

Introduction

On 21 August 2017, the skies of North America will darken as a result of a total solar eclipse. Its startling onset and eerie appearance combine to create a unique visual impression. The last total solar eclipse, where the moon almost completely covers the Sun, that was visible in the continental United States occurred in 1979. If you want to view the solar eclipse in 2017, be aware that staring at the Sun during an eclipse may cause eye injuries, such as permanent blurry vision and central blind spots. This Fact Sheet provides information about how to safely observe this inspiring event using protective devices designed for eclipse viewing or indirect viewing techniques to prevent eye injuries.

Potential Viewing Hazards and Suspected Eye Injuries

Is it safe to watch the eclipse without eye protection? No. Staring directly at the Sun is extremely hazardous to the eye and may cause permanent damage to the retina. Figure 1 shows a retinal lesion caused by staring at the Sun without proper eye protection. While most people gradually recover their normal vision within 1-6 months, some end up with permanent blurry vision and central blind spots. You would normally never stare at the Sun because it is extremely bright. However, during an eclipse you may be tempted to observe the event without suitable eye protection. The lower light levels experienced during a partial solar eclipse or an annular ring-of-fire eclipse will not render it safe. You will still be at risk for retinal injury.

So why is it less hazardous to watch a common sunset? Prolonged staring at the Sun is never a good idea and should be avoided as good safety practice. Sunsets are less hazardous to view

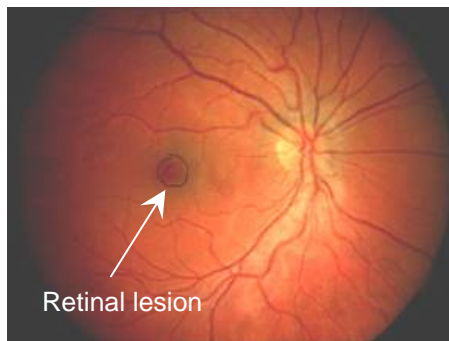


Figure 1: Damage due to Sun.

Image provided by
<http://astronomyonline.org/SolarSystem/SunspotRotation.asp>

because direct sunlight from near the horizon is more strongly filtered by the atmosphere than direct sunlight from when the Sun is higher in the sky. This filtering is the reason why the Sun appears to be orange-yellow as it sets.

Will sunglasses protect my eyes? No.

Sunglasses, smoked glass, and photographic neutral density filters cannot protect you from the hazards of staring directly at the Sun during an eclipse. Welding goggles with a minimum shade number 14 arc welding filter offer sufficient protection. The worst viewing method is directly viewing the Sun through a lens, such as unfiltered telescopes, cameras, or binoculars. A lens will capture even more of that damaging energy and focus it directly onto your eyes.

Can I view the eclipse through the camera on my phone? While it is fine to view an eclipse off an LCD screen, the potential danger comes with aiming the camera. If you try to hold your camera directly up to the Sun, the Sun can still damage your eyes if you accidentally glimpse it while aiming. Persons taking selfie videos of the eclipse may be tempted to glance over their shoulder and look toward the Sun. Filming direct unfiltered sunlight may also damage some smart phone sensors. If you decide to film the eclipse through your phone ensure that you protect your eyes with approved safety glasses.

What should I do if I suspect that I've experienced an eye injury? Get an evaluation by an eye care professional as soon as possible. Symptoms might develop immediately, or in a few days. The severity or type of symptoms may also change over time. The most common indications of possible injury are blurry vision and central blind spots. Color vision can also be affected. Often the injury from staring at the Sun will be in both eyes.

Safe Viewing

Where can I get the protective devices for viewing the solar eclipse? Disposable "Eclipse glasses" are available for commercial purchase (see Figure 2). Ensure that your eclipse glasses meet the international standard ISO 12312-2 on Filters for Direct Observation of the Sun. Glasses with only CE certification may not provide sufficient protection.

Are there other techniques to safely view the

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Figure 2: Eclipse Glasses.

Image from

http://eclipse2017.nasa.gov/sites/default/files/eclipse-glasses_with_emblem.png

eclipse? One of the safest techniques is called the pinhole-projection method, which is illustrated in Figure 3: (1) take two pieces of paper or cardboard; (2) using a pin, pencil point or paper clip, pierce a smooth round pinhole into one of the pieces of paper. In general, larger size pinholes will lead to a brighter but less focused image, and smaller size pinholes will lead to a dimmer but better focused image; (3) with your back to the eclipse, hold up the paper with the pinhole so that the sunlight shines through it; (4) hold up the second paper about three to four feet away so that the sunlight is projected onto it. You will see an inverted image of the eclipse on the second paper; (5) view the image of the eclipse that appears on the paper. **Do not view the Sun directly through the pinhole.**

Where to View the Eclipse

Most people in North America will be able to view at least a partial solar eclipse, while those in some states will see a total solar eclipse. Figure 4 shows the roughly 70 mile wide path of the total solar eclipse through North America as the shadow travels at 1670 mph across the country from the West to the East Coast.

