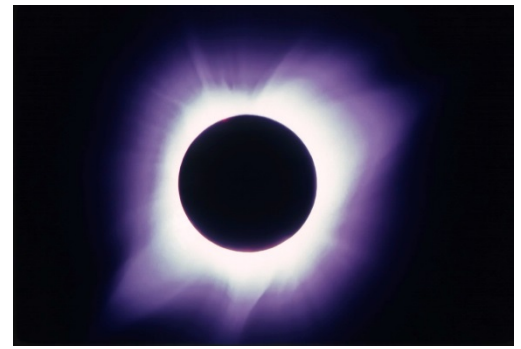


Example Solar Eclipse Photography Equipment

Rick Wallace, 2017



General Equipment

- Eclipse glasses and binoculars with solar filter (slip on to remove easily for totality). I use Canon Image Stabilized (IS) binoculars, 10x to 15x.
- Hat and long-sleeve solar-block shirt (you will be in direct overhead Sun for hours)
- Camera and lens.
 - Lens should be 500-1000mm (full-frame equivalent) to capture a close-up of solar disk. Wide f/stop (5.6 or wider) is preferable for totality to get the outer corona without long exposures.
 - Examples:



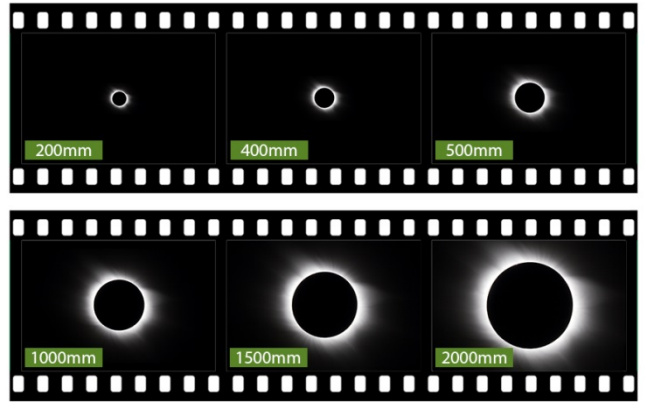
- Any point and shoot camera can take a scenic with eclipse in view; however mid-day eclipse will be around 60 deg in altitude and difficult to frame with foreground objects. A zoom lens of at least 4-6x will make the solar disk more visible. Brackets exist to attach cell phones and point & shoot cameras to binoculars or spotting scopes, which would be a better option. Point and shoot cameras or cell phones are ideal for eclipse progression images.



- The sun moves its own diameter in about 2 minutes, so a progression might use 5 minute intervals with a 35mm lens.
- Long-zoom compact cameras with lenses of at least 500mm equivalent telephoto setting will work (i.e., Canon PowerShot SX60 HS, Canon G3 X, or Sony Cyber-shot RX10 III [with 600mm zoom], etc.). A flip-out view screen is important for mid-day eclipses when camera is vertical.



- A DSLR with interchangeable lenses (Canon, Nikon, or others) allows obtaining high quality images of a large solar disk. These are larger, heavier, and more expensive than long-zoom compacts, but have larger (clearer) image sensors and a wider variety of telephoto lens options. Cameras with APS-C size sensors (i.e., Canon 7D II, 70D, 80D, Nikon D500, D7500, etc.) provide an equivalent multiplier of lens length by 1.5 or 1.6 (i.e., 400mm acts like 600mm).



- Personally, I use a Canon 7D II camera with Canon 400mm f/4 lens+1.4x extender (equivalent to 900mm telephoto), or with Canon 100-400mm zoom, for stills, and a Canon 80D with 500mm catadioptric mirror lens (equivalent to 800mm) for videos. The 80D has flip-out viewscreen.
- Any camera with video capability can be set to view your group and capture images of people's reactions as totality occurs. Just put a small camera on a small tripod, aimed at the people.



- Tape to fix focus. Many camera focus rings are easily bumped or will slide by themselves when the camera is pointed straight up. Manually focus on the Sun, then tape the focus ring (and zoom ring, if you have one).
- I use battery grips on my Canon cameras to increase the battery capability and reduce the chance of losing power in the middle of the eclipse. Remember to charge batteries the night before!



- Tripod to stabilize camera and lens during long wait, and provide stability during long totality exposures. Totality induces a 10-15 deg temperature drop, accompanied by a strong wind. Tripod should be heavy enough to stabilize your camera system in the wind. You might hang a gallon jug of water from the tripod to add weight. You may want to secure tripod legs to the ground if you are planning to do a time-lapse photo.
- A rough estimate of the longest exposure you can use without showing blur due to the Earth's rotation is about 500/ (lens focal length). So a 500mm lens can take exposures down to about 1 sec.



