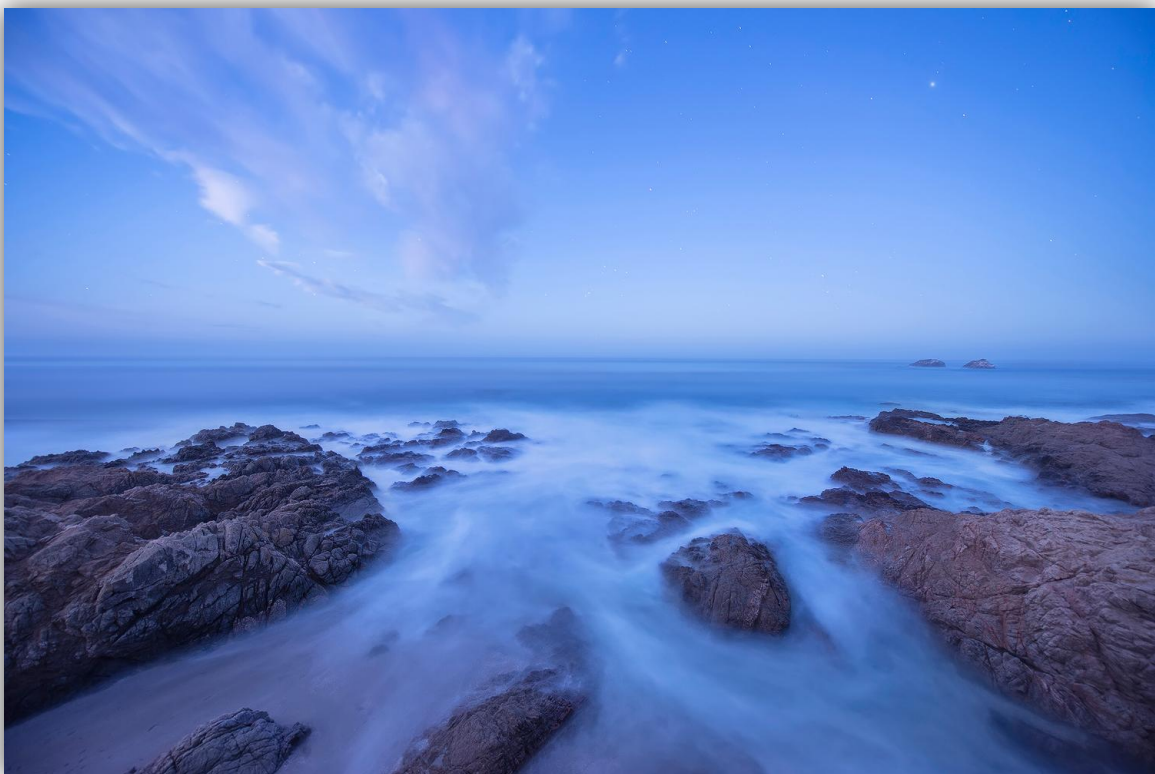
## Civil Twilight

During Civil Twilight the sun is 0 - 6 degrees below the horizon. This is usually a great time to capture warm, pastel colors which are also mixing with the cooler tones of Nautical Twilight. During this time of day a few stars may still be seen in the sky.

Taking multiple exposures during this time of day and blending them together using the [Exposure Blending Techniques](#) provided below will provide some amazing color and detail to your photos.

I'll often capture the twinkling stars during Nautical Twilight. Later I'll capture another shot of the entire landscape during Civil Twilight. This may require you to leave your camera and tripod in the same location for a while, so planning is key!

These two exposures can be blended together in Photoshop for a great overall result.



