

*Almost anything can happen
when the ultimate source
of Earth's light and life
is eclipsed.*



Solar Eclipses That Changed the World

By Bradley E. Schaefer

A TOTAL SOLAR ECLIPSE is one of the most beautiful spectacles the sky has to offer; it can also be an awesome and ominous celestial event. Despite their rarity, solar eclipses have such a large impact, they can change the course of history.

The best-known example of a solar eclipse affecting a historical event occurred during a war between the Lydians and the Medes in 585 B.C. Darkness fell in the middle of a pitched battle, and both sides became eager to make peace. The Greek historian Herodotus tells us that the year of the eclipse had been predicted by Thales of Miletus. But the contribution of Thales is under a modern cloud because of the vagueness of the claim and the lack of a framework for predictions even in later times.

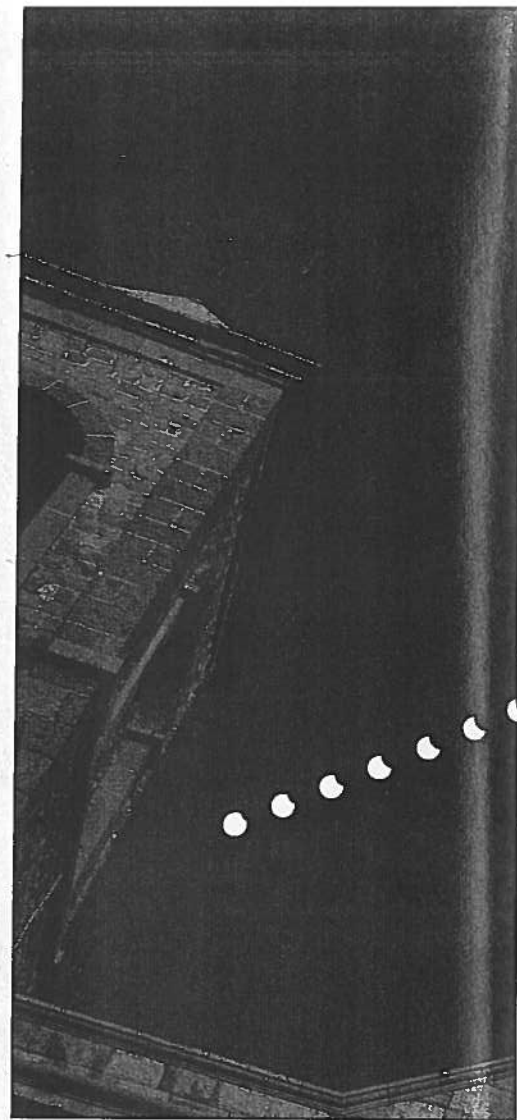
Solar eclipses have changed history in many other instances, and these often center on little-known stories involving famous people.

MUHAMMAD

The prophet Muhammad, founder of Islam, was born in Mecca in the Year of the Elephant, A.D. 569–570. His birth year got its name from an invasion by the Abyssinians, who used elephants in the assault. The army was miraculously driven off when a flock of birds dropped stones on the troops, causing an epidemic similar to smallpox.

The Year of the Elephant was also memorable (and datable) because of its solar eclipse. In ancient times, the births and deaths of leaders were often associated with celestial omens, and Muhammad's beginning was no exception. However, Islamic theology does not accept that the eclipse was sent by God as an omen of the prophet's birth, a doctrine that is based on another solar eclipse closely tied to Muhammad.

The prophet's infant son, Ibrahim, died tragically on January 22, 632. The Sun was eclipsed on that day, and some Meccans claimed it was a sign from God. Muhammad quickly corrected them, declaring, "The Sun and Moon are signs of God and do not eclipse for the death or birth of any man." Islamic legal scholars have used this



