

TOTALITY2017



ECLIPSES AND EYE SAFETY

Dispelling myths about viewing eclipses

By Charles Fulco





The 2017 Total Solar Eclipse (TSE2017) will occur on August 21 in the continental United States, bringing totality to this area for the first time since 1979. The Moon's umbra will traverse from Oregon to South Carolina in about 90 minutes, bringing an eerie darkness to 14 states coast-to-coast and a partial eclipse to every part of the country from Alaska to Florida. During the almost 40-year period since the last totality, there have been ample chances to observe partial solar eclipses during school hours. Unfortunately, many science teachers have been unable to observe the eclipses. Administrators, worried about students becoming blinded by the eclipsed Sun, have routinely prevented teachers from taking their classes outdoors to view eclipses.

This action by superintendents and principals is actually borne of lack of scientific knowledge, a perpetuation of myths, and ungrounded fears. More than a few administrators that I have recently interviewed believe that even looking indirectly at the Sun during an eclipse (e.g., sunlight streaming in through classroom windows) can damage a person's sight. From my talks with administration and staff this past year, some principals still plan to keep students indoors with the blinds closed during the duration of a solar eclipse. This philosophy is no longer acceptable in the era of *Next Generation Science Standards (NGSS)*, *STEAM (Science, Technology, Engineering, Art, and Mathematics)*, and the renewed effort to improve science performance in U.S. schools. Fortunately, NASA, the American Astronomical Society (AAS), and other trusted organizations have information available to assist in the promotion of safe viewing methods. See Internet Resources for safety information from NASA.

Safe Observation

Contrary to what you may have heard or been taught, the Sun *can* be viewed safely, if done correctly. There are two basic ways to do this: direct and indirect obser-



vation. Looking directly at the Sun without optical aid is dangerous, especially when used with magnification through a telescope, but there *are* several safe methods that any teacher can employ to ensure the safety of his or her students while observing. No matter which method you choose, though, you must make certain directions are understood and followed. This means constant monitoring of your students with zero tolerance for disregarding the directions imprinted on solar safety glasses or solar telescope filters. To directly observe the Sun in a safe and easy way, use solar shades or "eclipse glasses," which are usually made of colored paperboard with mylar "lenses" that allow only about .0003% of the Sun's light to pass through (see Internet Resources). The image is a pleasing orange, and while not magnified, the glasses clearly show the sphere of the Sun, and all stages of an eclipse can be safely viewed. If you are in the path of a total eclipse, remove these glasses for the brief duration of totality (in the case of TSE2017, totality can range from two minutes on the Oregon coast up to two minutes and 40 seconds in the Midwest); otherwise, you will miss the most stunning part of the eclipse. Remove the solar glasses from your eyes as the last bit of sunlight disappears behind the Moon, but they *must* be put back on immediately the moment sunlight peeks out again from behind the Moon!

Another safety note: solar glasses should only be purchased from reputable suppliers! To promote safety awareness on a national level, I am providing fully endorsed “Totality2017” solar glasses for low-cost distribution to any educational district or organization in the United States. They can be imprinted with your school or organization’s logo free of charge, and while they make a nice keepsake of Eclipse Day, they can be used on any sunny day as well to safely view our closest star (see my author bio for information). Whichever method and observing tool you decide on, it is a good idea to practice using them properly before the eclipse arrives to avoid wasting time during the eclipse itself. My favorite part of distributing solar glasses is the look of surprise and awe when a child or adult puts them on and sees the Sun for the first time this way. Now *that’s* education!

Direct Observations

Direct solar viewing using magnification allows one to see “First Contact”—the moment when the Moon’s disc can first be seen moving across the Sun—along with any sunspots that may be on the solar disc. This can be done using a “Sun-ready” Coronado PST solar telescope (see Internet Resources) or properly filtered telescope or binoculars, again *only* using filters from recognized dealers. Telescopes or binoculars let you zoom in on all the phenomena associated with totality—most notably, prominences and the solar corona—to see unforgettable sights. A major drawback to using a scope or binoculars is that only one person at a time can look through them, and with the extremely limited time of totality, this is a constraint to consider for those within the path of the umbra.