Stars Twinkle During Nautical Twilight in Big Sur, California – f/2.8, ISO800, 30 Seconds





A Moody Civil Twilight – Reykjavik, Iceland | | f/8, ISO 160, 35 Seconds



Just Before Sunrise in San Francisco, California – f/8, ISO160, 40 Seconds



Twilight Fades Over Godafoss in Iceland – f/8, ISO250, 15 Seconds for Landscape and f/8, ISO800, 0.5 Seconds for Foreground Water Detail

# Advanced Night Photography

## Skills Sets

*“There is no man living that can not do more than he thinks he can.”*

*Henry Ford*

Mastering the basics taught above is recommended prior to learning the advanced techniques provided below.

Each of these skills sets can be applied to any type of night photography. You can also apply Focus Stacking and Exposure Blending concepts to landscape photography

Please note, if you decide to apply them to your landscape photos, the camera settings will not be the same as they would be for night photography.

### Focus Stacking

Many landscape compositions have a very long depth of field, meaning there is an immediate foreground subject as well a background that extends as far as the eye can see.

For such a scene [focusing near infinity](#), as discussed above, may not work. You will find that when focused at, or near infinity, the subject in the immediate foreground will not be perfectly focused.

To ensure your entire scene is focused it will be necessary to take two exposures with the exact same settings, but different focal points. Here's How:



1. First take a photo focused near infinity as discussed in our [Methods for Focusing at Night Section](#) above.
2. Second, refocus your lens on the immediate foreground subject and take another photo.  
⇒ **TIP:** Shine a flashlight or headlamp on your immediate foreground subject that you're focusing on. Now you can use your Live View Mode ( zoomed in ) to focus on the subject that's illuminated by the light. Upon focusing, turn your light back off and take the photo. Usually, there isn't a reason to change any other settings on your camera, less your focal point. See the [Light Painting Chapter](#) for more details.
3. Upon taking each of these exposures, load them into Photoshop and blend them together. These skills are taught in the tutorial provided below.

## Video Tutorial – Focus Stacking for Landscape Photography

My free video tutorial will provide you with an in depth understanding of focus stacking. Click the link below and access the tutorial.

[Focus Stacking for Landscape Photography](#)

## Exposure Blending

The 500 Rule is only necessary because the stars are moving relative to us here on planet Earth. If we ( the Earth ) moved at the exact same rate as the stars, the 500 Rule wouldn't be necessary and our cameras could take much longer exposures and never exhibit star trails.

Since the ground / landscape we are taking photos of is not moving relative to us, we really don't need to use the 500 Rule to capture the entire photo, only the sky and stars.

For this reason Exposure Blending works very well to obtain higher image quality in the ground / landscape portion of night photos.

Here are the steps required for Exposure Blending:

1. Once you're done capturing the [Milky Way](#), [Star Trail](#), or sky portion of your composition, leave the focal point and focal length as they are.
2. Re-adjust the exposure time, ISO, and aperture, allowing you to take a long exposure of the landscape. At times I'll use a 3-4 minute exposure to capture the landscape at a much lower ISO ( ISO 300 - ISO 800 range ) and a slightly higher aperture ( f/3.2 –f/4 range ). This will keep the photo from having high levels of noise induced by the high ISO settings used to photograph the Milky Way or Star Trails.
3. Now that two photos have been taken, one for the sky and one for the landscape, they can be blended together in Photoshop to achieve a much higher quality image. I cover these Blending Techniques in my Star Photography Post Processing Video Tutorials. Once you have mastered this skill you can combine it with the [Focus Stacking](#) techniques provided above to achieve ultimate image quality.



## Light Painting

Light painting uses external light sources providing light to objects in your photo composition that you would like to stand out. These objects would otherwise be so dark that the camera could not correctly expose them.

When done correctly, light painting can work very well. When done incorrectly, light painting can look unnatural and ruin the photo.

Light painting is not something that should be used on every photo, but in specific cases it is required. It's up to you as the photographer to decide when it should or should not be used.

You can use any source of artificial light to perform the task. I've found that headlamps or flashlights work the best.

Since there are so many different variables in the subjects and scenes that can be light painted, experimentation is key. After using this technique for 2 years it still takes me a few minutes to correctly light paint a subject to my liking.