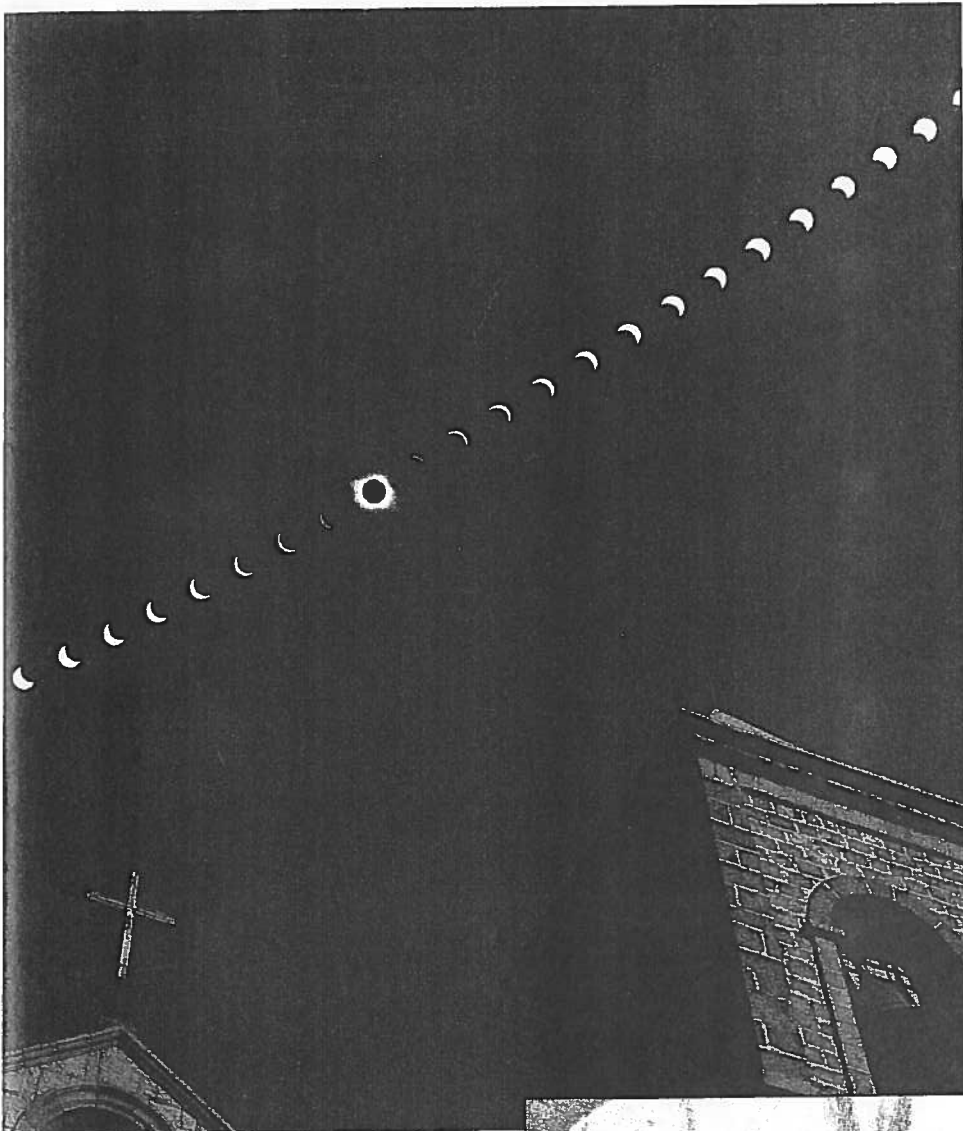
Because of their ominous symbolism solar eclipses have been powerful religious tools throughout history. They have won converts, legitimized spiritual leaders, and even shaped theologies. This sequence of the 1991 total solar eclipse above a cathedral in La Paz, Mexico, was obtained by Japanese photographers Akira Fujii, Hiroyuki Tomioka, and Yonematsu Shiono.

statement to reject astrology.

A third solar eclipse related to Muhammad occurred 39 years after his death. In 661 Mu'awiyah became leader of the empire after a revolt against Ali (the prophet's cousin, second convert, and son-in-law). The son of Muhammad's chief Meccan enemy, Mu'awiyah decided to transfer the prophet's pulpit from Medina to his capital in Damascus, Syria. But as his men were removing it the sky darkened such that stars could be seen. This was taken as a sign of divine displeasure, and the relic remained in Medina as a symbol of Mu'awiyah's failure.