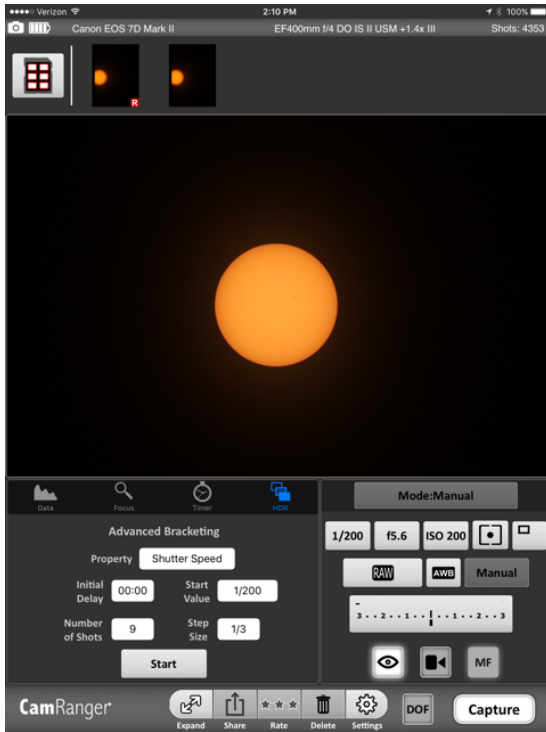
- Equatorial camera mount with solar tracking rate.
 - Not required, but makes it easier to keep the solar image in view during the long hours of partial phases leading up to totality. It will also allow longer exposures (several seconds) of the corona during totality.
 - There are many examples out there. An iOptron SkyTracker Pro will work for cameras under 4 pounds. I use an Orion Skyview Pro for stability with my 7-lb camera/lens, but it is much heavier and bulkier. Other intermediate options are also sold. Make sure it has a solar tracking rate.



- I use an iOptron SkyTracker Pro for my 3 lb camera, and an Orion Skyview Pro with GPS, SkyFi III wifi transmitter to Sky Safari 5 Pro to control the GOTO mount, and a Cam Ranger to transmit

the camera image to an iPad and control exposure and auto multiple exposure modes, for my 7 lb camera.

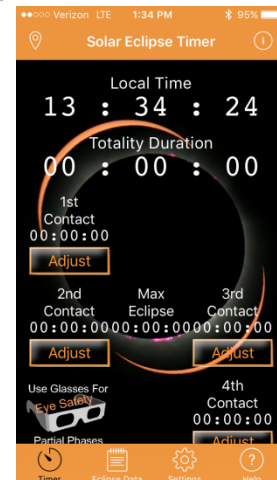
- I use an iPad for camera control from the Cam Ranger, but one could also use an iPhone.
 - If you don't have a way to transmit the camera image to an external viewer (many cameras now have this built-in), or a swivel monitor on the back of the camera, you will need an angle finder to keep from trying to look straight up into the sky to focus and to keep the sun in the frame.
 -



- If you use a tracking mount, you will need a source of battery power.
 - The Celestron Power-tank 7Ah battery is fine if you have a cigarette lighter 12-v plug. The Goal Zero Yeti 150 is a 14 Ah batter with a built-in 110-v plug.
- Solar filters for lenses, telescopes, finder scopes, binoculars, as well as eclipse glasses
 - Preferably slip-on filters that are easier to remove at totality than screw-on or taped-on filters.
- Sol-Searcher Sun Finder with flash attachment.
 - Attaches to camera hot shoe or telescope, to make it much easier to find the sun without looking at it. The Sun is a difficult target in the when your filter and glasses do not allow you to see how close you are to pointing at it.
- Spare Batteries, or run cameras off external power
- Spare memory cards (start with new ones – you will do a lot of bracketing)
- Cover to reduce Sun exposure while waiting for totality – light colored
 - I use small Weber grill-covers in white or silver. Some people use Mylar emergency blankets or white towels, but they are hard to fasten on in the wind.
- I have a chain lock (bicycle or luggage-type) to secure the equipment if I have to be away for a short time. It is better to be in a group so someone can keep an eye on it.
- Flashlight (I use a red/white headlamp) to see camera settings in the dark.



- During totality, the light levels are similar to about 40 minutes after sunset (though only in a small area around you – the horizon is bright – very eerie!). However, darkness descends in a few seconds just as totality starts, so your eyes do not have 20 minutes to become dark-adapted. In fact, this eclipse will be over in around 2 minutes!
- I use an iPad or iPhone with astronomy/planetarium software (I use Sky Safari Pro, but many others are available) to determine which stars and planets can be seen during totality (hint – look for Venus, Procyon, Sirius, Orion constellation, and perhaps Castor, Pollux, and Mars).
- I carry a shoulder bag to keep the iPads in when I'm not using them. Easier than finding a surface to put them down on.
- Small table or container to quickly drop solar filters into when totality begins.
- If you have an iPhone, you may want to check out the "Solar Eclipse Timer" app. It determines your time & location, then will give you a verbal count-down for important eclipse events (second contact, third contact, etc.), as well as calculate when to take exposures for an eclipse progression image.