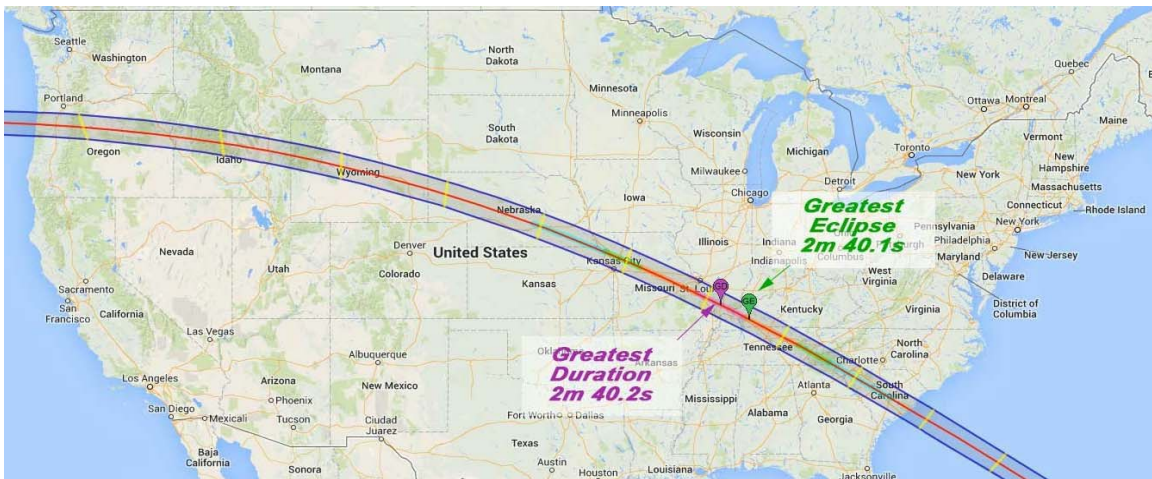


Figure 4. Eclipse Path. Image from: <http://eclipse.gsfc.nasa.gov/SEmono/TSE2017/TSE2017fig/TSE2017-usa.jpg>. Eclipse predictions by Fred Espenak, NASA Goddard Space Flight Center

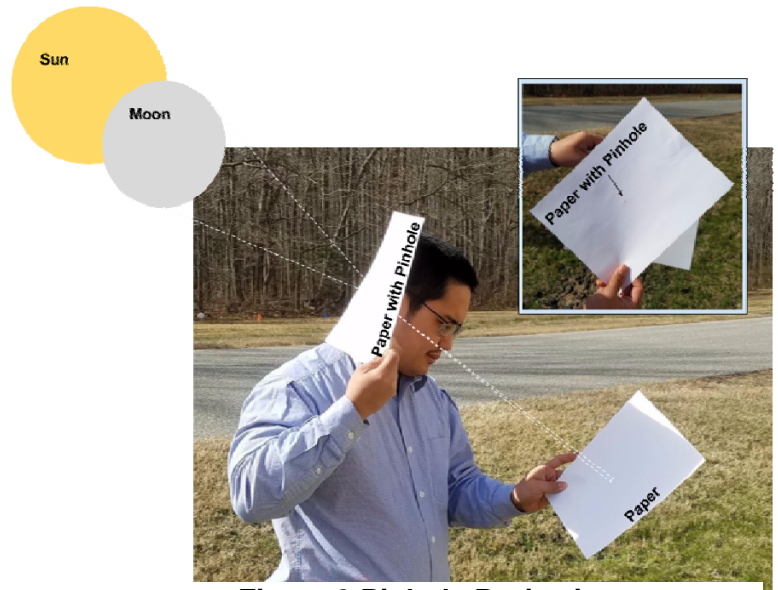


Figure 3 Pinhole Projection.

Image from Nonionizing Radiation Division APHC

The path of totality will start near Salem, Oregon at 1017 (PDT) and ends near Charleston, South Carolina around 1447 (EDT). Some of the major Army installations that will be in the best positions to observe the total eclipse are Fort Leavenworth, Fort Leonard Wood, Fort Campbell, and Fort Jackson. Wherever you decide to view the eclipse, do it safely. **Never stare at a solar eclipse without proper eye protection!**

Further Information

For further information about safety of ultraviolet, visible and infrared radiation sources, contact the Nonionizing Radiation Division at 410-436-3932. For information regarding vision and ocular damage, contact the Tri-Service Vision Conservation and Readiness Division at 410-436-9083.