ECLIPSE HISTORY

BY JAMES EDGAR

Eclipses have been recorded in history for as long as there have been records. Ancient Greeks used the term *ekleipsis*, meaning "the abandonment" or "the darkening of a heavenly body," from which we derive the current term. Experiencing a total solar eclipse is unforgettable, and such events created great fear in early observers.

Even though early astrologers (for it was they who kept track of heavenly events) were familiar with the apparent movements in the Solar System, measurements weren't precise enough and their Earth-centered model inadequate to establish that the Sun is at the center of the Solar System. Nor did they know at first what caused the Sun to suddenly darken for part of a day.

A standing-stone monument inscribed with petroglyphs at the Loughcrew Cairn L in Ireland is believed to record the solar eclipse of 3340 Nov. 30 BCE. Another record from China likely marks the day when "the Sun and Moon did not meet harmoniously" on 2134 Oct. 22 BCE. Fear that the Sun may not come back was quite real at that time. According to Chinese tradition, loud noises, banging drums and pots, and even shouting scared away the "dragon" that was eating the Sun.

Later scribes in Babylon kept careful records of celestial events on clay tablets, some of which exist to this day. We know from one of these records that on 1063 Jul. 31 BCE, a total solar eclipse "turned day into night." Assyrian observers in Nineveh wrote of the eclipse of 763 Jun. 15 BCE. These careful records led to the discovery of the Saros cycle (see p. 122). By about 610 BCE, Thales of Miletus was able to predict a solar eclipse, but his method does not survive. Ptolemy's writings in the *Almagest* around 150 CE show that he had a method for predicting both lunar and solar eclipses. The findings of Meton were widely known around the Mediterranean by then, as well (see p. 124).

For many, an eclipse was no longer something to be feared, but an interesting celestial regularity, something to anticipate with joy and excitement, much like today.

Science enters the picture

Many discoveries have occurred in the years since Ptolemy: solar prominences were first reported in 334 CE; a comet was observed during an eclipse in 418; Johannes Kepler wrote an accurate description of a total solar eclipse in 1605; Edmund Halley made an extremely accurate prediction of the solar eclipse of 1715 May 3, only missing the mark by 4 min and 30 km. The solar corona puzzled many observers, but by 1724, the proposal that it was part of the Sun met with acceptance. Francis Baily, in 1836, noted the "beads" of light that now bear his name—rays of light streaming through the mountain passes on the lunar limb as the eclipse is about to begin and then end. Helium was discovered as an element from a solar spectral line during a total solar eclipse in 1868, and a new element, "coronium," caused a brief flurry of excitement in 1869, until it was finally confirmed in 1941 to be ionized iron.

Sir Arthur Eddington is famously known for confirming Albert Einstein's prediction in his general theory of relativity that an object's mass "warps" spacetime, such that light travelling from a distant star curves past the edge of the Sun. The first proposal to measure the amount of bend came in the middle of WW I, but was postponed until after the war's end. Eddington chose the island of Principe off Africa's western coast to observe and photograph the eclipse of 1919 May 29, where the Moon's shadow, having crossed South America and the southern Atlantic Ocean, would pass right over his vantage point.

Fortuitously, in late May, the Sun is set against the bright stars of the Hyades star cluster, which, of course, would be obscured by the Sun's glare except during an eclipse. Even though the images Eddington recorded were of poor quality, the measurements derived from them showed that light does indeed bend near the edge of the Sun, and by the amount predicted by Einstein. This effect has been measured to exquisite accuracy, even with stars occulted by Jupiter. Gravitational lensing is a similar effect, and observations of such events are now used routinely to study the nature of very distant stars and galaxies.

Lunar Eclipses

Although not as spectacular as total solar eclipses, lunar eclipses also have been equally studied since ancient times, contributing to myths in many cultures. Was it a sow eating the Moon, as the Egyptians thought? Did a jaguar eat the Mayan Moon? Did a three-legged toad in China swallow the Moon whole? Many cultures—many myths. Careful study, though, especially by the ancient Greeks, led to discoveries such as the Saros and Metonic cycles. The early Greeks even declared that Earth is round like a globe, because the shadow cast on the Moon during an eclipse is always round.

Columbus is remembered for his "discovery" of the Americas, but he also famously used lunar eclipse predictions, stating that he could make the Moon disappear and then reappear to frighten the natives in Jamaica who were rebelling against the Spaniards eating all their food. He pulled off the stunt. The next day the natives continued to supply food.

Superstition has generally given way to scientific study and accurate measurement of events. As explained by Fred Espenak in the preceding pages, measuring crater timings—the moment when Earth's umbral shadow encroaches on a crater's central point—gives valuable information about the size of the shadow. A better way to measure is to accurately note the time when the shadow touches the crater rims, then divide the difference by 2 to get the average central time. It's known that Earth's shadow will be slightly larger than geometry requires, but what is still not well understood is why the enlargement varies from one eclipse to another, or what it is about Earth's atmosphere that causes such variation.

Eclipsophiles

When Eddington traveled to Principe to observe and measure during the 1919 eclipse, it was a big deal. Travel wasn't easy, and he traveled with a lot of baggage. These days, with easy travel arrangements, eclipsophiles can go anywhere in the world to bask in the glory of the Moon's shadow. And they do. There are at least two solar eclipses per year, and often one of them proves to be total. Many are the photos from people who travel to wherever the eclipse track takes them—the Australian Outback, Africa, onboard a ship, and even flying in a specially chartered aircraft to chase the shadow!

People continue to talk about the Great Eclipse of 2009, during which totality lasted over 6 minutes. This included travel to East Asia to see it. How about the one over northeast Australia in 2012? Or Svalbard in 2015? Many were the astronomers who visited those countries to see the Sun blotted out by the Moon. The hobby is more than a passion to some, who will continue to calculate, plan, and seek out places to get a fleeting glimpse of nature's amazing wonder—a total solar eclipse.