Example Procedures

Everyone is different, and mine will probably adapt on the spot to changing conditions. Here are my plans. Use RAW image setting if you have it, or at least LARGE jpeg.

Stills – close up

Canon 7D II & 400mm f/4 DO II + 1.4x (900mm equivalent) on SkyView Pro with Cam Ranger

- Polar align mount with iPad and Spyglass app (or SkySafari Pro)
- Connect camera to iPad with Cam Ranger (Remember to charge Cam Ranger!) or to angle finder and remote control.
- Place solar filter on lens
- Turn on solar tracking (if you have it)
- If GOTO mount, then GOTO Sun, and refine with Sol-Searcher
- Focus using **magnified view** in Cam Ranger (or on viewscreen), then tape focus control
- Tape zoom lens, if applicable.
- Partial phases
 - Manual exposure: ISO 200 and f/8 with Thousand Oakes Solar Filter
 - Set Cam Ranger for HDR at 9 shots, starting at 1/125 sec, at 1/3-stop increments.
 - Timer: As many sets as needed.
- Diamond Ring
 - HDR **3** shots @ **1-stop** increment, starting at **1/125 sec**
- Bailey's Beads
 - 1/8000 sec
- Note that without a Solar tracking mount, the Sun will move about 1 diameter in 2 minutes.
- Totality – **FILTER OFF**
 - HDR **9** shots @ **1-stop** increment, starting at **1/30 sec** (i.e., 8 sec – 1/8000 sec).
 - Movie mode for remaining eclipse – set manual exposure as needed.
 - **USE BINOCULARS**
 - **LOOK AT ECLIPSE WITH EYES!**

Backup, 2nd Camera, or video system

Equipment

- For video, I use a Canon 80D with flip-out viewfinder, 500mm mirror lens (800mm equivalent) on iOptron Skytracker Pro tracking mount. Can set camera for HDR and change number of exposures.
- Battery Grip to provide extra battery power (or plug camera into power source)
- Tripod (I use a Manfrotto)
- iOptron Skytracker Pro equatorial tracking drive with Solar rate with charger (charge before eclipse!)
- Sol-Searcher site with flash adapter
- Remove shoulder strap so it won't blow in the wind
- Extra counter weight to stabilize tripod (jug of water?)
- BBQ grill cover (white to reduce heat from Sun)
- Solar filter (in my case, for 500mm mirror lens)
- iPhone/iPad to polar align mount during daytime using Spyglass app
- Bicycle lock

Video system Procedure

- Polar align mount with iPad and Spyglass app (or SkySafari Pro)
- Connect remote control, or use WiFi to connect to iPad.
- Place solar filter on lens
- Set Camera to manual exposure (could try shutter-priority Auto, but test first)
- ISO 200 (my lens is fixed at f/5.6)
- Turn on solar tracking
- Find sun using Sol-Searcher, and flip-out screen
- Focus using magnified view in view screen, then tape focus control
- Tape zoom lens, if applicable.
- Partial phase with filter: stills – 3 HDR/bracket @ 1/3- stop interval, start at 1/200 sec.
- Partial phase with filter: video – shutter-priority auto, with manual correction as needed.
- Totality: Video on auto, with manual correction as needed.

Example Exposures (from B&H Photo Video)

TOTAL SOLAR ECLIPSE EXPOSURE SETTING GUIDELINES					
ISO200					
Aperture (f/stop)					
	f/2.8	f/4	f/5.6	f/8	f/11
Shutter Speed					
<i>Outer Corona</i>	1/4	1/2	1 sec.	2 sec.	4 sec.
<i>Mid Corona</i>	1/30th	1/15th	1/8th	1/4	1/2
<i>Inner Corona</i>	1/1000th	1/500th	1/250th	1/125th	1/60th
<i>Diamond Ring</i>	1/1000th	1/500th	1/250th	1/125th	1/60th
<i>Baily's Beads</i>	----	1/32,000th	1/16,000th	1/8000th	1/4000th

A more complete Exposure Guide can be found at

<http://www.mreclipse.com/SEphoto/SEphoto.html>.

Don't worry about the weather. Look for a break in the clouds and try anyway.



Sky Safari 5 Pro can show which stars and planets are visible during the eclipse.