TECUMSEH

At the start of the 19th century America was vigorously expanding west of the



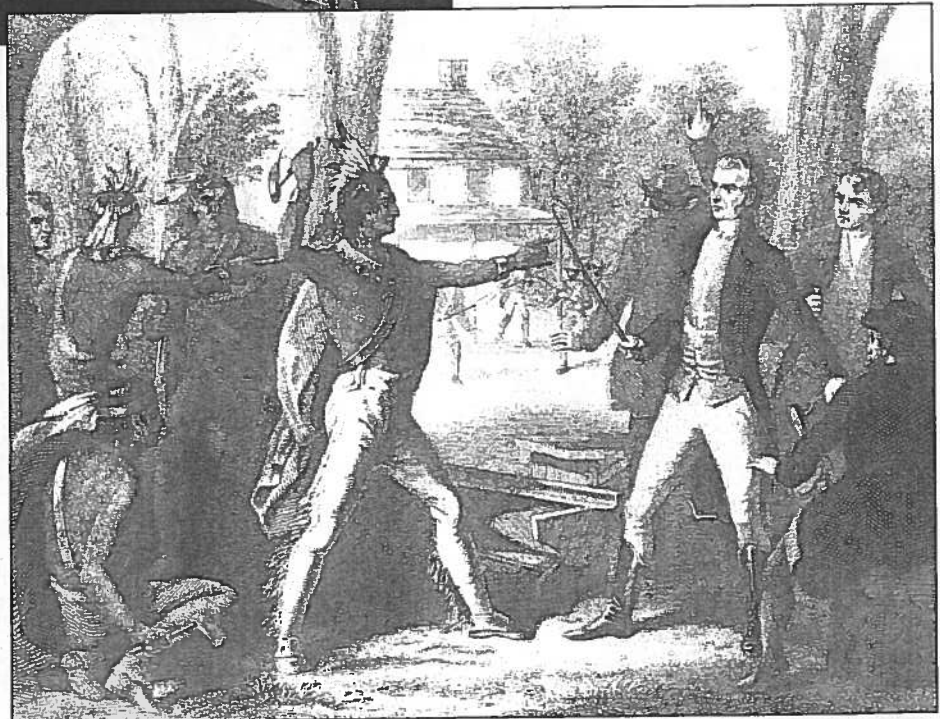
Any leader of a religion that supports the existence of miracles is always in a precarious position should he be challenged to perform one. William Henry Harrison, governor of the Indiana Territory, demanded that Tenskwatawa provide "some proofs at least of his being the messenger of the Deity." Tecumseh learned of an upcoming eclipse from members of an expedition to the area who were preparing for the event. He induced his brother to announce that on the morning of June 16, 1806, the Great Spirit would take the Sun in hand and hide it from the world. On the appointed morning, a large gathering in Greenville, Ohio, saw the prophet's promise come true. Then he saved the world from perpetual night by ordering the Great Spirit to release the Sun.

Backed by such a dramatic effect, the prophet became a powerful leader in the territory. The two brothers traveled from tribe to tribe, winning converts and organizing the confederation. For a time the alliance successfully held back the white settlers, and a capital, called Prophets-town, was built near Indiana's Tippecanoe River. The confederation later collapsed, however, when Harrison led a strong army against the town, and in a rash night assault Tenskwatawa made his warriors an ill-conceived promise of immunity from death. Their loss at Tippecanoe

Appalachian Mountains. This land was occupied by many diverse Indian tribes who did not have the population base or technological skills to hold back the advancing settlers. Moreover, the tribes seldom acted in concert or with long-term goals. But this was not always true.

Tecumseh was a warrior of the Shawnee tribe in the Ohio River valley who had the necessary vision. He realized that all tribes in the area would be killed or pushed out unless they formed a united front and protected each other. To this end he worked tirelessly to create an Indian confederation. He was aided by the logic of his arguments, his great diplomatic powers, and his brother, Tenskwatawa.

The Prophet, as Tenskwatawa was called, preached religious revival with a strong rejection of all white customs, particularly the drinking of alcohol. He attracted many followers because Indian society was collapsing and his call for a return to traditional practices promised to stem the tide of change. Thus both brothers were attempting to preserve Indian lands and culture.



