

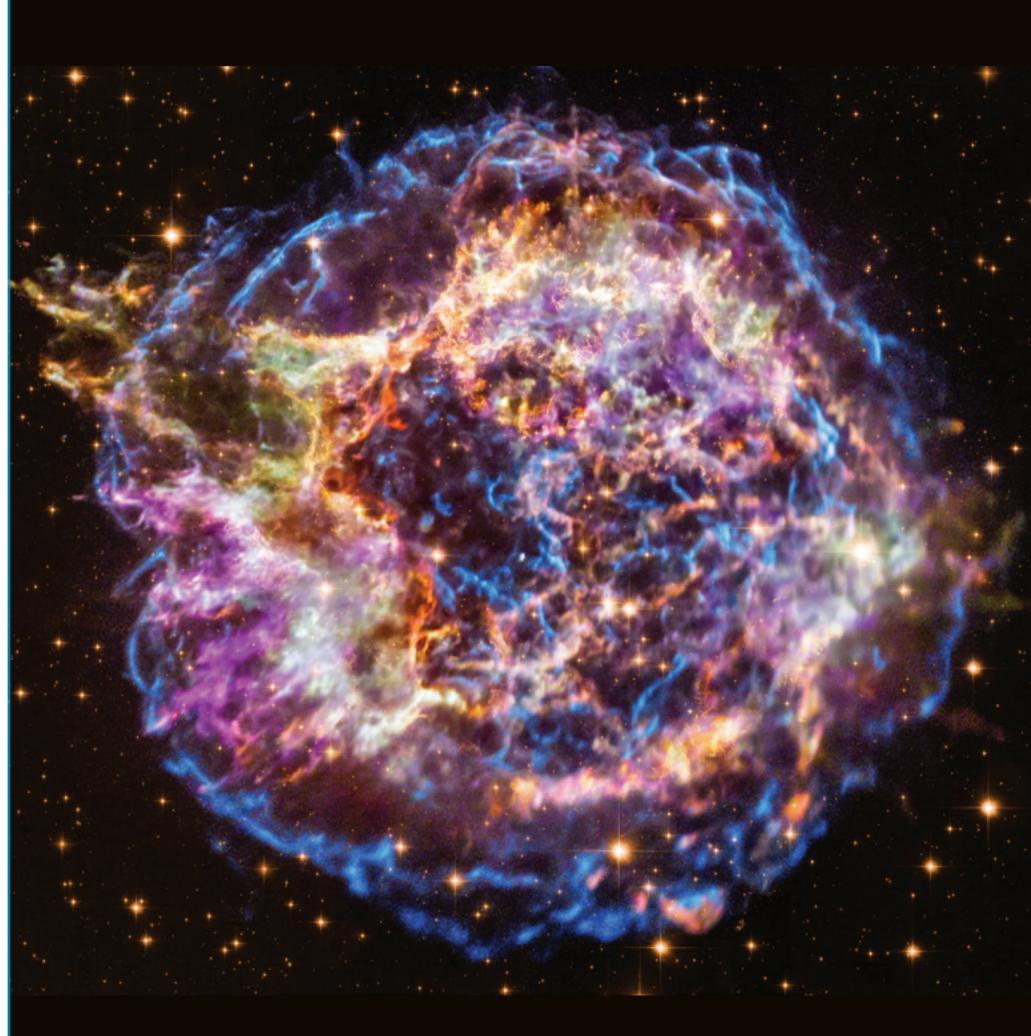
## Crab Nebula: Pulsar

During a supernova, the core of a massive star can be compressed to form a rapidly rotating ball composed mostly of neutrons that is only twelve miles in diameter. A teaspoon of such neutron-star matter would weigh more than one billion tons! Young, rapidly rotating neutron stars can produce beams of radiation from radio through gamma-ray energies. Like a rotating lighthouse beam, the radiation can be observed as a powerful, pulsing source of radiation, or pulsar, as in the case of the Crab Nebula. The jets and rings are caused by high-energy particles flowing away from the pulsar.



