

Total time:  
3-6 hours



Difficulty Level:  
Very challenging

#### Skill Points:

- Creating astrophotography images without star trails
- Learning how to calculate the length of shutter speed needed for star trails
- Applying the 500 Rule during a photo shoot

# THE 500 RULE

## IS FOR THE STARS | ASTRO-PHOTOGRAPHY



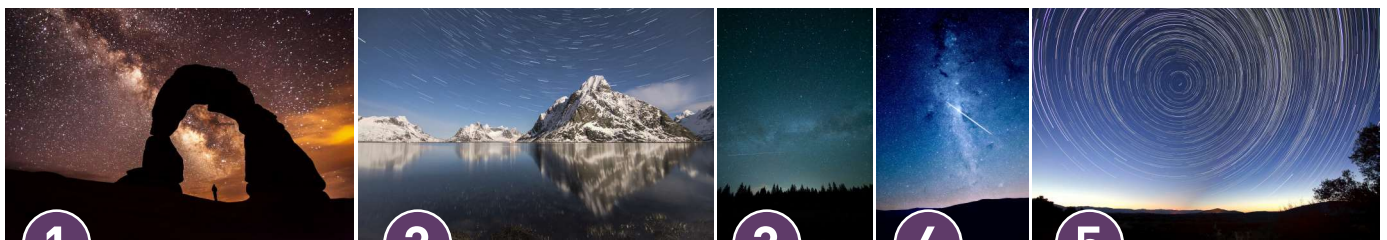
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If you've ever dreamed of creating beautiful Milky Way pictures, or landscape images combined with a sky full of shimmering stars, then this Action Assignment is for you. The 500 Rule is about keeping the stars sharp!

**KEY LESSON:** This rule states what the maximum time of shutter speed, with stars, can be that will NOT result in star streaks. You divide the effective focal length of the lens into the number 500. So, a 50mm lens, on a 35mm camera, or a full frame digital camera, would be  $500 / 50 = 10$  seconds of exposure before star trails become noticeable. For sensor formats other than full frame (35mm film), a further calculation is required (see example photos below).

**EQUIPMENT:** Any camera with manual exposure | wide-angle to normal lens | Tripod  
Remote Shutter Release - recommended | Post-processing software

### SAMPLE PHOTOGRAPHS



- 1- Due to the rotation of the Earth, the stars record as streaks of light "through the sky" in long night time exposures. Star trails can be a desired effect, but we may also want points of light (as we see the stars with our eyes). To achieve "points of light", you need to use the "500 Rule".
- 2- You may also have heard of the **600 Rule**. The 600 Rule provides slightly longer exposure times, which may result in star trail blur. The advantage is that it allows more light to reach the sensor (or film) for exposure. We recommend the 500 Rule.
- 3- When you work with a smaller sensor camera, you must include an extra calculation, which takes into account the crop sensor factor (unless it is a DX lens designed for the smaller sensor size). Crop sensor factors for these brands include: Sony and Nikon/1.5X & Canon 1.6X. Here is the 500 Rule formula, with the Nikon "crop factor" included (as an example):  $50\text{mm lens} \times \text{Nikon } 1.5\text{x crop factor} = 75\text{mm equivalent focal length}$ .  $500$  divided by  $75\text{mm}$  equals a 6 second maximum exposure length before star trails occur (always round down).
- 4- If the stars are sharp, and your picture exhibits one to several trails, this is not a failing of the 500 Rule. What you have captured is likely an airplane contrail, or a meteor.
- 5- You can also leave the 500 Rule behind, and experiment with creative star trails in your shots.



### ACTION ASSIGNMENT!

- 1- Organize a photo shoot similar in content to the example photos: Find an area with minimal light pollution. Have a clearly definable horizon line at the base of your photograph. Apply the 500 Rule to establish exposure length. Be sure to include the lens focal length and the crop factor (if necessary). Set your aperture to the widest setting and the ISO to 1600. Adjust as necessary for proper exposure after a test shot. Shoot in Camera Raw for maximum post-processing capability.
- 2- Shoot a number of frames starting at your calculated exposure length, and then increase and decrease the length of time. Adjust the ISO to keep a correct exposure. Keep good notes.
- 3- Adjust color, contrast, clarity, and saturation in post-production. All digital astrophotography requires post-processing to excel.
- 4- Print all of your different versions with your home computer printer or a photo lab.

### HOW DID YOU DO?

- Did the 500 Rule correspond as the sharpest image with no star trails and the best exposure?
- Do you now see how the exposure length affects the star trails?