

SOLAR ECLIPSE PHOTOGRAPHY

Be Ready to Create Your Own Memories of April 8, 2024

WHAT DO YOU NEED?

- Solar eclipses can be safely and successfully photographed with commonly available DSLR, mirrorless, and bridge cameras if you use the proper setup.



WHAT DO YOU NEED?

- What is the proper setup? The same solar safety film that goes into eclipse glasses can protect your camera. Practically any astronomy vendor or Amazon or Walmart.



WHAT DO YOU NEED?

- A tripod and a programmable remote. This is a slow-motion event where repeatability is key. Picture after picture after picture needs to be taken with precision.



WHAT DO YOU NEED?

- Optionally, a platform to track the Sun across the sky during the roughly three hour start to finish eclipse.



WHAT DO YOU NEED?

- Also, your camera should have a flip-out viewer or some way to display to another screen. Otherwise, the viewscreen will be pointed to the ground and you will strain your neck trying to see anything. Many modern cameras allow you to project to your smart phone or tablet.



ASSUMPTIONS

- In this presentation, we'll assume you have an APS-C DSLR or mirrorless, or a bridge camera but the principles will apply to full frame cameras. The reason for needing these types of cameras is because you won't be able to rely on "automatic" settings. You will need to set the shutter speed, f/ratio, and ISO potentially more than once during the eclipse.

ASSUMPTIONS

- While totality lasts for just a few minutes at best, the partial eclipse starts about 75 minutes earlier and lasts another 75 minutes after the end of totality. Though totality is the undisputed star of the show, you may want to capture the entire sequence. That means you will need either a wide-angle view that can cover the entire event from a stationary tripod or some method of following the Sun as it moves across the sky. Maybe both.

SUN PROOFING YOUR CAMERA

- First, you need to sun-proof your camera. This is easy and you can build your own adapter. You can of course buy one already made, but those tend to cost a few times more than the film. Start with solar protection film from Rainbow Symphony or other certified source.



SUN PROOFING YOUR CAMERA

- While that is on its way, use cardboard, foam core board, or E-Z Mac container to build a holder that will fit over your camera lens. Make it a loose but deep fit. You don't want it coming off with a gust of wind but you will want to be able to take off when totality starts and back on when totality ends without disturbing anything.



SUN PROOFING YOUR CAMERA

- I've settled on solar filter film sandwiched between two cheap camera filters on a flip up filter holder.



SUN PROOFING YOUR CAMERA

- I've settled on solar filter film sandwiched between two cheap camera filters on a flip up filter holder.
- Down for partial and up for totality.

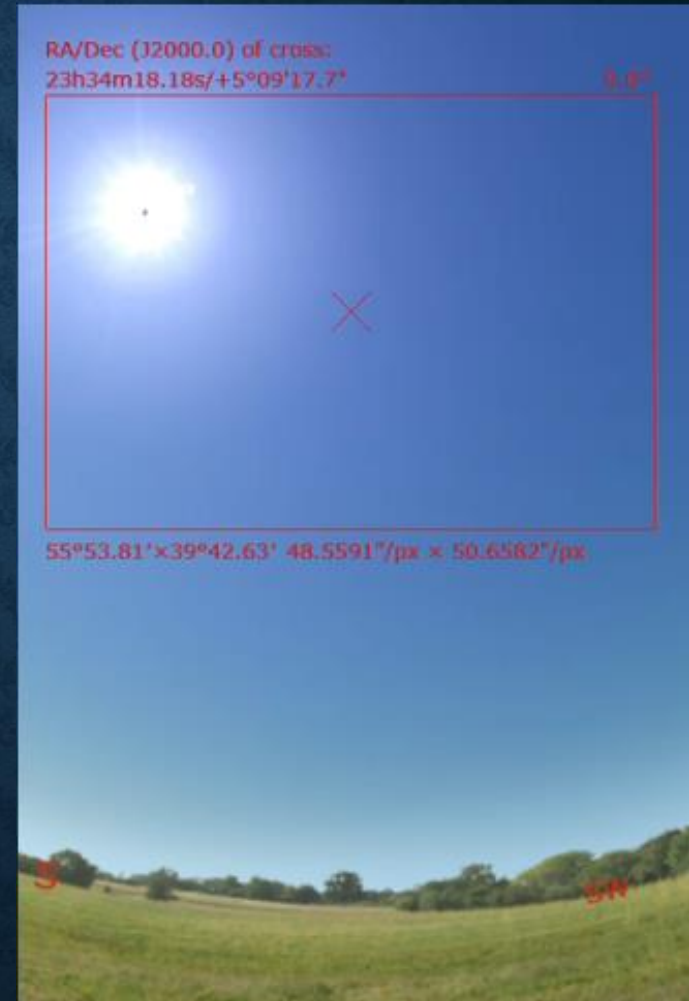


PLANNING

- In your preparations, you should determine for yourself what will work best for your situation and don't rely solely on what I am about to tell you.
- You should do one or more dry runs in the days before the eclipse. The uneclipsed Sun will simulate the partial phases of the event. The Sun's position and path will be virtually the same in the days before the eclipse.
- There will be no do overs after April 8.

