



This photo provided by Bob Baer and Sarah Kovac, participants in the Citizen CATE Experiment, shows a "diamond ring" shape during the 2016 total solar eclipse in Indonesia. For the 2017 eclipse over the United States, the National Science Foundation-funded movie project nicknamed Citizen CATE will have more than 200 volunteers trained and given special small telescopes and tripods to observe the sun at 68 locations in the exact same way. The thousands of images from the citizen-scientists will be combined for a movie of the usually hard-to-see sun's edge.

R. Baer, S. Kovac/Citizen CATE Experiment via AP

# More than spectacle: Eclipses create science and so can you

By **SETH BORENSTEIN**  
AP Science Writer

WASHINGTON — The sun is about to spill some of its secrets, maybe even reveal a few hidden truths of the cosmos. And you can get in on the act next week if you are in the right place for the best solar eclipse in the U.S. in nearly a century.

Astronomers are going full blast to pry even more science from the mysterious ball of gas that's vital to Earth. They'll look from the ground, using telescopes, cameras, binoculars and whatever else works. They'll look from the International Space Station and a fleet of 11 satellites in space. And in between, they'll fly three planes and launch more than 70 high-altitude balloons.

"We expect a boatload of science from this one," said Jay Pasachoff, a Williams College astronomer who has traveled to 65 eclipses of all kinds.

Scientists will focus on the sun, but they will also examine what happens to Earth's weather, to space weather, and to animals and plants on Earth as the moon totally blocks out the sun. The moon's shadow will sweep along a narrow path, from Oregon to South Carolina.

Between NASA and the National Science Foundation, the federal government is spending about \$7.7 million on next Monday's eclipse. One of the NASA projects has students launching the high-altitude balloons to provide "live footage from the edge of space" during the eclipse.

But it's not just the professionals or students. NASA has a list of various experiments everyday people can do.

"Millions of people can walk out on their porch in their slippers and collect world-class data," said Matt Penn, an astronomer at the National Solar Observatory in Tucson, Arizona.

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## Total solar eclipse: how it happens

As the moon eclipses the sun, it produces two types of shadows on Earth. The umbral shadow is cast when the sun is completely covered by the moon, producing a total solar eclipse. The penumbral shadow is much larger where only a partial eclipse can be seen.

If drawn to scale, the moon would be approximately 238,900 miles from Earth. The sun would be nearly 400 times that distance away.

### Eclipse phases

<b>First Contact</b> Edge of the moon starts to overlap the edge of the sun.	<b>Second Contact</b> Moon covers the entire disk of the Sun. Totality begins.	<b>Totality</b> The sun is completely covered.	<b>Third Contact</b> Moon starts moving away. The sun's disk re-emerges.	<b>Fourth Contact</b> Moon moves away from the sun as the eclipse event ends.

Sources: NASA; www.timeanddate.com

Alan Kenaga/EO Media Group



AP Photo/Gillian Flaccus

In this Aug. 3 photo, amateur astronomer Mike Conley practices with the telescope he will use to document the Aug. 21 total solar eclipse, at his home in Salem. Conley is part of a project led by the National Solar Observatory to have dozens of citizen-scientists posted across the U.S. photograph the celestial event in an effort to create a live movie of its path that will help scientists learn more about the sun's corona.

**"Who knows? Maybe a great secret will come of this, the mysteries of the sun will be revealed, because we're doing something that's never been done before and we're getting data that's never been seen before."**

— **Mike Conley**, Salem stock trader whose back yard is studded with telescopes



Scott G Winterton/The Deseret News via AP

In this Aug. 16 photo, Colton Hammer tries out his new eclipse glasses he just bought from the Clark Planetarium in Salt Lake City in preparation for the eclipse.

## Deities & dragons: How ancient cultures explained solar phenomenon

By **ROGER CULVER**  
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On August 21, a total solar eclipse will be visible across parts of the United States. As the Earth and moon sweep through space in their annual journey around the sun, the three bodies align in such a way that the Earth passes into the shadow of the moon. Observers then witness a sun that is gradually covered and uncovered by the moon's disk — a spectacular celestial event.

But until astronomers were able to explain this phenomenon, a solar eclipse could be a terrifying event. In many cultures throughout human history, the sun was seen as an entity of supreme importance, crucial to their very existence. It was regularly worshipped as a god — Amun-Ra to the Egyptians and Helios to the Greeks — or as a goddess, such as Amaterasu for the Japanese and Saule for many Baltic cultures.

One reason the sun served as a god or goddess in so many cultures was its awesome power: Looking directly at it would severely damage the eyes, a sign of the sun deity's wrath.

So the idea that the sun deity could be temporarily extinguished in a total eclipse inspired a number of imaginative explanations. Most involve some sort of evil entity trying to devour the sun. Such myths undoubtedly arose from the fact that during the early stages of a solar eclipse, the sun appears to have a bite taken out of it.

The various creatures include the Vikings' sky wolves Skoll and Hati, a Chinese dragon, a Vietnamese frog and assorted Roman demons. In many cultures, it was believed that such creatures could be driven off by creating as much loud noise as possible: yelling, ringing bells, and banging

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