It looks nice to go for a natural feel so the subject has enough detail, but isn't so bright that the viewer can tell it has been painted with light. Finding this balance can be difficult at first, but will become much easier with practice.

## Tips & Tricks for Light Painting

- Instead of shining your light source directly on the object in which you would like to light paint try this method instead. Hold one hand above your head with the palm of your hand facing the subject which you would like to light paint. Hold the

light source in your other hand and shine it at the open palm of your hand. In turn the light will reflect off the palm of your hand onto the subject which you want to light paint. This gives a more natural feel to your photos since there isn't harsh light shining on the object. This method still takes some practice, but it's much easier than the direct lighting method.

- When holding the light source in your hand per the bullet above, moving the light back and forth across the subject will allow it to look much more natural. I've found that holding the light in the exact same place over the entire exposure also makes the subject too bright. As the title "light painting" suggests, you should move the light back and forth to "paint" the subject.
- Light painting subjects in the immediate foreground can be used with the [Focus Stacking Technique](#) to provide a sharp and well exposed image.
- It's not always necessary to light paint the subject over the entire exposure. When taking Milky Way photos at very high ISO ( 2000 – 6500 ) you may only need to light paint the subject a quarter to a half of the total exposure time.
- When light painting a subject that is further away, it may not be necessary to shine the light off your hand as described in the first bullet. Far away subjects may require full light painting. Try shining your light directly on far away subjects.
- Moonlight also works very well for light painting. It provides soft and natural glow that can't be matched by any artificial light source. Since moonlight is not photographer controlled much more planning is required. This is why artificial light is usually preferred. Reference my [free planning video tutorial](#) for in depth instructions on preparing for these conditions using the Photographer's Ephemeris.

# Panoramic Images

Panoramic images are a great way to show a field of view larger than a single exposure with a wide angle lens can capture. You can use the following panoramic methods to create images that encompass up to a complete 360 degree view of your surroundings. Panoramic images are also referred to as “Panos”.

The larger the field of view the harder it becomes to effectively capture these images and make them look realistic.

## Shooting / In the Field

Panoramic images are a subject that require a great deal of practice and previsualization. You can make an image look like something truly unique by previsualizing what your desired final outcome will look like.

Unlike conventional single frame photography, you won't be able to preview what your pano will look like on the back of your camera screen. That being said, practice makes perfect!

You can follow my simple methods below to start capturing and creating panos on your next shoot:

1. Determine the scene you want to capture as a panoramic image.
2. Level your tripod so you can swivel the camera on it, keeping it completely level the entire time. It helps to have a head that provides 360 degree rotation in a single plane. Using a head like this will keep your camera lined up along the same horizontal or vertical plane, and make the photos much easier to stitch together in Photoshop. I use the Really Right Stuff BH-55 Ballhead.

3. Capture all of the images which you want to be a part of your pano providing a 25-30% overlap for each image. It's also best practice to capture some area around the outside of the pano that you don't plan on using in the final image. This will provide some "wiggle room" in case a mistake is made. After a few tries you'll have this technique down.
- ⇒ **TIP:** I've tried smaller overlaps such as 10%, and it becomes much harder to control these images when blending them together. This is why I suggest the overlap noted above.

## Video Tutorial – Create Panoramic Images in Lightroom & Photosthop

After you've captured some images in the field you can use the following video tutorial to stitch these images together in Photoshop and create a panoramic image. I'd recommend watching this video prior to going out to shoot as well since some tips on shooting are provided within. Click the link below and access the video.

[How to Create Panoramic Images in Lightroom & Photoshop](#)



# Example Photos, Camera Settings & Discussion

Click on any of the following photos to see them full size online in my [Portfolio](#).

## Not of this World – Crater Lake, OR



This photo was created from 4 different exposures, all taken with my tripod in the exact same location. Each shot was captured at 14mm on a Nikkor 14-24mm f/2.8 lens.

