National Aeronautics and Space Administration

Multiwavelength Crab Nebula (M1)

Colorful Portrait of the Crab Nebula

This colorful view of the Crab Nebula combines data from five telescopes that span nearly the entire electromagnetic spectrum. It includes observations from the Karl G. Jansky Very Large Array (radio), the Spitzer Space Telescope (infrared), the Hubble Space Telescope (visible), the XMM-Newton mission (ultraviolet), and the Chandra X-ray Observatory (X-ray).

The Crab Nebula is the expanding remains of a star that exploded as a supernova. This explosion was seen in the year 1054 as a bright "new star." However, the nebula itself was discovered by Charles Bevis in 1731 and was independently rediscovered by Charles Messier in 1758. Messier was hunting for comets when he spotted the nebula. He included it as the first entry in his famous catalog of deep-sky objects, and it is now known as "Messier 1" or "M1" for short.

In 1844, Lord Rosse named the nebula the "Crab" because its tentacle-like structure resembled the legs of the crustacean. It wasn't until 1928 that Edwin Hubble first proposed associating the Crab Nebula to the ancient supernova explosion. In 1939, astronomers confirmed the Crab Nebula as the tattered remains of the star that ended its life in the 1054 blast.

In the 1950s and 1960s, astronomers discovered that the Crab possessed strong magnetic fields. The object also was unleashing energetic X-rays, as well as the strongest radio waves of any known celestial object. But what was producing this powerful radiation? They found the answer in 1968: an ultra-dense object — a neutron star — lies at the nebula's center. Called the Crab pulsar, it is one of the first objects of its kind discovered.

Energy from both the supernova blast and the Crab pulsar keeps the whole nebula radiating over virtually the entire electromagnetic spectrum. Most of this energy reaches us in forms of radiation that are invisible to the human eye, but it can be detected by telescopes.

Though the Crab has been studied extensively for decades, astronomers still have much to learn about it. The multiwavelength observations have already provided a broader understanding of this stellar corpse, with more discoveries yet to be unraveled.

The Crab Nebula resides 6,500 light-years away in the constellation Taurus.

Credit: NASA, ESA, G. Dubner (IAFE, CONICET-University of Buenos Aires) et al.; A. Loll et al.; T. Temin et al.; F. Seward et al.; VLA/NRAO/AUI/NSF; Chandra/CXC; Spitzer/JPL-Caltech; XMM-Newton/ESA; and Hubble/STScI

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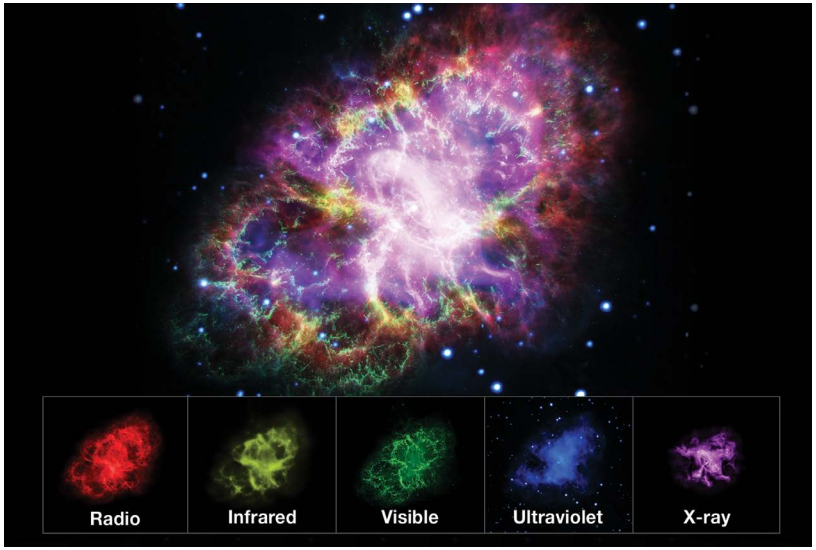

This colorful view of the Crab Nebula combines data from five telescopes that span nearly the entire electromagnetic spectrum. The visible-light image (in green) offers a sharp view of hot, thread-like structures that spread throughout the nebula. The infrared image (in yellow) reveals the glow of dust particles absorbing ultraviolet and visible light, and reradiating the energy at longer wavelengths in the infrared. An energetic cloud of electrons, driven by the rapidly rotating neutron star at the nebula's core, glows brightly in ultraviolet radiation (in blue) and in X-rays (in purple). The neutron star's fierce "wind" of charged particles energizes the nebula, causing it to emit radio waves (shown in red). The background stars in the image appear blue because they were observed in ultraviolet light.

VOCABULARY

Supernova: The explosive death of a star that ejects the star's outer layers into surrounding space at high speeds.

Neutron star: The collapsed remnant of a massive star that remains after some supernova explosions. It is one of the few possible endpoints of a star's life. When the radiation from a spinning neutron star is observed as periodic pulses, it is known as a pulsar.

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