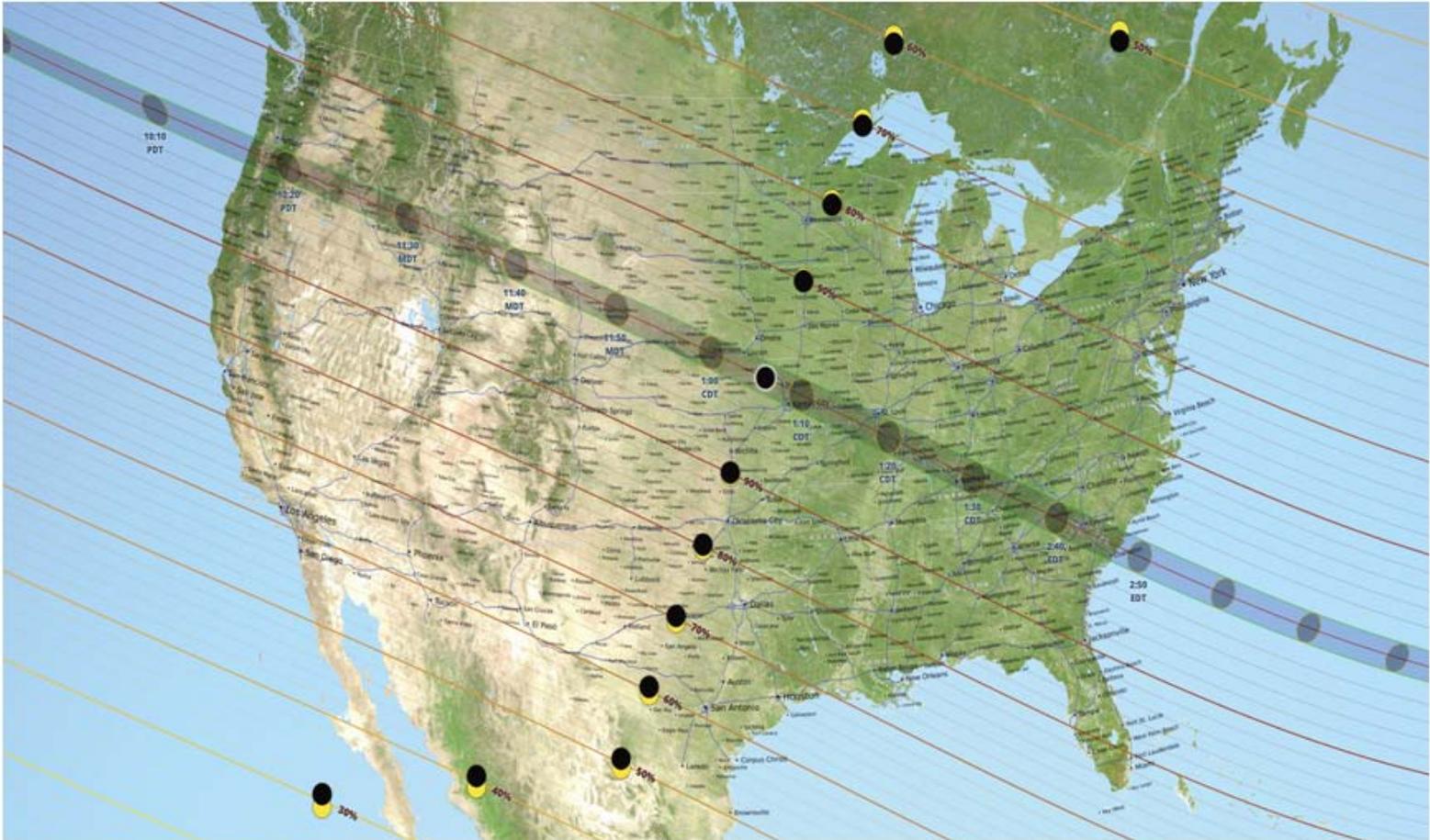


# Photographing Solar Eclipse



# 3 Types of Solar Eclipse

- **Partial and Total Solar Eclipses**
- The moon's cone-shaped shadow has two parts, the *penumbra* and the *umbra*. The penumbra is the moon's faint outer shadow and partial eclipses are visible from within the penumbral shadow. The umbra is the moon's dark inner shadow and total solar eclipses are visible from within the umbral shadow. The track of the moon's umbral shadow across Earth is called the *Path of Totality*, and it covers less than 1 percent of Earth's surface area (typically 10,000 miles long and about 100 miles wide.)
- A solar eclipse begins as a small notch slowly appears along one edge of the sun. During the next hour, the moon will gradually cover more and more of the sun's bright disk. If the eclipse is a *total solar eclipse*, the last remaining minutes of the partial phases can be dramatic. The crescent of the sun grows thinner as the moon's shadow approaches. The abrupt darkness of totality is stunning to view, and the solar corona is an awe-inspiring sight. The sun's corona can only be seen during the few brief minutes of totality