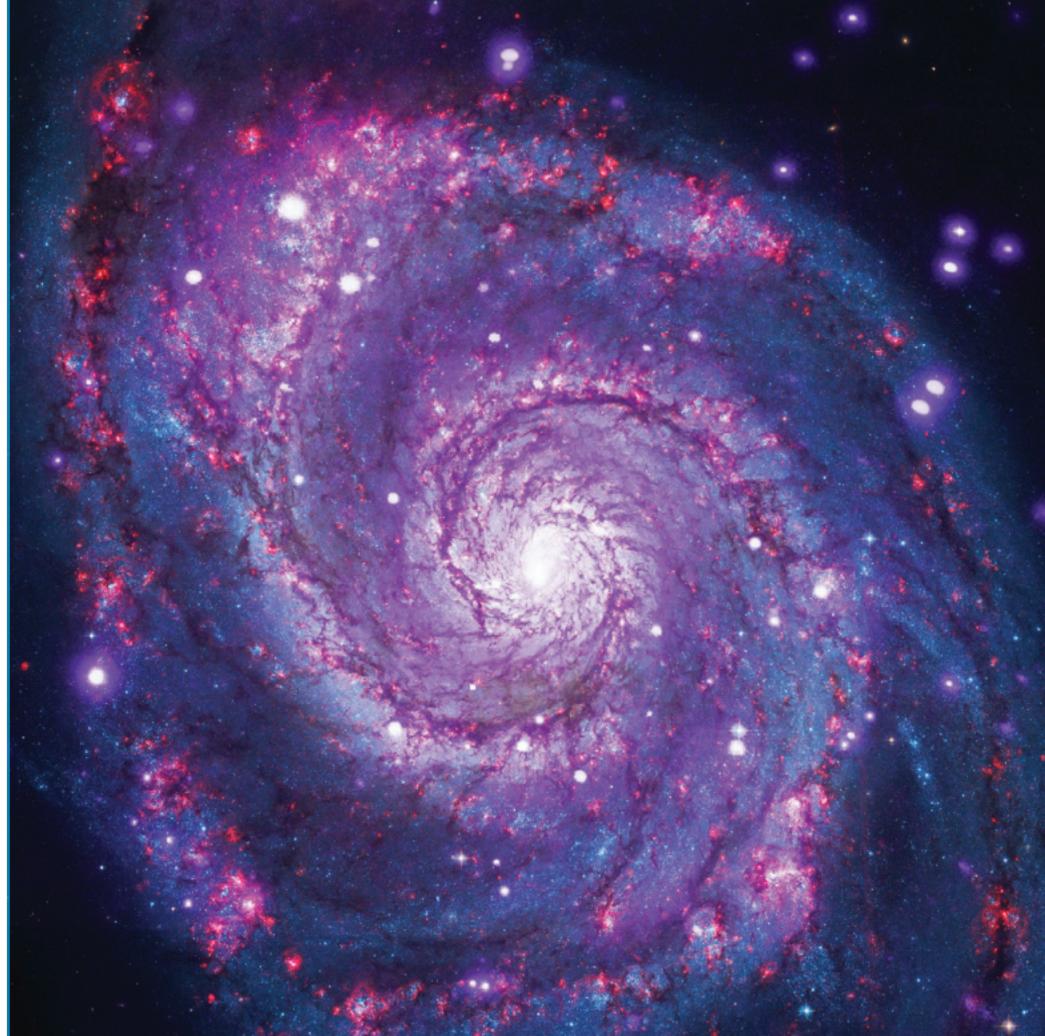
## **Cassiopeia A: Supernova Remnant**

Cassiopeia A is the remnant of a massive star that exploded. The material from the explosion is rushing outward at supersonic speeds in excess of ten million miles per hour. As this matter crashes into gas that surrounded the former star, shock waves analogous to awesome sonic booms heat the gas and heat the ejected matter to temperatures in excess of fifty million degrees Celsius. At the center of the remnant is an enigmatic source, which could be a rapidly spinning neutron star.



## **Whirlpool Galaxy: Black Holes & Neutron Stars**

The Whirlpool is a spiral galaxy with spectacular arms of stars and dust located about 25 million light years from Earth. By studying the Whirlpool in different kinds of light, astronomers can reveal things that would otherwise be invisible. For example, X-ray data reveal over 400 X-ray sources within the galaxy. Most of these are X-ray binary systems, in which a neutron star or black hole is in orbit with a star like our Sun. Understanding where these systems are, how they behave over time, and their role in the evolution of the galaxy is important in helping learn us more about other galaxies including our own.



## **Eta Carinae: Blue Giant**

Eta Carinae, one of the most luminous stars known in our galaxy, radiates energy at a rate that is 5 million times that of the Sun, and is estimated to have a mass of about 100 solar masses. The exact nature of Eta Carinae is unknown, but it may be an extreme example of a luminous blue variable. Such stars are violently unstable and likely explode as supernovas.

When a massive star uses up the hydrogen fuel in its central core, it expands enormously to become a red giant. Intense radiation from the blue giant pushes gas away at speeds in excess of 3 million miles per hour. The collision between the high speed “stellar wind” and the previously ejected red giant material creates a spectacular nebula.



## Cat's Eye: White Dwarf

The Cat's Eye, also known as NGC 6543, is a planetary nebula, a glowing shell of gas and dust that forms when Sun-like stars die. A planetary nebula is a stage of life that our Sun will experience billions of years from now. The Cat's Eye is found about 3,000 light years from Earth in the middle of the constellation Draco, which is Latin for "dragon." Material from the outer layers of the star in the Cat's Eye is flying away at about 4 million miles per hour. A hot core is left behind that eventually collapses to become a white dwarf star. The central star in the Cat's Eye is surrounded by a cloud of multi-million-degree gas.