In the early 1800s Shawnee leader Tecumseh realized that all Indian tribes had to work together if they were to hold their ground against the onslaught of white settlers. He gained support for a confederation when his brother, Tenskwatawa, correctly "prophe-sied" that the Great Spirit would hide the Sun during the 1806 eclipse. Here Tecumseh is shown confronting William Henry Harrison, then governor of the Indiana Territory. Courtesy Cincinnati Historical Society.



Nat Turner, born into servitude in Virginia, led a slave uprising in the United States. A religious leader, Turner told his followers of the vision he'd had during the 1831 solar eclipse of a black angel overcoming a white angel, signaling to him that the time for rebellion had come. Courtesy the Schomburg Center for Research in Black Culture.

noe on November 7, 1811, was decisive, and the prophet's followers turned on him. Tecumseh was killed during a large battle in Ontario in 1813, and the defeated tribes were soon transported across the Mississippi River. The confederation forged by two brothers of vision and a solar eclipse could not survive failed prophecies and the loss of its leaders.

NAT TURNER

The treatment of the American Indians and black slaves reflects the most despicable episodes in United States history. Kidnapped Africans were transported to the New World and forced to work long hours under squalid conditions for no reward. Any such situation is inherently unstable, so the slave masters lived in deep fear of an uprising by their chattels.

The best-known slave rebellion in America centered on the charismatic figure of Nat Turner. He was born in 1800 in Southampton County, Virginia, where he learned to read from his master's son. His literacy was unusual because slave owners knew that education could lead to revolt. Turner channeled his energy into religious devotion and became a preacher for his fellow blacks, who came to call him The Prophet. In 1828 Turner had a vision that he would lead his people to freedom. He slowly gathered his forces by recruiting an inner circle of roughly 20 trusted friends.

But first Turner had to await a sign from God. A solar eclipse on February 12, 1831, appeared to Turner as a black

angel occulting a white one. This omen symbolized black overcoming white, so the time for revolt had come.

The slaves planned to murder farmers for their weapons, gather recruits from nearby farms, march on the armory in Jerusalem, Virginia, then head for the Great Dismal Swamp, where capture would be difficult. The revolt was set for the Fourth of July, both as a symbol of freedom and because the slaves were allowed greater movement on that holiday. However, the uprising was delayed when Turner became ill, forcing the group to await another sign. It arrived on August 13th when the Sun appeared dim, with green and blue coloring. Then Turner saw what was likely a naked-eye sunspot group (1831 was the year just after a maximum of the sunspot cycle).

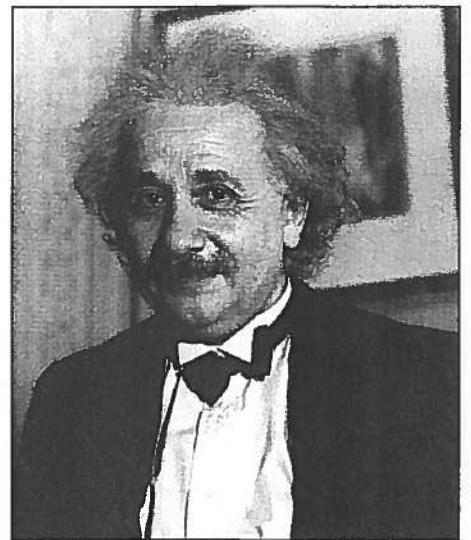
The revolt started on the night of the 21st with the murder of Turner's owners. The march on Jerusalem was stopped the next morning by a small band of militia, and the revolt soon degenerated into a rout with the capture and execution of the slaves. A total of 60 whites and perhaps 200 slaves (many innocent of rebellion) were killed in the uprising. Turner remained in hiding for 70 days until he, too, was caught and hanged.

ALBERT EINSTEIN

In 1905 Albert Einstein wrote three papers, each worthy of a Nobel prize, that explained Brownian motion, the photoelectric effect, and special relativity. The success from the papers transformed him

from an obscure patent clerk to one of the top scientists in the tiny field of physics. He followed this phenomenal start with many strong advances in the field, including the discoveries of Bose-Einstein statistics, stimulated emission, the cosmological constant, and the Einstein-Rosen-Podolsky paradox.

