

AstroPhotography

Star Trails Using StarStaX



Image Stacker same as StarstaX software OR use Photoshop Stacking with Lighten blend mode.

This mode will add new light signal to the composite image from each of the layers.



AstroPhotography using only DSLR

Stacking is used to create a Star trail effect

Preparation for Startrails

- Sturdy Tripod (tie down straps, weights)
- Shutter Release Cable and take 120 to 240 photos
- Could be 2.5 hours session, need to wipe moisture off lens
- Extra batteries (keep them warm), gaffer tape, etc.



Camera Setting

- Recommended to use a wide angle lens or use the widest one you have
- Manual mode for everything
- F stop use the largest opening
- **ISO** : must experiment try 1600, 3200, 6400 , 12800
n.b. depends on what you find acceptable (take test shoots)
- Raw at 12 bit

Shutter Speed depends on sensor size and lens used

- 500 rule for full Frame camera
- 300 rule for crop Frame Camera

Shutter Speed

Full Frame Camera

Ex.: 1 I have a 50 mm lens

Set shutter speed to **$500/50 = 10$ seconds**

this means if you shoot 10 seconds or less you will have a very sharp image

for star-trails you want to shoot greater than 10 seconds. I suggest to use greater than 20 seconds (30 seconds will be fine).

Ex.: 2. I have 20 mm lens

Set shutter speed to **$500/20 = 25$ seconds** or less you will have a very sharp image

for star-trails you want to shoot greater than 30 seconds

Crop Frame Camera

I have a 50 mm lens

speed **$300/50 = 6$ seconds** or less for sharp images, I suggest to use shutter speed greater than 20 seconds for star trails

Noise Reduction

- It doubles the time and it will remove all of the static noise caused by keeping the lens open (i.e. : long exposure)
- **I suggest not to use camera built-in Noise Reduction**
- Please note for general single shot long exposure photography, it is recommended to use Noise Reduction within the camera settings).
- **However there are great noise reduction programs that could be used instead of the builtins, must experiment**

How to set FOCUS

I focused at 30 feet, using 24 mm focal and F stop at 2.8 My Dof is from 12.8 to infinity

If you are using a zoom lens it is recommended to use Gaffer (gaff) tape to ensure the lens does not move.

Location is most important and you want the foreground to be sharp, so focus on the foreground and the rest will be sharp too, if you consider hyper focus distance.

Depth of Field Calculator

Camera, film format, or circle of confusion Nikon D800, D800E, D700	Subject distance 30 ft
Focal length (mm) 24	Depth of field
Selected f-stop f/2.8	Near limit 12.8 ft
Subject distance 30 feet	Far limit Infinity
Calculate	Total Infinite
	In front of subject 17.2 ft
	Behind subject Infinite
	Hyperfocal distance 22.3 ft
	Circle of confusion 0.03 mm

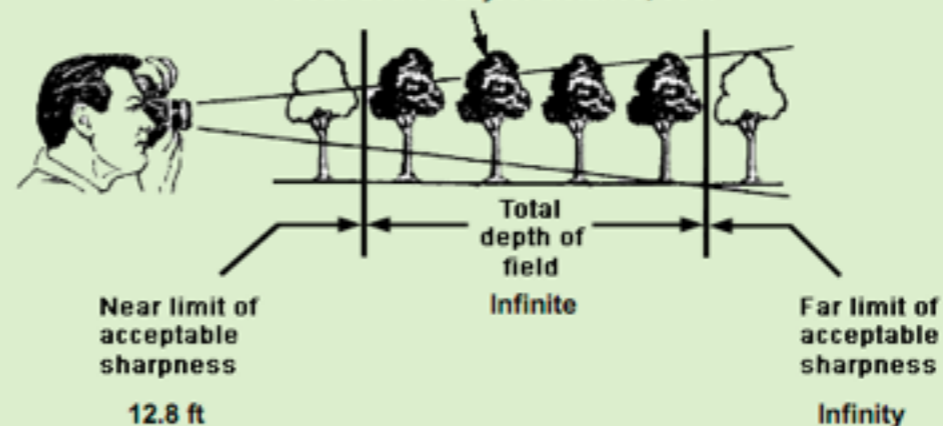
Hyperfocal distance



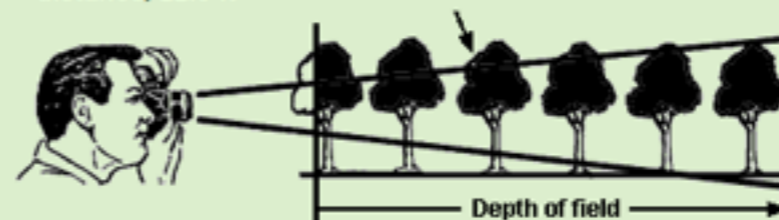
Use the actual focal length of the lens for depth of field calculations. The calculator will automatically adjust for any "focal length multiplier" or "field of view crop" for the selected camera.

