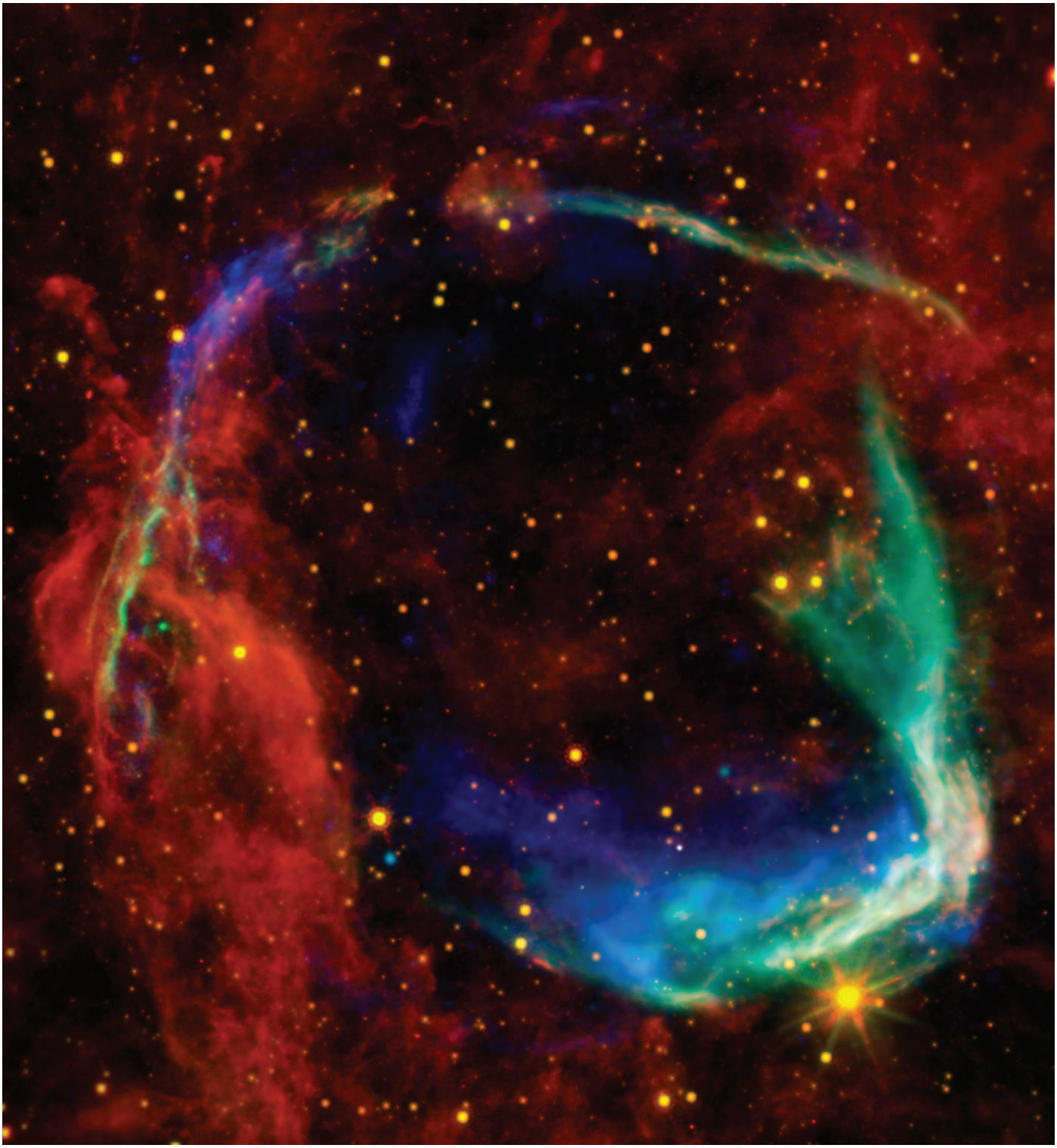

RCW 86, a Supernova Footprint

Supernova Footprint

This glowing cloud of interstellar gas, called RCW 86, is all that remains of what is believed to be the first supernova documented by humans.

The Chinese witnessed the supernova event in 185 A.D., describing a mysterious "guest star" that remained in the sky for eight months. Credit: 18th century tapestry, anonymous.

RCW 86 is approximately 8,000 light-years away. At about 85 light-years in diameter, it occupies a region of the sky in the southern constellation of Circinus that is slightly larger than the full Moon.

Four different space telescopes combined forces to create this multiwavelength view. X-ray images from the European Space Agency's **XMM-Newton Observatory** and NASA's **Chandra X-ray Observatory** are combined to form the blue and green colors in the image. The X-rays show the interstellar gas that has been heated to millions of degrees by the passage of the shock wave from the supernova.

Infrared data from NASA's **Spitzer Space Telescope**, as well as NASA's **Wide-Field Infrared Survey Explorer (WISE)**, are shown in yellow and red, and reveal dust radiating at a temperature of several hundred degrees below zero, warm by comparison to normal dust in our Milky Way Galaxy.

By studying the X-ray and infrared data together, astronomers were able to determine that the cause of the explosion witnessed nearly 2,000 years ago was a Type Ia supernova, created by the relatively peaceful death of a star, which then shrank into a dense star called a white dwarf. But then the white dwarf is thought to have later blown up in a supernova after siphoning matter, or fuel, from a nearby star. A white dwarf is like a smoking cinder from a burnt-out fire. If you pour gasoline on it, it will explode.

The observations also show for the first time that a white dwarf can create a cavity around it before blowing up in a Type Ia event. A cavity would explain why the remains of RCW 86 are so big. When the explosion occurred, the ejected material would have traveled unimpeded by gas and dust and spread out quickly.

Scientists initially suspected that RCW 86 was the result of a core-collapse supernova, the most powerful type of stellar blast. They had seen hints of a cavity around the remnant, and, at that time, such cavities were only associated with core-collapse supernovae. In those events, massive stars blow material away from them before they blow up, carving out holes around them.

But other evidence argued against a core-collapse supernova. X-ray data from Chandra and XMM-Newton indicated that the object consisted of high amounts of iron, a telltale sign of a Type Ia blast. Together with the infrared observations, a picture of a Type Ia explosion into a cavity emerged.

The results thus may have significant implications for theories of white-dwarf binary systems and Type Ia supernovae.

Modern astronomers unveiled one secret of a two-millennia-old cosmic mystery only to reveal another. Now, with multiple observatories extending our senses in space, we can fully appreciate the remarkable physics behind this star's death throes, yet still be as in awe of the cosmos as the ancient astronomers.

NASA's Jet Propulsion Laboratory, Pasadena, California, manages the Spitzer Space Telescope mission for NASA's Science Mission Directorate, Washington. Science operations are conducted at the Spitzer Science Center at the California Institute of Technology in Pasadena. Caltech manages JPL for NASA.

JPL manages, and operated, WISE for NASA's Science Mission Directorate. The spacecraft was put into hibernation mode after it scanned the entire sky twice, completing its main objectives.

For more images from the Spitzer Space Telescope, go to **www.spitzer.caltech.edu.**

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