

Making a Pinhole Camera

by Charles Fulco

On Monday, August 21, 2017, the United States will be treated to a very special event in the sky, something that has not been seen from our continent in 38 years—a total eclipse of the Sun. Before or after the total-eclipse part, if you are in the 70-mile-wide track of totality, or off to the side, you would have only a partial solar eclipse. You can observe the partial phases safely, using a solar viewer that you can make yourself with materials found around the house. It is called a pinhole camera, because sunlight enters it through a small opening in the device.

Most times you get to see only a partial eclipse, when the Sun is partially covered by the Moon. However, for anyone lucky enough to be within a narrow path from Oregon to South Carolina on

August 21, 2017, the entire Sun will be covered by the Moon—a total solar eclipse!

Only during totality can you look directly at the Sun safely without a special filter. Since you will not want to miss any of this celestial spectacle, you will need to have a special viewer to make sure your eyes are protected before and after totality. And—you can use this viewer on any sunny day to look at the Sun safely! Simply point the end with the hole in the foil at the Sun and an image of the Sun will appear inside the viewer at the other end.

NOTE: If there is an eclipse in progress, it probably will not become visible in your viewer until the Sun is more than half-covered. Only if there is a very big sunspot or group of sunspots would they show in this simple setup. After the August 21, 2017, total solar eclipse, you will get another chance to use your viewer at the partial phases of the eclipse of April 8, 2024.

Pinhole Cameras

The invention of the pinhole camera dates back to at least fifth century b.c. China. Millennia later, in the 10th century a.d., Arab mathematician and astronomer Alhazen explained how observers of a partial solar eclipse could use projection through a small hole to protect their eyes by looking away rather than toward the Sun. Centuries later in Europe, the pinhole camera became a basic tool for safely observing the partial phases of solar eclipses.

From studying the solar eclipse observations made by Nicolaus Copernicus from 1530 to 1541, historians have suggested that he probably used a pinhole camera. A few decades later, at the outset of his career as an observational astronomer, Tycho Brahe (see pages xxx) taught that partial-eclipse measurements can best be made by using a pinhole camera. Tycho's younger colleague Johannes Kepler knew that Tycho had had some difficulties with his pinhole camera measurements. To overcome these problems, Kepler worked out a theory of pinhole images and built his own pinhole camera for use in solar eclipse observations.

Kepler, in his 1604 book on optics, described how he covered his wooden eclipse-viewing device in “so many layers of black cloth that no light can break in.” Kepler also observed a solar eclipse on October 12, 1605, using a pinhole camera—but he was dissatisfied with his observations.

—Naomi Pasachoff