Focal lengths of digital camera lenses are listed [here](#).

Focus at the subject distance, 30 ft

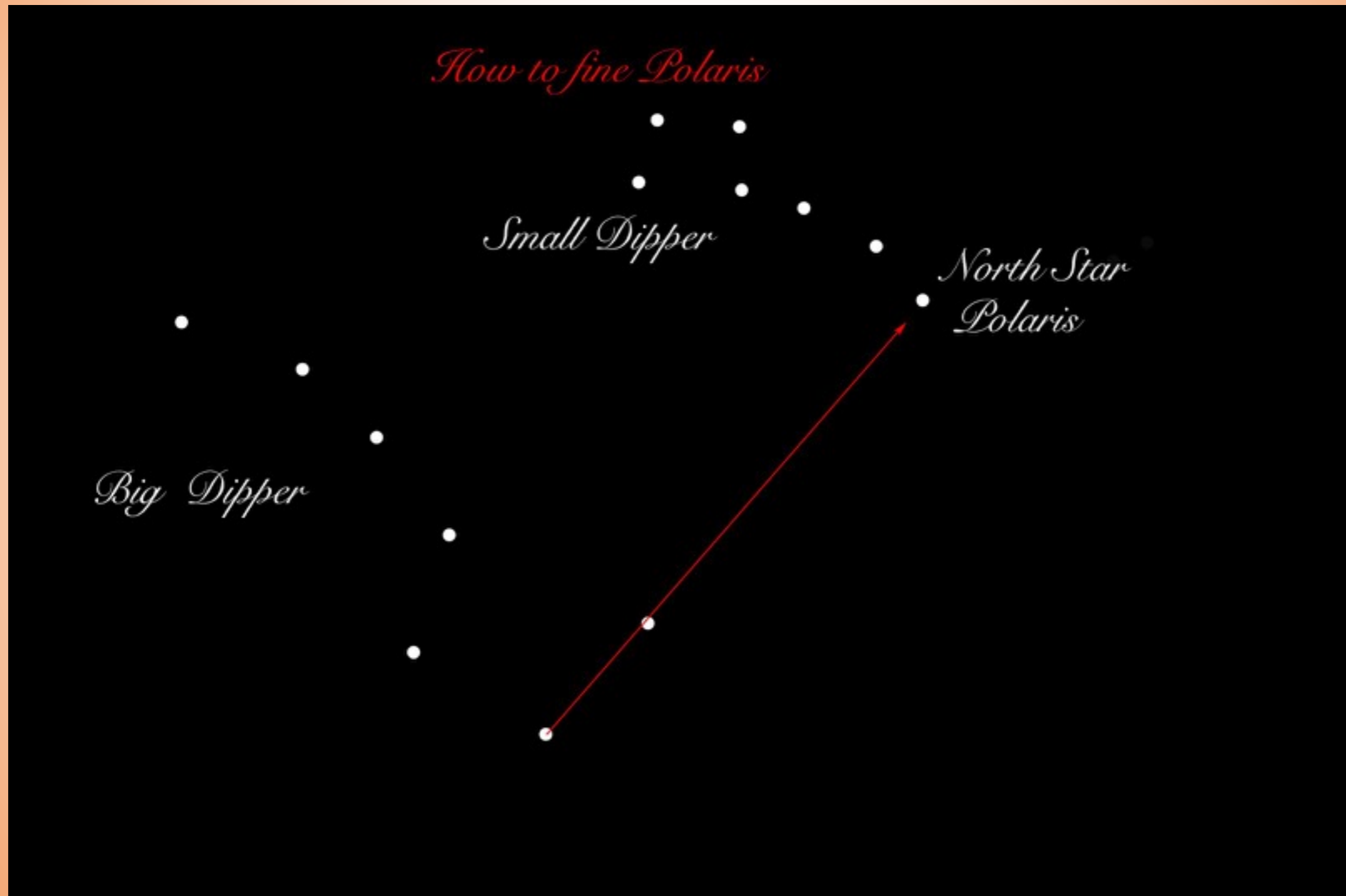


Focus at the hyperfocal distance, 22.3 ft



Depth of field extends from 11.15 ft to infinity

How to Find the North Star Polaris



Examples of Star Trails



Not including Polaris



Including Polaris

Try to have interesting Foregrounds

Demo 3

StarTrails using Photoshop

Example of Lighten blend modes on a sample of star trails

Demo 4

StarTrails using StarStax

The camera I used was a Canon Rebel T3i and the 18mm-55mm zoom lens that came with it.