PLANNING

- If you want to go the wide-angle route with a stationary tripod, it appears to me that a commonly available 28mm lens on an APS-C camera will be slightly too narrow to capture the entire event. You will need a shorter lens.



PLANNING

- An 18mm lens on the other hand looks to be wide enough. In this clip, I have simulated an 18mm lens on my APS-C camera pointed South-Southwest with the Sun starting in the upper left. Three hours later, after the eclipse, it is still in the frame.



PLANNING

- If you use this technique and take pictures every few minutes you will see the Sun creeping from upper left to lower right, at first slowly being hidden by the Moon before totality and slowly revealed afterward. Three minutes will be enough time to let the Sun move its full width in the frame.



PLANNING

- Because you will have to have the filter on, except during totality, you are not likely to be able to see anything else in the images. Taking an image every three minutes would result in around 60 images over the entire event. Your result would be a series of frames that could be combined into something like this.



PLANNING

- That said, I'm going to take a picture every minute or less so that I have a more continuous flow of images.
- You don't have to use all of your data but you can't use it if you don't have it.



PLANNING

- Many of the most stunning eclipse photos combine the eclipse pictures with the surrounding foreground via pictures taken before or after the eclipse with the solar filter removed. Unfortunately, the Sun will be high in the sky April 8th making foreground features difficult.

PLANNING

- Maybe you could set up on the north side of a mountain and have that in your foreground. The Sun will be a little east of due south and 60 degrees high when the eclipse starts and just shy of due southwest and 48 degrees high at the end. If no mountain, maybe a tall building or statue in the left-hand side of your stationary frame would be just the thing to take your picture to 11.

PLANNING

- If you want to zoom in, and you should especially during totality, then you may want to follow the Sun.
- There are several sky trackers available ranging in price from around \$300 to \$600, most require a user supplied tripod. The following list is not meant to be exhaustive, nor do I have any recommendations.
 - Move Shoot Move
 - Sky-Watcher Star Adventurer Mini Astrophotography Mount
 - I-Optron Sky Tracker Pro
 - Slik ECH-630 Astro Tracker

Search for “simple sky tracker” to find these and others.

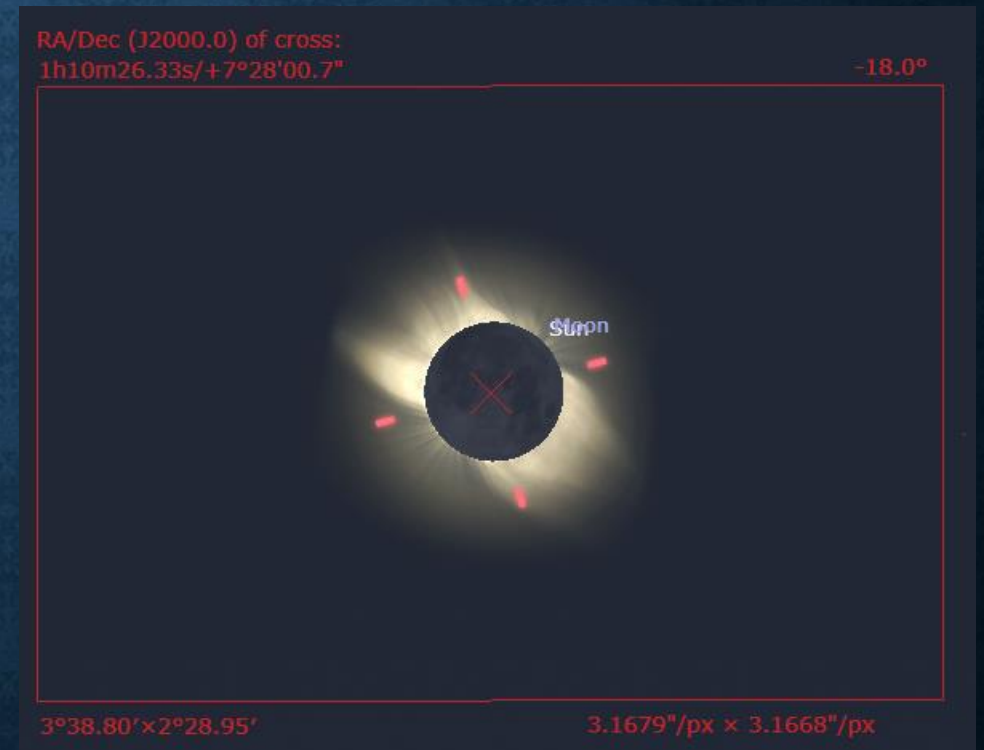
PLANNING

- My sky tracker from the annular eclipse.



