

Solar eclipse notes

Solar eclipses have historically been viewed as omens that bring about death and destruction. But in reality, they are harmless—and they even helped prove Einstein's theory of relativity.

The word eclipse comes from *ekleipsis*, the ancient Greek word for being abandoned.

Scientific Discoveries

The British astronomer and mathematician, Sir Arthur Eddington, used the [total solar eclipse of May 29, 1919](#) to test Albert Einstein's theory of general relativity.

By taking pictures of stars near the Sun during totality, Eddington was able to show that gravity can bend light. This phenomenon is called gravitational deflection.

[All eclipses worldwide 1900–2099](#)

Helium Named After the Sun

A solar eclipse is also responsible for the discovery of helium. The first piece of evidence for the existence of the second lightest and the second most abundant element known to humans was discovered by the French astronomer Jules Janssen during a [total solar eclipse](#) on August 16, 1868. Because of this, it's named after the Greek word for the Sun: *Helios*.

Predicting the Emperor's Future

Surviving records have shown that the Babylonians and the ancient Chinese were able to predict solar eclipses as early as 2500 [BCE](#).

In China, solar eclipses were thought to be associated with the health and success of the emperor, and failing to predict one meant putting him in danger. Legend has it that 2 astrologers, Hsi and Ho, were executed for failing to predict a solar eclipse. Historians and astronomers believe that the eclipse that they failed to forecast occurred on October 22, 2134 BCE, which would make it the oldest solar eclipse ever recorded in human history.

Ancient cultures tried to understand why the Sun temporarily vanished from the sky, so they came up with various reasons for what caused a solar eclipse.

Hungry Demons, Thieving Dogs

In Vietnam, people believed that a solar eclipse was caused by a giant frog devouring the Sun, while Norse cultures blamed wolves for eating the Sun.

This flying [black dog](#) of Chinese legend is responsible for eating the sun during a solar eclipse because some dogs eat anything. The story goes that [Zhang Xian](#), god of birth, fires arrows at Tiangou to ward him off. Eventually Tiangou gets scared and throws up the sun like an old tennis ball. And our star is safe and a little slobbery.

According to ancient Hindu mythology, the deity *Rahu* is beheaded by the gods for capturing and drinking *Amrita*, the gods' nectar. Rahu's head flies off into the sky and swallows the Sun causing an eclipse.

[Korean](#) folklore suggests that solar eclipses happen because mythical dogs are trying to steal the Sun.

Traditionally, people in many cultures get together to bang pots and pans and make loud noises during a solar eclipse. It is thought that making a noise scares the demon causing the eclipse away.

Bear Eats the Sun

The Pomo, an indigenous group of people who live in the northwestern [United States](#), tell a story of a bear who started a fight with the Sun and took a bite out of it. In fact, the Pomo name for a solar eclipse is *Sun got bit by a bear*.

After taking a bite of the Sun and resolving their conflict, the bear, as the story goes, went on to meet the Moon and take a bite out of the Moon as well, causing a [lunar eclipse](#). This story may have been their way of explaining why a solar eclipse happens about around [2 weeks before or after a lunar eclipse](#).

Angry Sun

The ancient Greeks believed that a solar eclipse was a sign of angry gods and that it was the beginning of disasters and destruction.

The Tewa tribe from New Mexico in the United States believed that a solar eclipse signaled an angry Sun who had left the skies to go to his house in the underworld.

Quarreling Sun and Moon

According to Inuit folklore, the Sun goddess *Malina* walked away after a fight with the Moon god *Anningan*. A solar eclipse happened when *Anningan* managed to catch up with his sister.

The Batammaliba, who live in [Benin](#) and [Togo](#), used a solar eclipse as a teaching moment. According to their legends, an eclipse of the Sun meant that the Sun and the Moon were fighting and that the only way to stop them from hurting each other was for people on Earth to resolve all conflicts with each other.

Modern Day Superstitions

Fear of solar eclipses still exists today. Many people around the world still see eclipses as evil omens that bring death, destruction, and disasters.