Focal length used was 18mm at f/4, 25 seconds exposures at ISO 3200. A jpeg image was taken at one minute intervals (25 seconds exposure, **25 seconds for in camera noise reduction** and a buffer of 10 seconds to allow time to write the image on the camera's memory card

Mark Miller's Star trail data and camera settings

Next Step

Sky Tracker by iOptron



Nikon Vs Canon

- Most DSLR astrophotographers use Canon cameras. Canon releases the details of the camera's software.
- This allows the development of third party software, designed specifically for astrophotography.
- **Nikon does not create a truly raw image A simple median blurring filter is always applied... removing many stars**, as they are seen as noise. This prohibits precise image calibration. Some Nikons allow the "Mode 3" work around.
- However I called Nikon Canada and they are not aware of this blur filter. We need to test it ourselves.

Camera Settings

- Set Program Mode to Manual Exposure.
- Set Drive to Single Shot.
- Set ISO to 400, 800 or 1,600 based on ambient temperature.
- Turn Image Review OFF.
- Turn Auto-focus Off.
- Set White Balance to Daylight
- Set File Format to Raw (or Raw + JPEG).
- Turn in-camera long-exposure noise reduction Off if you are planning on shooting separate dark frames. Turn On if you are not going to shoot separate dark frames.
- Turn off in-camera sharpening if you are shooting JPEGs at a high ISO.
- Set contrast and color saturation to normal if shooting JPEGs.
- Set color space to sRGB. Set to Adobe RGB if you are extremely knowledgeable about color spaces.

Camera Settings cont'd

- Turn off flash.
- Set exposure to Bulb.
- Put Compact Flash Card in camera.
- Use a remote release to open the shutter.
- Mirror lockup is not necessary for long-exposure astrophotography with a decent mount. Turn mirror lockup on for high-resolution planetary work.
- High ISO noise Reduction
 - set to on if you plan to shoot a few Jpeg images.
 - set to off if you plan to use Dark Frame correction.
 - This function is slightly mis-named as it does not really reduce "noise", but rather thermal signal
- The eyepiece shutter keep closed

To Help plan activity

www.moonconnection.com/moon_phases_calendar.phtml

[www.lightpollutionmap.info/
#zoom=4&lat=5759860&lon=1619364&layers=B0TFFFFTT](http://www.lightpollutionmap.info/#zoom=4&lat=5759860&lon=1619364&layers=B0TFFFFTT)

The Photographer's Ephemeris

photoephemeris.com/

Dark sky

www.cleardarksky.com/c/Montrealkey.html

To learn more just go to the internet or Youtube and search for
Astrophotography using DSLR camera

Bias, Darks and Flat frames

The **Bias frames** are very short exposures made with no light reaching the sensor. **With a DSLR, they are taken at the fastest possible shutter speed and lowest possible ISO, with the body, lens or telescope capped.** Their purpose is to remove the read noise that is present and roughly the same in every frame. You should take a large number of Bias frames (~50), and DSS will average them to create a master Bias frame, which it will subtract from every other frame used in the image processing. You don't need to take new Bias frames very often, just once or twice a year, because the read noise doesn't change much over the life of a DSLR. The Bias frames also contain the "Offset" signal, an elevated baseline added to every image by the camera electronics. With my Canon 350D, the Offset signal is 255 counts out of a maximum range of 4,096 counts (12-bits). So subtracting the Bias frame from every other shot removes the Offset signal as well as the read noise.

Dark frames are made at the same exposure time and ISO as the subject light frames, but with no light reaching the sensor. They should also be made at approximately the same temperature as the light frames. Normally they are interspersed in the imaging session, or taken at the end of the imaging session. Their purpose is to remove the thermal noise from the light frames. Normally you want between 10 and 20 dark frames during each imaging session, and if you use multiple exposure time or ISO values for the light frames during a session, **you must acquire sets of dark frames to match the exposure and ISO of each set of light frames. The master Bias frame is subtracted from each of the dark frames before they are combined to create a master dark frame.**

Flat frames are short exposures made through the imaging optics with the camera pointed at an evenly illuminated field. They record uneven field illumination due to vignetting caused by the optics and due to partial obstructions in the light path such as dust particles on the sensor, and they are used to remove that uneven field illumination from the light frames. **Flat frames can be taken by pointing the camera at the twilight sky, by covering the aperture with a smooth, translucent, light colored material such as a t-shirt, or by covering the aperture with a specially constructed "light box", and making 15 to 20 exposures in Av mode. They must be taken with the camera in exactly the same orientation relative to the telescope as used for the light frames, so they are usually taken at the beginning or end of each imaging session. ISO isn't critical but most people use the same ISO as used for the light frames.**

The master offset frame is subtracted from each flat frame, and then the flat frames are averaged to make a master flat frame. The master flat frame is divided into each of the light frames, after the master Bias and master Dark frames have been subtracted from the light frames. Applying the Offset, Flat and Dark frames to the subject frames is called calibration.

Thank you

Comments

Q & A