PLANNING

- Here is a simulation of what totality would look like with an APS-C camera and 300mm lens. The corona can extend well away from the Sun so you don't want to go too high on focal length even if you can.



PLANNING

- No tracking platform? You can let the Sun drift across your field of view during totality. During totality, the Sun will move a little more than twice it's width.
- Even at 300mm, if you start with the Sun at about a third of the way in on the left, it will finish about the same on the right.
- If your camera is horizontal to the ground, like the wide-angle view was, then the Sun will drift downward as well so start higher on the left.



TECHNICAL

- Set your camera on manual and then use the following chart, provided by “Mr. Eclipse” Fred Espenak, to determine your focal ratio, ISO, and exposure times.
- In the days prior to the eclipse, confirm the settings that work for you for the partial phases by shooting the uneclipsed Sun.
- For totality, pick ISO and f/ratio settings and then go down to determine exposures.

Solar Eclipse Exposure Guide

ISO	f/Number									
25	1.4	2	2.8	4	5.6	8	11	16	22	
50	2	2.8	4	5.6	8	11	16	22	32	
100	2.8	4	5.6	8	11	16	22	32	44	
200	4	5.6	8	11	16	22	32	44	64	
400	5.6	8	11	16	22	32	44	64	88	
800	8	11	16	22	32	44	64	88	128	
1600	11	16	22	32	44	64	88	128	176	

Eclipse Feature	Q	Shutter Speed									
Partial ¹ - 4.0 ND	11	—	—	—	1/4000	1/2000	1/1000	1/500	1/250	1/125	
Partial ¹ - 5.0 ND	8	1/4000	1/2000	1/1000	1/500	1/250	1/125	1/60	1/30	1/15	
Baily's Beads ²	11	—	—	—	1/4000	1/2000	1/1000	1/500	1/250	1/125	
Chromosphere	10	—	—	1/4000	1/2000	1/1000	1/500	1/250	1/125	1/60	
Prominences	9	—	1/4000	1/2000	1/1000	1/500	1/250	1/125	1/60	1/30	
Corona - 0.1 Rs	7	1/2000	1/1000	1/500	1/250	1/125	1/60	1/30	1/15	1/8	
Corona - 0.2 Rs ³	5	1/500	1/250	1/125	1/60	1/30	1/15	1/8	1/4	1/2	
Corona - 0.5 Rs	3	1/125	1/60	1/30	1/15	1/8	1/4	1/2	1 sec	2 sec	
Corona - 1.0 Rs	1	1/30	1/15	1/8	1/4	1/2	1 sec	2 sec	4 sec	8 sec	
Corona - 2.0 Rs	0	1/15	1/8	1/4	1/2	1 sec	2 sec	4 sec	8 sec	15 sec	
Corona - 4.0 Rs	-1	1/8	1/4	1/2	1 sec	2 sec	4 sec	8 sec	15 sec	30 sec	
Corona - 8.0 Rs	-3	1/2	1 sec	2 sec	4 sec	8 sec	15 sec	30 sec	1 min	2 min	

Instructions

Choose the ISO speed in the upper left column. Next, select the f/number of the lens or telescope (on same line as ISO). Finally, drop straight down to the bottom table to get the correct exposure for each feature of the solar eclipse.

Note that the brightness of the corona varies dramatically with distance from the Sun's edge. All exposure values in this guide are estimates. For best results, use them only as a guide and bracket your exposures.

Exposure Formula: $t = f^2 / (I \times 2^Q)$ where: t = exposure time (sec)
 f = f/number or focal ratio
 I = ISO film speed
 Q = brightness exponent

Abbreviations: ND = Neutral Density Filter.
Rs = Solar Radii.

Notes: ¹ Exposures for partial phases are also good for annular eclipses.
² Baily's Beads are extremely bright and change rapidly.
³ This exposure also recommended for the *Diamond Ring* effect.

TECHNICAL

- For example, set ISO to 100 and f/ratio to 5.6. The chromosphere reads 1/4000 second while the corona at two radii reads 1/4 second.
- Set your camera to bracket your exposures, this will cause the camera to take three pictures at different exposures to allow you to capture different aspects of the eclipse with each click of the camera.
- If you are “drifting” as discussed before, don’t let your exposure go too long or it will be blurry.