The first two shots are for field of view. Since the entire Milky Way and massive Crater Lake wouldn't fit within a single frame of the Nikkor 14-24mm lens I had to improvise using a [two shot vertical pano](#).

First, I took a shot of the top half of the frame which included the horizon and the night sky. Next, I took another shot with the composition pointed downwards capturing the horizon, entire crater, and foreground. Both of these shots were taken with the camera in the landscape / horizontal position.

These two shots were focused at or near infinity to capture a broad range of focus.

The settings for these first two shots were ISO 3200, f/2.8, and exposure time of 30 seconds capturing the Milky Way and distance landscape.

Since there is also immediate foreground detail in this scene, two more exposures were required for depth of field and image quality.

To capture these next two shots for the immediate foreground I dropped the ISO to 800 and increased the exposure time to 2 minutes while the aperture stayed the same at f/2.8. In turn, I was able to capture the foreground detail without inducing much high ISO noise.

The first of these two shots was focused at the closest green plant. The second was focused a bit further back at the rocks which jut out into the scene.

Each of these 4 exposures were lined up in Photoshop and hand blended to achieve the final result, which is shown above. This procedure involved some of the techniques provided in the [Focus Stacking](#) and [How to Create Panoramic Images](#) chapters of this book.

## Shoot Me to the Stars – Mount Rainier, WA



This was a slightly easier photo to capture than the one mentioned above. It is composed of 3 separate exposures, all of the exact same composition. Each exposure was taken at 14mm.

The first exposure was taken for the entire landscape, mountain, stars & Milky Way galaxy at ISO 5000, f/2.8, and 30 seconds.

I focused on the abrupt transition from the mountain to the sky as taught in my [High Contrast Focusing Methods](#) section above. In doing so, the entire landscape came out sharp in the final image.



The next two exposures were taken at the same settings to capture the two shooting stars seen on the left and right-hand sides of the photo. This took a few hours to capture since just the right timing was required.

All three images were then processed in both Lightroom & Photoshop using my unique post processing and luminosity masking techniques which are described in my Star Photography Post Processing Video Tutorials.

## The Last Drop – Palouse Falls, WA



The image above was not a technically challenging image to take, but the planning required was fairly advanced. The image comes from a single exposure taken at ISO 3200, f/2.8, and 30 seconds at 14mm.

I had tried to shoot the same scene before, but the entire waterfall was completely dark and didn't stand out well. How to combat this? A flashlight wouldn't work since the scene is much too vast.

Moonlight it is! I timed this shot as the Milky Way rose behind the falls while the Moon simultaneously rose in the opposite direction. Since the Moon was less than a



quarter full it nicely illuminated the falls, but didn't shine bright enough to block out the Milky Way.

Looking closely you can see that the Milky Way is dimmer than in most of my other photos. That's due to the fact the Moonlight added some additional brightness to the sky.

I used the [Photographer's Ephemeris](#) to plan this shoot along with the methods shown in my [Planning for Star, Milky Way & Night Sky Photography Video Tutorial](#).

## The Photographer's Apprentice – Mount Rainier, WA



The shot above comes from a [10 shot panoramic](#) captured at 14mm for each exposure. These 10 shots were [blended together in Photoshop](#) to achieve the result seen above. The settings for each shot were ISO 1000, f/2.8, and 30 second exposure time.

Since the Moon was rising and the Milky Way wasn't visible I wanted to add an extra element of "interestingness" to the photo. At first this was hard to come up with, then I saw the Moonlight reflection in the bottom left-hand corner of the photo.

To my surprise the Moonlight was strong enough to cast my shadow down by the lake. I didn't plan for this; it was purely luck, the right time and the right day. This only goes to show that planning has its advantages, but constantly going out to shoot can leave you with images you didn't plan for & enjoy just as much! Never stop exploring!

## Become Your Dreams – Olympic National Park, WA



Olympic National Park is one of the darkest and most photogenic locations in the United States, if not the world.

This specific night started out cloudy, rainy, and stormy, but close to sunset things started to clear. As the day faded, the stars came to life.

