Helix Nebula (NGC 7293)

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This Galaxy Evolution Explorer (GALEX) ultraviolet image shows the Helix Nebula (also called NGC 7293), one of the largest and oldest planetary nebulae known. It is quite close to us in astronomical terms, at around 500 or 600 light years away. At about 4 light years across, it is many times larger than our entire solar system.

The Helix Nebula is the nearest example of what happens to a star like our own Sun as it approaches the end of its life, when it runs out of fuel, expels gas outward, and evolves into a much hotter, smaller, and denser white dwarf.

For a while, the white dwarf is still hot and bright enough to make the material from the former star glow, and that is what we see as a beautiful nebula. Over 10,000 years or so, the gas will drift away and the white dwarf will cool so much that we can no longer see the nebula.

Our Atoms Born in Dying Stars

A star is a balancing act between the crushing inward force of the star's own gravity and the outward force of the nuclear fires burning at the star's center.

When the star has used up almost all its hydrogen nuclear fuel (after several billion years), the outward pressure from the nuclear reactions is no longer able to counteract the gravity, and the core of the star collapses under its own weight. As the core collapses, it gets even hotter. The outer layers of the star puff up from this increased heat, but as the star puffs up, the outer layers get cooler. The star is called a red giant at this point.

Even as the outer layers puff up, the core of a red giant continues to contract and get even hotter. When the core gets hot enough, the nuclear fires ignite again, as the helium atoms fuse into carbon and oxygen atoms. It is in the cores of dying stars that much of the carbon and oxygen atoms in ours bodies were made!

The nuclear reactions again exert outward pressure and stop the collapse of the core. But now the nuclear reactions are very sensitive to temperature. If the temperature goes up just a little, the nuclear reactions happen much faster, releasing more energy, making the temperature go up even more. The star becomes very unstable. It begins to pulsate violently, as the gravitational and nuclear forces fight to the death. Finally, the stellar atmosphere is blown into space, forming a cloud around what is left of the star, the surface of which is so hot it makes the cloud of gases around it glow. That glowing gas cloud is called a planetary nebula, and what is left behind at the center is called a white dwarf. The white dwarf may have half the mass of the Sun contained in an object with the volume of Earth. (Today the Sun has a volume more than one million times that of Earth!)

Seeing a Different Universe

The Galaxy Evolution Explorer was launched on April 28, 2003. Its mission is to study the shape, brightness, size and distance of galaxies across 10 billion years of cosmic history. The Explorer's 50-centimeter-diameter (19.7-inch) telescope sweeps the skies in search of ultraviolet-light sources.

Caltech leads the Galaxy Evolution Explorer mission and is responsible for science operations and data analysis. NASA's Jet Propulsion Laboratory, Pasadena, California, manages the mission and built the science instrument. The mission was developed under NASA's Explorers Program managed by the Goddard Space Flight Center, Greenbelt, Maryland. South Korea and France are the international partners in the mission.

For more GALEX images and information, visit http://www.galex.caltech.edu.