- The one thing you can confirm beforehand is the proper exposure for the partial eclipse. Assume that is 1/1000 of a second as in this example.
- Then the prominences are half that at 1/2000 of a second. Four radii from the Sun is $\frac{1}{2}$ of a second. That is 10 f/stops and in the middle is 1/60 of a second.

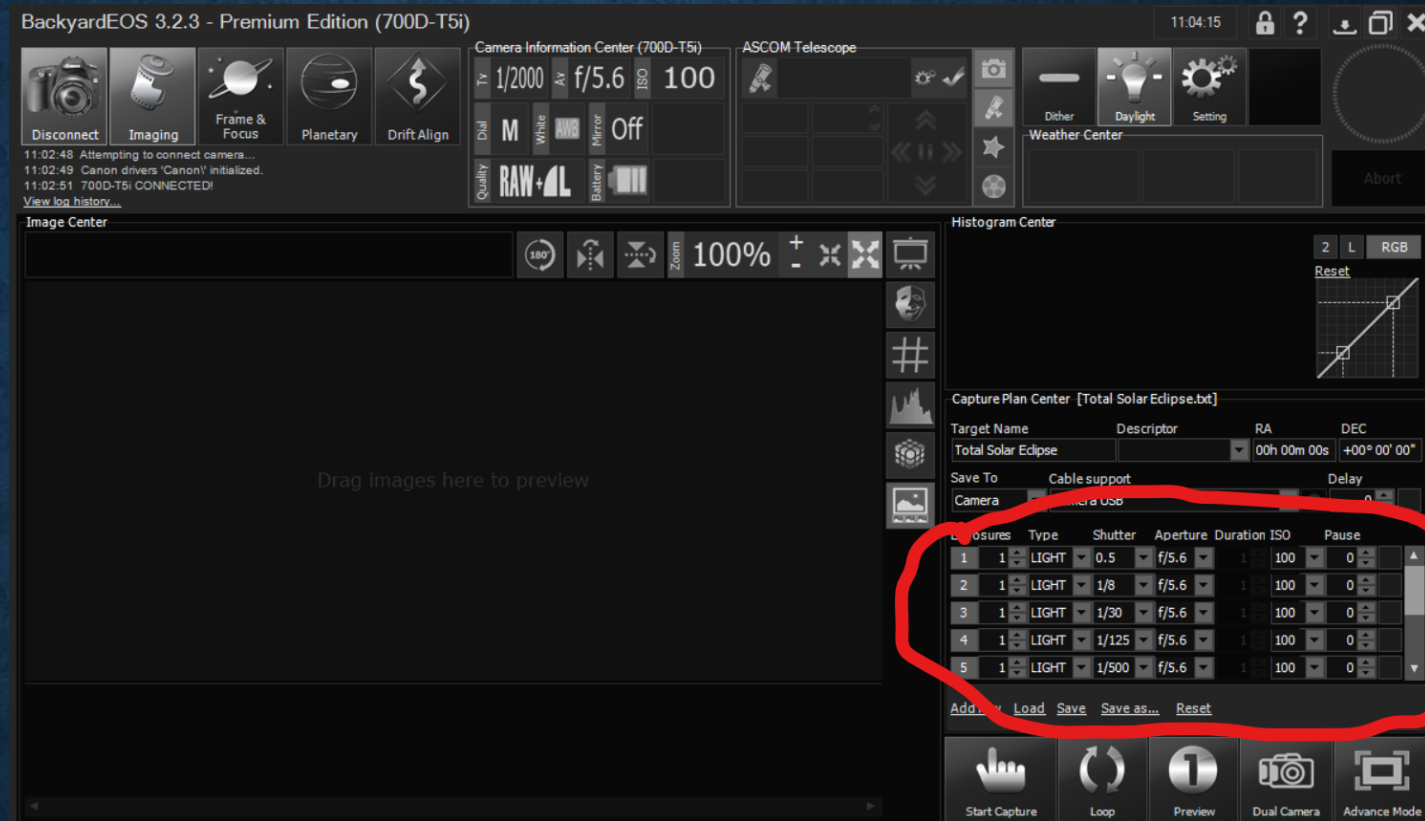
ISO				
25	1.4	2	2.8	
50	2	2.8	4	
100	2.8	4	5.6	
200	4	5.6	8	
400	5.6	8	11	
800	8	11	16	
1600	11	16	22	