My goal was to [capture the Milky Way](#) as it rose over the Pacific Ocean, as though it were confronting the massive sea stacks seen on the beach. These sea stacks are huge when standing next to them, but dwarfed by the Milky Way and night sky.

This shot comes from [2 separate exposures of the same composition](#). One shot was taken to capture the sky and stars at ISO 3200, f/2.8, and 25 second exposure time.

The next shot was captured for the foreground reducing the noise with a lower ISO setting. The foreground was captured at ISO1000, f/2.8, and a 2 minutes exposure.

These two exposures were then processed in Lightroom & Photoshop using my post processing and luminosity masking techniques which are taught in my [Star Photography Post Processing Video Tutorials](#).



# In Closing... As the Sun Rises

First off, thank you for reading. It means so much to me!

Over the past year it's been a dream of mine to write this book allowing anyone and everyone to bridge the unknown and explore the great, and somewhat alien, worlds that come to life after the sun sets.

For many, this experience can seem almost unobtainable without a small stepping stone into those strange worlds beyond. From an outside perspective, the concepts behind astro-photography seem overly complicated and daunting to try for the first time. In reality this is not the case. Any goal can be accomplished when performed in a step by step and systematic manner as provided above.

As artists we must master the skill in which we use to create. Each time we learn something new, we grow a bit closer to our goal, that vision, that dream inside our heads of the art we want to produce.

Allowing mass opinion to cripple our creativity with pre-defined awards ( bragging rights ) and place an established value on the beauty we create is giving away our path to the stars, to our dreams, and most of all our path to create something new, something beautiful, something that cannot be defined by words, actions or ideas that the human mind has yet conceived.

You've Mastered the Skills

Become Your Dreams, Go Create!

# Photography Tutorials, Workshops & Useful Links

Provided below are a selection of my favorite free / paid tutorials, workshops, and other helpful information which can be found on my website.

For an up to date list of all the tutorials contained on my website check out the following link.

[www.DaveMorrowPhotography.com/LearnPhotography](http://www.DaveMorrowPhotography.com/LearnPhotography)

## Star Photography Workshops & Tutorials

- [Dave's Free Milky & Star Photography Tutorial](#)
- [Star Photography Workshops & Tours](#)
- [Online Star Photography Post Processing Group Workshops](#)

## Dave's Favorite Video Tutorials

- [Dodging & Burning in Photoshop Using Luminosity Masks](#)
- [Dave's Learn Photography YouTube Channel](#)
- [Focus Stacking for Landscape Photography Photoshop & Shooting Tutorial](#)
- [Perspective & Panoramic Blending for Landscape Photography \(Shooting & Photoshop Tutorial\)](#)

## Reviews / Equipment

- [What's In My Camera Bag?](#)
- [Using Your Nexus 10 or Nexus 7 to Transfer Picture Files from Your Camera's Memory Card to an External Hard Drive](#)



# Night Photography Camera & Lens Suggetions

Full frame or medium format cameras ( 35mm sensor and larger ) offer the best photo quality for night photography. You can also shoot with a crop sensor camera, but it will not capture the same quality results as using a full frame. I highly recommend the full frame options, but have provided some crop sensor options as well.

Full detail on the topics of cameras and lenses are covered in the tutorials above since different equipment is preferred for each. If you're not sure what camera / lens setup to use, come back and reference this section upon reading these tutorials.

I've shot with the following cameras / lenses and found them to work well for night photography. **There are many other equipment options, but I have not personally tested them out as of yet so I won't recommend them below.**

Although new cameras will come out every year, this doesn't make the performance of the following cameras degrade or change at all. The Nikon D8\*\* series is the best all around night photography camera body I've found. The D8\*\* series will still continue to be a great night photography camera for the next 5-8 years from now ( 2015 ) even as new cameras hit the market. This goes for any camera listed below. Just remember a newer model in the stores doesn't change how your current camera performs!