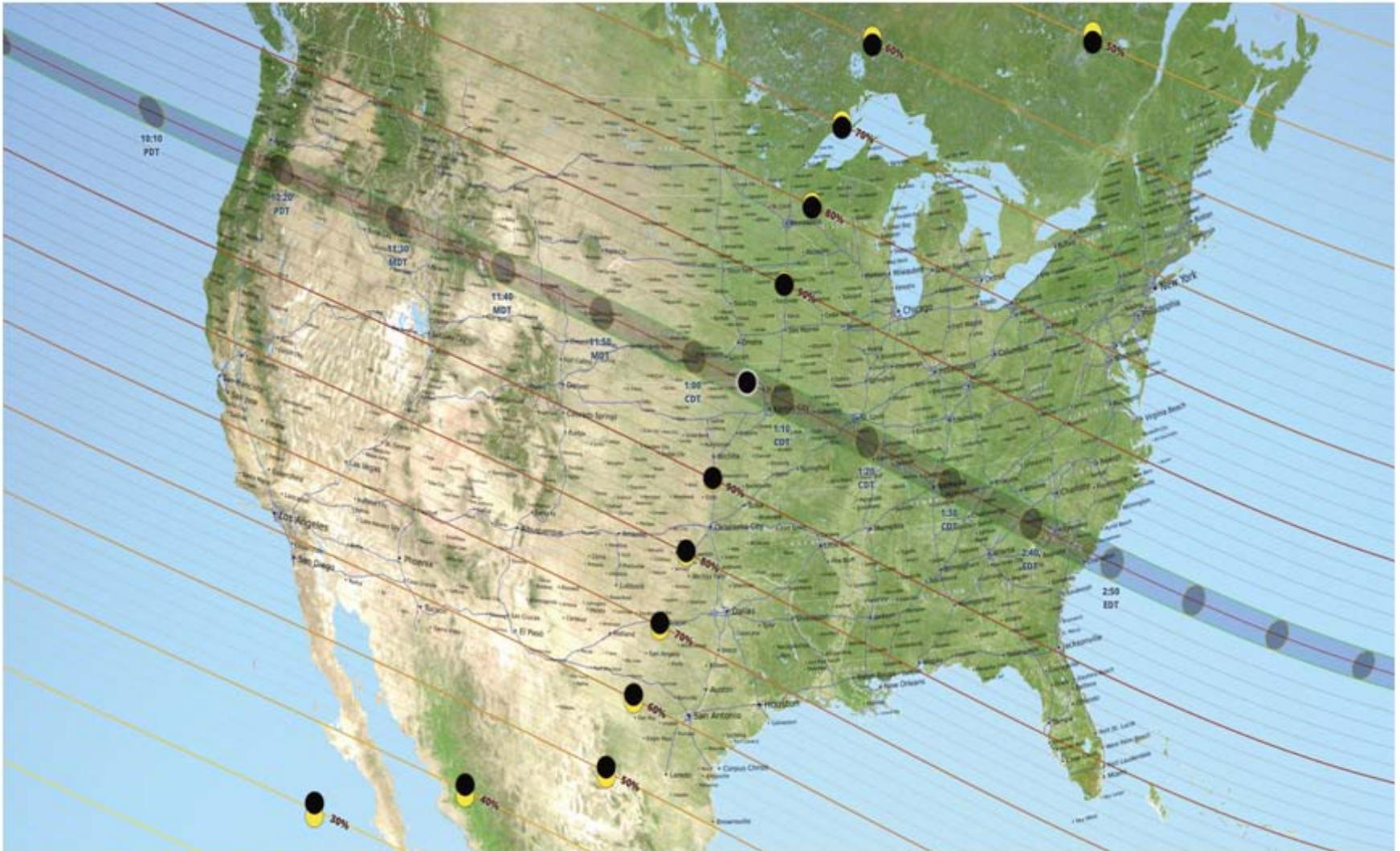
# Annular Solar Eclipses

- A total solar eclipse occurs when the moon is on the near side of its elliptical orbit. When the moon is on the far side of its orbit, it appears smaller and can't completely cover the sun. It is during these eclipses that the moon's *antumbra* shadow (the extension of the umbra) reaches Earth, causing an *annular* eclipse for people who are within the track of the antumbra (also called the *path of annularity*). During this type of eclipse, you will see a ring or *annulus* of bright sunlight surrounding the moon at the maximum phase.
- Just as with the partial eclipse of the sun, you must take precautions and use a solar filter to view the annular eclipse. Annularity can last up to 12 minutes