Eclipse Feature	Q			
Partial ¹ - 4.0 ND	11	—	—	—
Partial ¹ - 5.0 ND	8	→ 00	1/1000	
Baily's Beads ²	11	—	—	—
Chromosphere	10	—	—	1/4000
Prominences	9	→ 00	1/2000	
Corona - 0.1 Rs	7	1/2000	1/1000	1/500
Corona - 0.2 Rs ³	5	1/500	1/250	1/125
Corona - 0.5 Rs	3	1/125	1/60	1/30
Corona - 1.0 Rs	1	1/30	1/15	1/8
Corona - 2.0 Rs	0	1/15	1/8	1/4
Corona - 4.0 Rs	-1	→ 1	1/2	
Corona - 8.0 Rs	-3	1/2	1 sec	2 sec

- Use exposure bracketing centered on 1/60 of a second with bracketing +5 and -5 f/stops from there to capture all three with each snapshot. If your camera won't go 5 stops, go as far as you can.
- If your partial eclipse exposure is something other than 1/1000, use these proportions to properly expose the prominences as well as corona near and far away from the disk.

ISO				
25		1.4	2	2.8
50		2	2.8	4
100		2.8	4	5.6
200		4	5.6	8
400		5.6	8	11
800		8	11	16
1600		11	16	22

Eclipse Feature	Q			
Partial ¹ - 4.0 ND	11	—	—	—
Partial ¹ - 5.0 ND	8	→	1/1000	
Baily's Beads ²	11	—	—	—
Chromosphere	10	—	—	1/4000
Prominences	9	→	1/2000	
Corona - 0.1 Rs	7	1/2000	1/1000	1/500
Corona - 0.2 Rs ³	5	→	1/125	
Corona - 0.5 Rs	3	1/125	1/60	1/30
Corona - 1.0 Rs	1	1/30	1/15	1/8
Corona - 2.0 Rs	0	1/15	1/8	1/4
Corona - 4.0 Rs	-1	→	1/2	
Corona - 8.0 Rs	-3	1/2	1 sec	2 sec



- A solution to the bracketing issue is to use something like BackyardEOS. This adds a laptop to your gear but increases your options.

TECHNICAL

- I've said a few times now that you can't practice totality, only the partial phases of the eclipse. I've subsequently learned that a gibbous Moon can substitute for the total eclipse.
- The Moon between first quarter and full and full and last quarter is a good approximation of the brightness and dynamic range of a total solar eclipse.

OTHER IDEAS

- What else could you shoot? You might do some pinhole photography with your cellphone. Is there a tree nearby? The partial eclipse might be projected on the ground through the gaps in the leaves. Or you might bring a kitchen strainer and let it stand in for the tree.



OTHER IDEAS

- There is a phenomenon called shadow bands that you might see. They are ripples on the ground. Keep an eye out and camera or cellphone ready.
- Are you on a mountain top looking down on everything to the south? You might see the shadow of the Moon racing toward you.



GAME DAY

- Put fresh batteries in your cameras. Have spares and cross your fingers that won't have to interrupt the process to replace batteries. In the scenarios that are about to be described, you won't take that many pictures perhaps 200 per camera. However, your camera will be on for three hours.

GAME DAY

- Make sure there are SD cards in your cameras. 32 GB cards should be more than enough but your dry runs will tell you what you will need.
- You need to know the exact time of each transition in the eclipse for your location. <https://ar-eclipse.info/> provides that information for many towns and cities in Arkansas.

GAME DAY

- You are going to be in the Sun for three hours. Arrange for some shade and a way to cool off.
- Bring snacks and drinks. You don't want a blood sugar crash while this is going on. The eclipse starts around 12:30, so eat lunch beforehand.

GAME DAY

- Start your camera(s) just before the start of the partial eclipse and end them just after the end of the partial eclipse.
- You can remove the filter(s) from your camera(s) a few seconds before totality starts but you have to know exactly when that is.

GAME DAY

- Likewise, you can wait a few seconds but no more after totality ends to put the filter(s) back on. Set a timer to let you and your friends know it's time.
- Don't do that with your eyes. Don't remove your eclipse glasses before totality and put them back on before it ends. You can replace a camera.

ALL TOO SOON IT'S OVER

- Pack everything up, go home, start processing your pictures when you get there.
- If you are in a crowd of ten thousand, take a break. Eat an apple, use the bathroom, wait for the crowd to disburse. Might as well wait in comfort as in your car moving at 1 MPH.

PRACTICE, PRACTICE, PRACTICE

- I know I'm repeating myself but do one or more dry runs to make sure you get the results you want. There will be no do over until 2026 in Iceland.

PRACTICE, PRACTICE, PRACTICE