A popular misconception is that solar eclipses can be a danger to pregnant women and their unborn children. In many cultures, young children and pregnant women are asked to stay indoors during a solar eclipse.

Not all superstitions surrounding solar eclipses are about doom. In [Italy](#), for example, it is believed that flowers planted during a solar eclipse are brighter and more colorful than flowers planted any other time of the year.

×



Next Partial Lunar Eclipse: [Mon, Aug 7, 2017 ... See animation](#)
Solar eclipses have historically been viewed as omens that bring about death and destruction. But in reality, they are harmless—and they even helped prove Einstein's theory of relativity.



Solar eclipses used to be seen as omens.

©iStockphoto.com/wynnter

The word eclipse comes from *ekleipsis*, the ancient Greek word for being abandoned.

Scientific Discoveries

The British astronomer and mathematician, Sir Arthur Eddington, used the [total solar eclipse of May 29, 1919](#) to test Albert Einstein's theory of

gravitational deflection.

[All eclipses worldwide 1900–2099](#)

Helium Named After the Sun

A solar eclipse is also responsible for the discovery of helium. The first piece of evidence for the existence of the second lightest and the second most abundant element known to humans was discovered by the French astronomer Jules Janssen during a [total solar eclipse](#) on August 16, 1868. Because of this, it's named after the Greek word for the Sun: *Helios*.

In 1868, Janssen traveled to Guntur, India, to observe the solar eclipse. He focused on the solar prominences and concluded they mostly comprise hydrogen gas, heated to extremely high temperatures. But on August 18, when he observed the sun's spectrum through his spectroscope, he noticed that the wavelength of the yellow line supposedly indicating the presence of sodium didn't actually match up to the wavelength for that element. In fact, it didn't match the wavelength of any known element to date. The line was bright enough, he thought, that it should be visible even without the aid of an eclipse, provided a means could be found to filter out all but that wavelength of visible light. That is how he came to invent the spectrohelioscope to better analyze the sun's spectrum.

Some 5,000 miles away, on October 20, 1868, the English astronomer Joseph Norman Lockyer also succeeded in observing the solar prominences in broad daylight. His paper detailing those observations arrived at the French Academy of Sciences on the same day as Janssen's paper, so both men received credit for the discovery of helium.

Initially it was a dubious honor: Many colleagues doubted this could be a new element and ridiculed their conclusions. Others thought helium could exist only in the sun. In 1882, the Italian physicist Luigi Palmieri was analyzing lava from Mount Vesuvius when he noticed that same telltale yellow spectral line in his data — the first indication of helium on Earth. It would be another 12 years before the Scottish chemist William Ramsey found further experimental evidence of this new element.

Predicting the Emperor's Future

Surviving records have shown that the Babylonians and the ancient Chinese were able to predict solar eclipses as early as 2500 [BCE](#). In China, solar eclipses were thought to be associated with the health and success of the emperor, and failing to predict one meant putting him in danger. Legend has it that 2 astrologers, Hsi and Ho, were executed for failing to predict a solar eclipse. Historians and astronomers believe that the eclipse that they failed to forecast occurred on October 22, 2134 BCE, which would make it the oldest solar eclipse ever recorded in human

Substitute Kings

Clay tablets found at ancient archaeological sites show that the Babylonians not only recorded eclipses—the earliest known Babylonian record is of the eclipse that took place on May 3, 1375 BCE—but were also fairly accurate in predicting them. They were the first people to use the saros cycle to predict eclipses. The saros cycle relates to the lunar cycle and is about 6,585.3 days (18 years, 11 days, and 8 hours) long.

[How often do solar eclipses occur?](#)

Like the ancient Chinese, the Babylonians believed that solar eclipses were bad omens for kings and rulers. Predicting solar eclipses enabled them to seat substitute kings during solar eclipses with the hope that these temporary kings would face the anger of the Gods, instead of the real king.

Eclipses as Peacemakers

According to the Greek historian Herodotus, a solar eclipse in 585 BCE stopped the war between the Lydians and the Medes, who saw the dark skies as a sign to make peace with each other.

