



Howard Russell Butler's triptych of solar eclipses, painted in 1918, 1923 and 1925: the first works by an artist to depict the solar corona accurately.

## ASTRONOMY

# Art of the eclipse

As the next solar eclipse approaches, **Jay M. Pasachoff** and **Roberta J. M. Olson** ponder how artists from the early Renaissance onwards have interpreted the phenomenon.

State-of-the-art photography can capture a solar eclipse in all its evanescent glory — as will be seen on 29 April, when the first solar eclipse of 2014 will be visible from Australia and Antarctica. But long before such technology existed, artists from the fourteenth to the early twentieth century portrayed this fleeting phenomenon in paint with increasing accuracy, on the basis of direct observations, scientific documents and contemporary theory. These are rare artworks: the phenomenon appears in one location on average roughly every 300 years, and its dramatic phases can be seen for just minutes from a narrow band of the planet hundreds of kilometres across, although thousands of kilometres long.

In the Middle Ages and even the early Renaissance, artists couched portrayals of eclipses in religious contexts redolent with symbolism. The Crucifixion was believed to have taken place during a total solar eclipse, and a few early renderings show a stylized, occulted Sun on one side of the cross. In

the fourteenth century the Florentine artist Taddeo Gaddi, a student of Giotto, took a revolutionary step. On the inside shutter of a Crucifixion triptych, he suggested the darkened sky and strange light of a solar eclipse by painting a dark-blue wedge in one corner, rimmed faintly with now-tarnished silver. And in his frescoed *Annunciation to the Shepherds* in the Basilica of Santa Croce in Florence, Italy, Gaddi represented divine radiance using light effects that he had seen during the eclipse of 16 July 1330 — an observation that left him partially blind. He effectively conveys the eerie, quasi-nocturnal illumination.

Some 200 years later, in the High Renaissance, an artist captured the solar corona — the pearly halo surrounding the Moon's silhouette during total eclipse. In a loggia of the Vatican's Apostolic Palace around 1518–19, Raphael and his workshop frescoed a depiction of a solar eclipse with a dark lunar disk ringed by

the innermost corona in *Isaac and Rebecca Spied Upon by Abimelech*. Although lacking details such as the coronal 'streamers' jutting out from active regions on the Sun, and otherwise showing some artistic licence, the spiky rays around the inner corona are roughly representative. No corona would have been visible during the 8 June 1518 annular eclipse that passed through Rome, but the event may have inspired Raphael.

An even more accurate portrayal was achieved another two centuries later, when Cosmas Damian Asam painted his *Vision of St Benedict* in 1735 for a monastery in Weltenburg, Bavaria. In the eclipse that confronts the elderly saint, light bursts from the edge of the lunar disk after totality — the first relatively faithful representation of the 'diamond-ring effect', which occurs when the first ray of light breaks through a valley on the Moon's edge. Asam must have seen the eclipse of 13 May 1733, and might also have consulted descriptions from contemporary scientists such as Edmond

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the actual detailed shapes of the corona over the sunspot cycle. Butler created a vast, stunning triptych from them, installed in 1935 at the AMNH's newly established Hayden Planetarium, where it engaged hordes of visitors until the original building was torn down in 1997. The triptych is now in storage. Butler also created a half-size replica for the Fels Planetarium in Philadelphia, Pennsylvania, still hanging; one for New York State's Buffalo Museum of Science; and one newly rehung for long-term display at Princeton University in New Jersey.

Butler went on to paint the 1932 solar eclipse, and filled large canvases with close-ups of solar prominences — beautiful and complex shapes of gas shining in the red light of hydrogen above the solar limb, or Sun's edge, which are still studied in astronomy. Six of Butler's paintings remain in storage at the AMNH, along with some of his other works, such as fanciful views of Mars from vantage points on its moons.

Today, eclipse photography is highly advanced. Because the corona diminishes in brightness by a factor of more than 200 from the solar limb to a distance of one solar radius, filters radially graded in density are sometimes used. This allows film or electronic detectors to capture the corona's appearance in a single exposure. Computer scientists or

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astronomers can also combine dozens of photographs taken with different exposures to reveal the coronal structure, and to artificially enhance contrast to make its features stand out.

But Butler's paintings, like Gaddi's, demonstrate that the acute visual perception cultivated by the handful of representational artists keen to probe this astronomical phenomenon enabled them to make startling observations, and even discoveries. We hope that the run-up to the 2017 total solar eclipse, which will cross the continental United States, will inspire a campaign to restore and display Butler's fascinating astronomical oeuvre. ■

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Halley, whose predictions of eclipses had circulated some years before.

A handful of subsequent eclipse ‘portraits’ stand out, such as Ippolito Caffi's oil painting *View of Venice with the Eclipse of 8 July 1842*, which depicts the moment just before or after totality. Caffi shows one-quarter of the sky brightly lit and three-quarters of it dark, which is highly inaccurate; yet he does show an eclipse as a process involving dynamic changes in light.

Complete accuracy came towards the end of the twentieth century, when photography and computer analysis finally captured the nuances and phases of eclipses. But in that century's first decades, one artist had already

achieved precision, and beauty, in paint.

Howard Russell Butler was a high-profile portrait painter who had degrees in physics and law, and had studied painting in Mexico under Frederic Edwin Church, a US landscape painter obsessed with portraying astronomical phenomena. That mingling of science and art made Butler's professional life unusual and rich. In his 1923 book *Painter and Space, or The Third Dimension in Graphic Art*, for instance, he brought his knowledge of physics to bear on the realistic rendering of modelling, light and perspective in art. But it was his astronomical paintings that showed this duality most dramatically.

Highly methodical, Butler kept shorthand notes on spatial and colour details for his paintings. This was to prove invaluable when, at age 62, he was invited to join the US Naval Observatory for its expedition to Baker, Oregon, to view the total solar eclipse of 8 June 1918. Butler later noted that as a portraitist, “I generally asked for 10 sittings of 2 hours each. But all the time they would allow me on this occasion was 112 1/10 sec. As it turned out I got a trifle more, for their calculations were short by 3/10 of a second.” Along with an oil painting, Butler reproduced his studies of this eclipse the following year in ‘Painting the Solar Corona’, an article in *Natural History*, the magazine of New York's American Museum of Natural History (AMNH).

Butler refined his methods over time, painting the eclipse of 1923 in Lompoc, California, and of 1925 in Middletown, Connecticut. The three artworks are the first to show



The corona at an eclipse is visible in Raphael's *Isaac and Rebecca Spied Upon by Abimelech*.