***Disclaimer:** The following along with other equipment links in this book are affiliate links to B&H Photo. This is a company I trust, and also where I buy all of my cameras, lenses, and other equipment. There are also affiliate links to iTunes and Amazon within this book. An affiliate link will not increase the price of the equipment, but provides me with a small profit of any sale made.*

## Nikon Full Frame Cameras

[Nikon D810](#) – Best full frame Night Photography Camera as of 2015.

[Nikon D800](#) – Works almost as well as the D810 at a much lower price point.

[Nikon D610](#)

[Nikon Df](#)

[Nikon D4](#)

[Nikon D4S](#)

## Nikon Crop Sensor Cameras

[Nikon D7100](#)

## Nikon Compatible Lenses

[Nikkor 14-24mm f/2.8G](#) - The best / most versatile star photography lens made in my opinion. It's great for landscapes as well.

[Nikkor 17-35mm f/2.8D ED-IF Autofocus Lens](#) - Another great wide angle choice.

[Nikkor 16mm f/2.8 Fisheye](#)

[Rokinon 14mm f/2.8](#) - Fantastic wide angle lens at a great price.

[Rokinon 35mm f/1.4](#)

[Nikkor 20mm f/2.8D Lens](#)

## Canon Full Frame Cameras

[Canon 5D Mark III](#)

[Canon 6D](#)

[Canon 1D X](#)

## Canon Crop Sensor Cameras

[Canon 7D](#)

[Canon 70D](#)

## Canon Compatible Lenses

[Canon EF 16-35mm f/2.8L](#) - Fantastic all around lens, great for night photography and landscapes.

[Rokinon 14mm Ultra Wide-Angle f/2.8](#)

[Rokinon 35mm f/1.4](#)

# Dave's Camera Equipment

After testing a lot of different equipment, I've found the following to work the best for night photography. When going out to shoot at night this is the only gear carried in my backpack. Reference the [What's In My Camera Bag Page](#) on my website for more details!

## Camera

[Nikon D800](#)

[Vello Camera Timer / Remote](#) – This works great. You really don't need to spend 160\$ on the Nikon Timer, unless you really want to. These both work just the same in my opinion.

## Lenses

[Nikkor 14-24mm f/2.8G](#)

## Tripod

BH-55 LR Ballhead – For TVC-34L Tripod

TVC-34L Versa Series 3 Tripod - Road Trips & Short Hikes

BD800-L: L-Plate for Nikon D800/800E – Works for Both Tripods

[MeFoto Black Carbon Fiber Tripod](#) – Backpacking & Hiking Only

# Star Photography Resources & Tools

Once you have captured and post processed some night shots feel free to click the link directly below and upload them to my website. I will share my favorite shots every once in a while on [Facebook](#), [Google+](#), and my [website](#) with credit to you.

Once the picture has uploaded wait 60 seconds or so to allow it to show up on the page. After this has been done, comment on the picture with your name and website or Facebook profile address.

**All photos are protected so they cannot be downloaded, but the "share" button is enabled for easy promotion!**

## [Share / Upload Your Star Photography Photos](#)

If you're over on Google Plus feel free to join my star photography community. There are lots of good pictures, discussion, and tutorials from star photographers all over the world.

## [Under the Stars Photo Community](#)



# About the Author

Dave Morrow is a landscape photographer, workshop instructor, and word slinger with a passion for travel, the truth, and all things strange.

He currently teaches [Star Photography Workshops & Tours](#) spanning the entire West Coast of the United States as well as [Online Star Photography Post Processing \( editing \) Group Workshops](#).

Dave's goal is to educate photographers from across the globe, bringing them together, and exploring the night skies in some of nature's darkest and most beautiful locations.

For more information on Dave's workshops, other free and paid tutorials, and of course, more photos, head over to [www.DaveMorrowPhotography.com](http://www.DaveMorrowPhotography.com)



**Bamboo Rafting on the Lijiang River - Guilin  
China. Photo Credit: [Paul Weeks](#)**