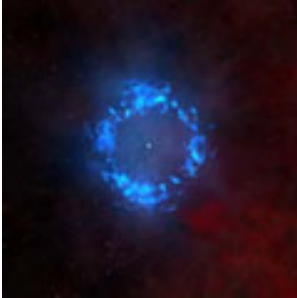




X-Ray Astronomy Field Guide

Supernovas and Supernova Remnants

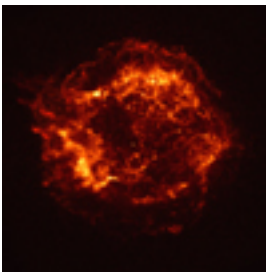
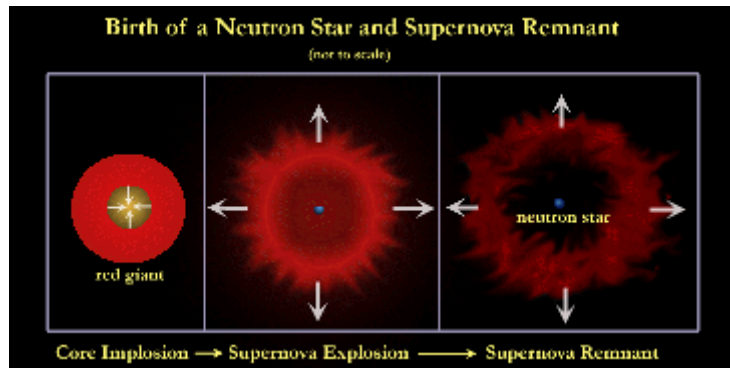


Animation of Supernova Explosion

Every 50 years or so, a massive star in our galaxy blows itself apart in a supernova explosion. Supernovas are one of the most violent events in the universe, and the force of the explosion generates a blinding flash of radiation, as well as shock waves analogous to sonic booms.

There are two types of supernovas: **Type II**, where a massive star explodes; and **Type Ia**, where a white dwarf collapses because it has pulled too much material from a nearby companion star onto itself.

The general picture for a Type II supernova goes something like this. When the nuclear power source at the center or core of a star is exhausted, the core collapses. In less than a second, a neutron star (or black hole, if the star is extremely massive) is formed. As in-falling matter crashes down on the neutron star, temperatures rise to billions of degrees Celsius. Within hours, a catastrophic explosion occurs, and all but the central neutron star is blown away at speeds in excess of 50 million kilometers per hour. A thermonuclear shock wave races through the now expanding stellar debris, fusing lighter elements into heavier ones and producing a brilliant visual outburst that can be as intense as the light of several billion suns!

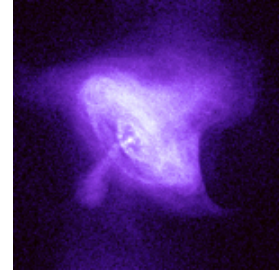


Chandra Image of Cassiopeia A (NASA/CXC/SAO)

The matter thrown off by the explosion plows through the surrounding gas producing shock waves that create a shell of multimillion degrees gas and high energy particles called a supernova remnant. The supernova remnant will produce intense radio and X-radiation for thousands of years.

In several young supernova remnants the rapidly rotating neutron star at the center of the explosion gives off pulsed radiation at X-ray and other wavelengths, and creates a magnetized bubble of high energy particles whose radiation can dominate the appearance of the remnant for a thousand years or more.

Eventually, after rumbling across several thousand light years, the supernova remnant will disperse.



*Chandra Image of
Crab Nebula
(NASA/CXC/SAO)*