# Hybrid Eclipse

- A third type of solar eclipse, that may rarely occur, is called a *hybrid eclipse*. A hybrid eclipse is the name given to a total eclipse that changes to an annular eclipse or an annular eclipse that changes to a total eclipse. They are sometimes called annular/total eclipses. Hybrid eclipses occur when the curvature of Earth brings different points of the path into the total and annular shadows respectively

# New Orleans area will have about 75% Solar Eclipse



# Two Main Safety Issues Here

- First one is your eyes!
- Second is the safety of your camera's Sensor!

# Solar Filters

- When viewing or photographing the partial phases of a solar eclipse or the maximum phase of an annular eclipse, you must use a solar filter. Even if 99% of the sun is covered by the moon, the remaining 1% crescent is dangerous to view with the naked eye and can cause serious eye damage or blindness, or camera detector damage.
- You can find information on solar filters and where to purchase them from astronomy websites and magazines. Safe solar filters for cameras and telescopes are available as either "Full-Aperture" and "Off-Axis" filters. Both of these filters fit over the objective (front end of the telescope) or camera lens.
- Full-aperture solar filters are the preferred filters of choice. This is because the filter completely covers the front of the telescope so the entire mirror or lens is used. No refocusing of the telescope or camera lens will be needed when you remove the filter at the beginning of totality or when it is replaced back on the telescope/camera lens at the end of the total phase

# Solar Filters

To protect all this expensive camera gear you need some special filters. There are a variety of solar filters available for your lenses. Some of these filters are made of optical-quality film and some are made from glass. Most of these solar filters are equivalent to 16- to 20-stop neutral density filters. The filters range in price from about \$100 to \$200, depending on filter size. A cheaper alternative is to use optical Mylar film. The most common of these films is Baader AstroSolar Film and Thousand Oaks Optical Black Polymer Filter Sheets. You can make your own filter by cutting a very precise circle of this film and fitting inside the filter ring of a skylight or UV filter. Just make sure the film covers all the glass of the filter and has no light leaks. It is even easier to use a square filter holder such as those made by LEE Filters, buy a glass or resin filter that fits the holder and cut a rectangle that covers the whole filter. It is easier to cut a rectangle to cover the filter than a precise circle. You can use masking tape to seal the filter on all four sides and then just insert it in the holder over your lens. This way you can make a very good filter without spending hundreds of dollars for something you may only use once. I photographed the Baja eclipse using this method

# Starting Exposure

- Solar eclipses may be viewed and photographed, provided certain precautions are taken. You can photograph a solar eclipse with any type of camera: The longer the focal length of the lens, the larger the images of the sun you'll be able to make. While you can also use film cameras to photograph eclipses, this article specifically discusses digital camera use.
- With a DSLR, you can also combine a super telephoto lens with a teleconverter to increase the focal length. You can also increase the relative size of the eclipse image by selecting an FX camera's "DX Crop Mode". If you're photographing the solar eclipse, turn the built-in flash to OFF.
- How large you want the sun to be in the frame will determine what focal length lens to use. For a DSLR camera with a full frame FX sensor, choose a focal length of 2000mm or less. For a DSLR camera that has a DX sensor, the maximum focal length is about 1300mm; any longer and you won't be able to get the entire sun in the frame.
- However, if you also want to capture the sun's corona during the phase of totality, then you should choose a focal length that's shorter still—no more than 1400mm for an FX (full frame sensor) camera, or 900mm for a DX camera

- Place your camera on a sturdy tripod, and manually focus the camera, setting it to infinity.

A solar filter must be used on the lens throughout the partial phases for both photography and safe viewing. These filters typically attenuate the sun's visible and infrared energy by a factor of 100,000. Almost any ISO can be used because the sun gives off abundant light. The actual filter factor and choice of ISO will play critical roles in determining the correct exposure.