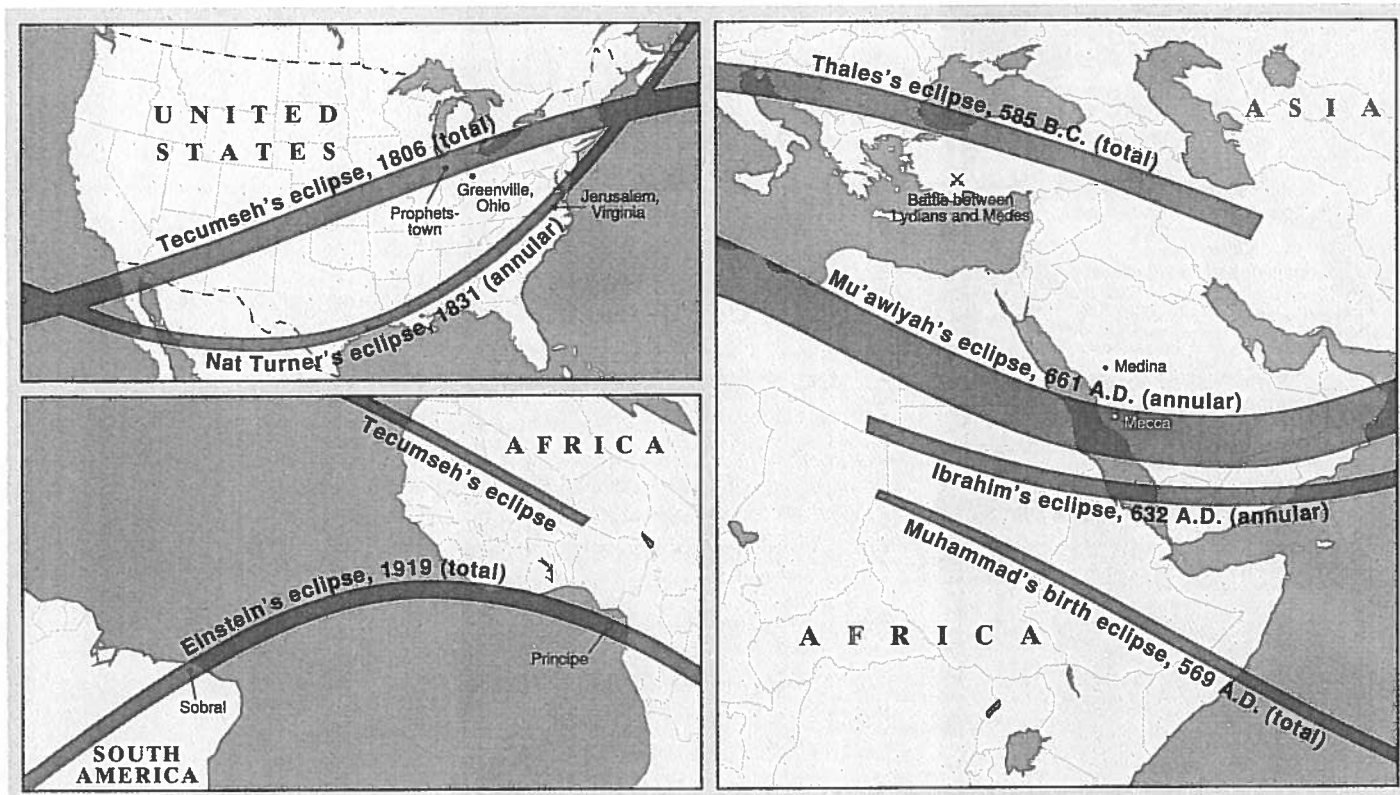
By far Einstein's most famous and influential work after 1905 was his theory of general relativity, which describes the distortion of space-time in a strong gravitational field. He completed his formulation of the theory between 1913 and 1916, and during this time he predicted a previously unknown phenomenon that, if observed, would validate his work. He believed that the curvature of space near a massive object like the Sun would bend light that passed close by. Thus, for example, a star seen near the edge of the Sun during an eclipse would appear to have shifted by 1.75 arc seconds from its usual place. A German expedition to the Crimea was mounted for the August 21, 1914, total solar eclipse to test the predic-



Albert Einstein, shown here at Carnegie Hall in 1934, developed the theory of general relativity. One consequence of this theory is that light bends when traveling near a massive object. British astronomer Arthur Eddington confirmed Einstein's hypothesis by observing the displacement of stars near the limb of the Sun during an eclipse in 1919. Clyde Fisher photograph.

tion. But that was not a good time to be a German national in Russian territory — no photographs were exposed, and the team was interned for a month until an exchange was arranged.

