

Cat's Eye Nebula (NGC 6543)



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A Sun-like Star's Last Hurrah

This image reveals new details of the Cat's Eye Nebula (catalogued as NGC 6543), one of the most complex planetary nebulae ever seen. A planetary nebula is the glowing gas ejected during the final stages of evolution of a star similar in mass to our Sun.

Planetary nebulae are like snowflakes: no two look alike. When a Sun-like star nears the end of its life, it expands in size to become a bloated red giant, with a diameter about 100 times greater than its original size. The star then ejects its outer layers into space, exposing its hot core. Ultraviolet radiation from the central core streams out into the surrounding ejected gas, causing it to glow. The glowing gas is called a planetary nebula, so-named because its round shape resembles that of a planet when viewed with a small telescope. Over the next several thousand years, the nebula will gradually disperse into space, and then the star will cool and fade away for billions of years as a white dwarf. Our Sun is expected to undergo a similar fate, but not for another 5 billion years. Astronomers still do not fully understand many details of the process that lead a star to lose its gaseous envelope. The study of planetary nebulae is one of the few ways to recover information about these last few thousand years in the life of a Sun-like star.

The expelled gas from the dying, central star has intriguing symmetrical patterns as well as more chaotic structures. Scientists are trying to understand how a spherical star can produce such prominent, non-spherical symmetries in the gas that it ejects.

Astronomers have considered several mechanisms to explain the shapes of planetary nebulae. One possible explanation is that the star's magnetic field affects the shape. Another is that a companion star exerts a strong gravitational force on the ejected gas and sculpts it into the patterns we see. Trying to explain these complex patterns is difficult because we view planetary nebulae from Earth and cannot move around them to see their three-dimensional structure.

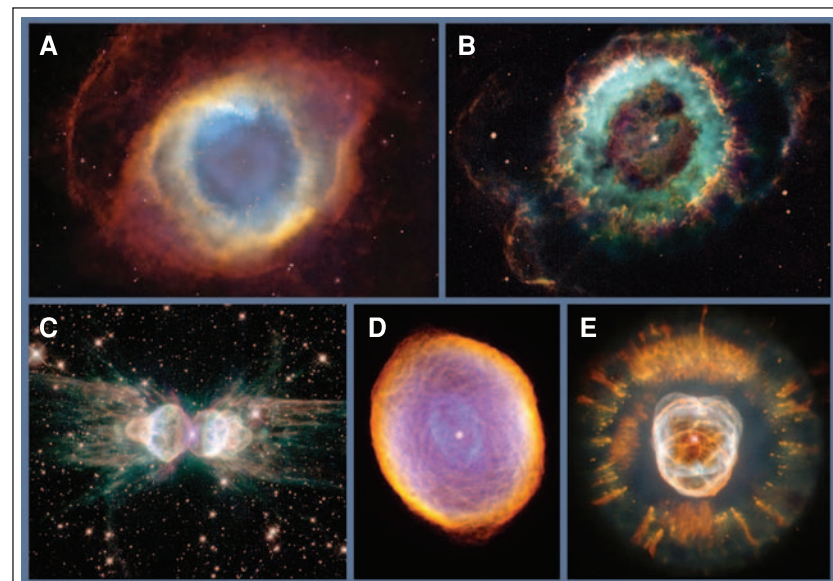
The Hubble telescope has made several observations of the Cat's Eye. This image, taken with Hubble's Advanced Camera for Surveys, reveals the full beauty of a bull's eye pattern of 11 or more concentric rings, or shells, around the dying star. Each ring is actually the edge of a spherical bubble seen projected onto the sky — that is why the nebula appears bright along its outer edge. These rings suggest that the initial ejection of gas from the star was episodic, recurring about every 1,500 years. Observations with the Hubble telescope were the first to reveal these puzzling concentric rings, which have now been seen around a number of planetary nebulae.

Hubble's images of the Cat's Eye and other planetary nebulae are revealing many new mysteries of these glowing patterns of gas spun into space by dying stars.

VOCABULARY

Red giant: When a Sun-like star nears the end of its life, its outer layers expand in size and become cooler, forming a bright star much larger and cooler than the Sun.

White dwarf: The hot, compact remains of a low-mass star like our Sun that has exhausted its sources of fuel for thermonuclear fusion.



A Nebula Gallery. Above is a sampling of nebulae imaged by the Hubble Space Telescope: The Helix Nebula (A), Little Ghost Nebula (B), Ant Nebula (C), Spirograph Nebula (D), and Eskimo Nebula (E).

Credits: Helix Nebula: NASA, ESA, C.R. O'Dell (Vanderbilt University), and M. Meixner, P. McCullough (STScI); Little Ghost, Ant, and Spirograph Nebulae: NASA and The Hubble Heritage Team (STScI/AURA); Eskimo Nebula: NASA, A. Fruchter, and the ERO Team (STScI).

FAST FACTS

Location: Constellation Draco.

Distance from Earth: 3,000 light-years.

Credits: R. Corradi (Isaac Newton Group of Telescopes, Spain), Z. Tsvetanov (NASA).

You can get images and other information about the Hubble Space Telescope on the World Wide Web. Visit <http://www.stsci.edu/outreach> and follow the links.

The corresponding classroom activity for this lithograph can be found at:

<http://amazing-space.stsci.edu/> or may be obtained by contacting the Office of Public Outreach at the Space Telescope Science Institute, 3700 San Martin Drive, Baltimore, MD 21218.