Indirect Observations

Indirect methods of observation are the safest and most group-friendly way to observe since you are not looking directly at the Sun. This can take the form of pinhole projection (Fraknoi and Schatz 2016), student-constructed solar viewers (Fulco 2017), or through devices such as the Sunspotter and Solar Scope (see Internet Resources and the insert in this issue). The eclipsed Sun’s image can also be viewed on the ground, underneath leaves of trees and thatched roofs, or by holding a pasta colander or peg-board above a light-colored surface. Some students will be able to cross their hands over each other to project tiny solar images onto the ground. Even looking into a large puddle or pond will reveal partial stages of an eclipse. With all these choices, no children should be left in a classroom to view a solar eclipse on a television or computer screen—or worse yet, miss it entirely, due to safety concerns.

Promoting Good Science

Eclipses are rewarding teaching tools but are also subject to numerous myths, fears, nontruths, and just plain bad science. In an age where valid information is available in-



stantaneously, education personnel appear to know less about eclipses today than their predecessors, judging from periodicals and writings from back in the day. For examples, see James Fenimore Cooper's 1806 retelling of totality and Chapter 6 of Mark Twain's *A Connecticut Yankee in King Arthur's Court* for accounts of total solar eclipses (see Internet Resources). The content may not be appropriate for elementary students, but teachers (and film buffs) may want to search YouTube for the crucifixion scene in the 1961 film *Barabbas*—which actually was shot during a real totality!

With TSE 2017 approaching, educators have an obligation to promote safe viewing methods for solar eclipses. We need to demonstrate that there are many safe ways to observe an eclipse. Provide your administrators with online links on eye safety and assure them that you have taken every precaution with your students. Arrange a meeting with your science specialist at school, and perhaps create a take-home letter for parents or guardians to sign if the need arises. Inform them of the eclipse and state that their child will be adequately protected and supervised at all times. Check with your district's policies on this in order to cover yourself from any liability. If you still have doubts, consult with your union attorney or local astronomy center for more information and assistance on drafting this letter.

Whether or not you plan on observing from within the umbral path, certain rules of safety must be adhered to at all times. Even those seeing totality will see a partial eclipse before and after the very brief total phase, so eye safety is required knowledge for *everyone*. When you are leading outdoor solar-based activities, there is no

room for error in observing techniques, nor in the type of equipment being used. You never want to put your vision or that of your students' in jeopardy. Have fun but be safe—and remember, when it comes to TSE 2017: No Child Left Inside! ■

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References

- Fraknoi, A., and D. Schatz. 2016. *Solar science: All-American total solar eclipse*. Arlington, VA: NSTA. www.nsta.org/publications/press/extras/files/solarscience/SolarScienceInsert.pdf.
- Fulco, C. 2017. Totality 2017: Get ready for the Great American Eclipse! *Science and Children* 54 (5): 60–65.
- Fulco, C. 2017. Totality 2017: Countdown to the Great American Eclipse. *Science and Children* 54 (6): 60–65.

Internet Resources

- James Fenimore Cooper's *The Eclipse*
<https://americanliterature.com/author/james-fenimore-cooper/short-story/the-eclipse>
- Mark Twain's *A Connecticut Yankee in King Arthur's Court*, Chapter 6
www.gutenberg.org/files/86/86-h/86-h.htm#6

Eclipse Information

- Eclipse2017.org
www.eclipse2017.org/2017/viewing.HTM
- Exploratorium
www.exploratorium.edu/eclipse/how-to-view-eclipse
- Mr. Eclipse
www.mreclipse.com/Totality2/TotalityCh11.html
- NASA
<http://eclipse2017.nasa.gov/safety>

Eclipse Viewing Resources

- Coronado PST Solar Telescope
www.meade.com/coronado-personal-solar-telescope-pst.html
- Solar Scope
www.solarscope.com/us/index.us.html
- Solar Telescope Filters
www.thousandoaksoptical.com/solar.html
www.daystarfilters.com/Telescope.shtml
- Sunspotter
www.sunspotter.org