During World War I scientific ideas were precariously swapped between Germany and the Allies. When English astronomer Arthur Eddington received Einstein's paper on general relativity he



Upper left: The eclipses of Tecumseh and Nat Turner were both used in the United States to rally forces against oppressors — one spurred an alliance among Indian tribes, and the other inspired a slave revolt. **Lower left:** Perhaps the most scientifically important eclipse occurred in 1919 and confirmed one aspect of Albert Einstein's general theory of relativity. **Right:** Three eclipses were associated with the Islamic prophet Muhammad; they occurred in the year of his birth, on the day his son, Ibrahim, died, and when one of his successors tried to remove the prophet's pulpit from Medina. The Thales eclipse ended a war between two Middle Eastern kingdoms. Based on maps provided by Fred Espenak.

immediately realized its importance. He mounted an eclipse expedition of his own for the May 29, 1919, event. The planning started at the height of the war, when prospects were darkest for the Allies. This British test of a German's theory was a great display of internationalism in science and served to quash attempts to boycott German scientists after the war.

To guard against clouds Eddington had two observing sites — one on Principe Island off the west coast of Africa and one in Sobral, Brazil. On Principe eclipse day began with heavy rain; it stopped by noon, but the Sun was glimpsed only after first contact. In a routine familiar to many amateurs, Eddington took 16 photographs through scattered clouds and glanced up only twice. The results confirmed Einstein's theory exactly.

The news was announced on November 6, 1919, at a meeting of the Royal Astronomical Society. The packed audience realized it was present at the shifting of humankind's world view. The international press trumpeted the discovery and lionized Einstein as the epitome of genius. It is doubtful he would have progressed from being a renowned physicist to the legendary scientist without the dramatic fanfare that followed the eclipse.

ECLIPSES AND RELIGION

The first three case studies of solar eclipses affecting history mentioned here involve figures known as The Prophet, who used the phenomena, deliberately or otherwise, for religious purposes. Other prophets have done the same. Saint Patrick is reputed to have used a great darkness to convert the Irish pagans in the 5th century, and in 1884 the Mahdi used a solar eclipse to demoralize the defenders of Khartoum. Eclipses have been linked to the deaths of religious figures, including those of Saint Olaf at the battle of Stiklestad and of Jesus Christ, who had three hours of darkness during his crucifixion. Both Christians and Muslims have prophecies of eclipses associated with Judgment Day in their holy scripture.

Eclipses have probably been associated so closely with religion because they occur in the heavens — the abode of the gods where mortals can't intervene. What better place to look for divine signs? Fear of eclipses may have developed because Sun worship is such a strong part of humankind's past, making an eclipse a terrifying symbol of the death of a god.

In modern society the association between eclipses and religion is largely

gone. If preachers tried to capitalize on this month's eclipse they would be laughed at. Now that we know what causes eclipses and can predict when they will occur, the fear is gone. A predictable event does not break harmony but instead is a manifestation of order in the universe. In the last century eclipses have changed from signs of God to the tools of science. As we have seen, the 1919 eclipse was used to confirm general relativity. These events allow astronomers to better study the Sun as well as permit multitudes of amateur astronomers to view its corona and prominences. Even Ibrahim's eclipse has been used to quantify the acceleration of the Earth's rotation.

This attitude shift reflects a change in our world view. No longer is religion the only model for all thought; science has become a guiding paradigm for art, philosophy, and even commerce — mainly because science delivers miracles, and its prophecies come true. The 1919 eclipse was used to confirm the highest doctrine and to raise a new "prophet." In a sense, science has become a new religion with eclipses as one of its rituals.

Bradley E. Schaefer studies gamma-ray bursts with data from the Compton Gamma Ray Observatory.