- The easiest way to determine exposure is to run a calibration test on the un-eclipsed sun on a clear day prior to the eclipse. Digital cameras are ideal as you can see your results almost instantaneously. Shoot the mid-day sun at a fixed aperture, (choose an aperture between f/8 and f/16) using every shutter speed from 1/4000 second to 1/30 second. Looking at the exposures, choose the best shutter speed/aperture combination and use them to photograph the partial phases of the solar eclipse. Your camera's histogram function is an excellent way to evaluate the best exposure. The histogram should not be clipped but should lie toward the upper end of brightness values. Because the sun's brightness stays the same throughout the partial phases, no exposure compensation will be needed. You may also decide to bracket your exposures to ensure that you photograph the solar eclipse with a perfect exposure. If you ran your test on a sunny day and the eclipse occurs on a hazy day, increase the bracket of exposures an additional f/stop.

# Photographing the Totality Phase of a Solar Eclipse

- Certainly the most spectacular phase of the solar eclipse is totality. For a few brief seconds or minutes, the sun's pearly white corona, red prominences, and chromosphere are visible.
- The great challenge is to obtain a set of photographs that captures these fleeting phenomena. During the total phase, all solar filters must be removed. This is because the sun's corona has a surface brightness a million times fainter than the sun's visible disk or photosphere, so photographs of the corona must be made without a filter. Furthermore, it is completely safe to view the totally eclipsed sun directly with the naked eye. No filters are needed, and in fact, they would completely hide the view.
- The average brightness of the *corona* varies inversely with the distance from the sun's *limb*. The inner corona is far brighter than the outer corona thus, no single exposure can capture its full dynamic range. The best strategy is to choose one aperture and bracket the exposures over a range of shutter speeds from 1/1000 second to 1 second. You should rehearse the actions of setting up the camera and adjusting exposures because it is common for photographers to become easily distracted when viewing this phase of the solar eclipse, so much so that you forget to make pictures

- A zoom lens, preferably one that has a focal length of at least 400mm.
- A solar filter to protect your lens and camera or Neutral density filter of 16 to 20
- Solar glasses so you can watch the eclipse unfold as it happens.
- A tripod to hold your camera steady.
- A place to view the eclipse, free of obstructions.

- **Use a fast shutter speed.** It's not about stopping the vibration of your camera, which is what a tripod is for, but freezing the motion of the moon as it travels across the sun. 1/125th of a second will be more than adequate, and going faster than that won't really give you much of an advantage. Once again, make sure you have a solar filter or else you will damage your camera, and get a pair of solar glasses for your eyes too.
- **Use a small aperture, but not too small.** Each lens is different, but in general f/8 or f/11 is going to give you a sharp image without much diffraction or chromatic aberration. Go much larger than that (i.e. f/4, f/2.8) and you risk getting an image that isn't as sharp as it could be. Much smaller than that (i.e. f/16, f/22) will likely result in weird optical artifacts that happen as the light enters such a small opening and is reflected throughout the glass elements of your lens.
- **Shoot in RAW**, not JPEG, and correct your white balance afterward in Lightroom, Photoshop, or another similar program
- **Use a two-second delay timer** or remote trigger (if you're shooting with a tripod) so you don't get any vibration from your finger pressing the shutter, which can cause the image to appear blurry.
- **Use Live View to check for focus.** Alternatively, you can use autofocus but make sure to check your pictures on the LCD screen right away to make sure they are properly in focus.
- **...Don't spend all your time** chimping, or looking at the LCD screen on the back of your camera after you take photos. You will only have a few minutes at most to take pictures of the total eclipse, and you will have plenty of time to admire them after it's all done.

# Basic DSLR Camera Settings

- Shoot Raw file format. If your camera can record Raw + JPEG that is ok, as long as your camera is also recording Raw.
- Use your camera's highest native optical resolution. Look up your camera's resolution for [Canon and Nikon cameras here](#) under "Pixel Array". Go into your camera's settings and make sure it is set to the highest resolution. Read your camera manual to find out where this setting is located in the camera menus

- Use Daylight White Balance. You are shooting the Sun. That is where daylight comes from, so that's the white balance you want to use!
- Turn off Auto ISO. Set your ISO manually. Low ISOs like ISO 200 will result in exposures that have the lowest noise.

- Turn off Long Exposure Noise Reduction. The eclipse is not long enough to double your exposure times on long exposures for maximum corona.
- Turn off the flash. It' won't reach the Sun. It won't even reach the Moon
- Use a tripod. Exposures will be long enough during totality that you will need one.

- Prefocus on the edge of the Sun (with the solar filter in place) and tape the focus down. Don't forget to take your filter off during totality! Focus should not change with the filter off.
- Turn off autofocus! This is very important. Your camera might not even fire if you have autofocus on and it can't detect a subject in focus.

- Use a remote release to open the shutter so you don't accidentally jostle the camera and make the images blurry.