The Greek astronomer Hipparchus used a solar eclipse to determine that the Moon was about 429,000 km (268,000 mi) away from the Earth. This is only about 11% more than what today's scientists accept as the average [distance between the Moon and the Earth](#).

Kepler Close, Halley Closer

Although early eclipse pioneers, including Chinese astronomer Liu Hsiang, Greek philosopher Plutarch, and Byzantine historian Leo Diaconus tried to describe and explain solar eclipses and their features, it was not until 1605 that astronomer Johannes Kepler gave a scientific description of a [total solar eclipse](#).

More than a century later, Edmund Halley, who the famous Halley's [comet](#) is named after, predicted the timing and path of the total solar eclipse on May 3, 1715. His calculations were only 4 minutes and about 30 km (18 mi) off from the actual timing and path of the eclipse.

Halley's comet causes 2 annual [meteor showers](#): the [Eta Aquarids](#) and the [Orionids](#).

Some Other Notable Solar Eclipses in History

The scientific fascination with solar eclipses has led to some important scientific discoveries about the nature of the Sun, Moon, and our solar system.

The **Baily's beads** effect is a feature of total [solar eclipses](#). As the [moon](#) "grazes" by the [Sun](#) during a [solar eclipse](#), the rugged [lunar limb](#) topography allows beads of sunlight to shine through in some places, and not in others. The name is in honor of [Francis Baily](#) who provided an exact explanation of the phenomenon in 1836. ^{[1][2]} The diamond ring effect is seen when only one bead is left: a shining diamond set in a bright ring

distance) are known accurately from observations of grazing [occultations](#) of [stars](#). Astronomers thus have a fairly good idea which mountains and valleys will cause the beads to appear in advance of the eclipse. While Baily's beads are seen briefly for a few seconds at the center of the eclipse path, their duration is maximized near the edges of the path of the [umbra](#), reaching 1–2 minutes.

The first correctly-exposed photograph of the solar corona was made during the total phase of the solar eclipse of 28 July 1851 at Königsberg (now Kaliningrad) by a local daguerreotypist named Berkowski. Berkowski observed at the Royal Observatory following a proposal by its director A. Busch. A small refracting telescope ($D = 6.1$ cm, $f = 81.2$ cm) was attached to the hour drive of the 15.8-cm Fraunhofer heliometer, and a 84-s exposure was taken shortly after the beginning of totality. After the eclipse, Busch (who did not observe the eclipse at Königsberg but at Rixhöft), published some details about the daguerreotype (without mentioning Berkowski's first name) and ordered a local artist (R. Trossin) to make an enlarged steel engraving from the daguerreotype plate. On the original plate the moon's diameter is 7.85 mm, and at least 5 prominences are well visible on the limb of the sun. Later Berkowski himself made some daguerreotype reproductions from his original plate. One of these is still preserved at Jena University Observatory, it has a moon

diameter of 8.69 mm. In 1891 the Königsberg Astronomer C.F.W. Peters ordered photographic reproductions of the original daguerreotype (which then still existed) to be made, some of which have been published in astronomical textbooks. We have calculated the local circumstances, in particular the contact times, of the Königsberg eclipse and compared them with observations. We describe the Berkowski daguerreotype and some of its copies, and we report about the Jena copy of this famous daguerreotype.

Year	Date	Type	Importance
632	January 27	Annular	Visible in Medina, Saudi Arabia , the eclipse coincided with the death of the Prophet Mohammad's son Ibrahim. The Prophet reportedly dismissed rumors that this was a miracle, stating that the Sun and the Moon were signs of God and that they are not eclipsed for the birth or death of a man.
1133	August 2	Total	King Henry's Eclipse: King Henry I died shortly after the eclipse, prompting the spread of the superstition that eclipses are bad omens for rulers.
1836	May 15	Annular	English astronomer Francis Baily first discovered and described Baily's beads—a phenomenon that occurs in the seconds before and after totality in a total solar eclipse and annularity in an annular solar eclipse .
1851	July 28	Total	The first photograph of the Sun's corona was taken by a Prussian photographer called Berkowski.
2009	July 21/22	Total	Longest total solar eclipse of the 21st century. Totality lasted for 6 min and 39 secs.