Star goes boom, telescopes zoom

Supernova in nearby Pinwheel Galaxy excites astronomers

By Nadia Drake
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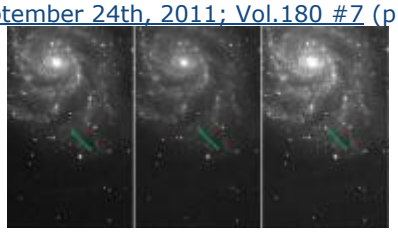


BOOM STARAstronomers detected supernova PTF 11kly very soon after it exploded (indicated by arrow in the three panels above) in the nearby Pinwheel Galaxy. Caused by a thermonuclear reaction inside a white dwarf star, supernovas of this type — termed 1a — are incredibly bright and are used by scientists to measure the expanding universe.Peter Nugent and the Palomar Transient Factory

Many people appreciate a good light show, but probably not as much as the astronomers who recently spied a rare cosmological treat.

On August 24, telescopes at the Palomar Observatory in southern California captured a white dwarf star just 21 million light-years away — the next state over, astronomically — as it went supernova, exploding in a blaze of light. Scientists involved in the Palomar Transient Factory sky survey raced to record the detonation's early death throes.

"We think we found it probably 12 hours after it exploded," says astronomer Mark Sullivan of the University of Oxford in England. "The amazing thing for me is, that supernova exploded 21 million years ago. It's taken light 21 million years to arrive. And we just happened to open up the telescope on that Wednesday night, and in came the photons."

Located in the Pinwheel Galaxy (officially labeled M101), the new supernova is the type that astronomers designate as 1a. Seeing a type 1a supernova so soon after birth and so close by is a rarity.

"Saying it's 'once in a generation' is very true," says astronomer Peter Nugent of Lawrence Berkeley National Laboratory. In the last four decades, Nugent notes, astronomers know of only three supernovas that have gone off at this distance or closer, — and just one, observed in 1972, was a type 1a. Only supernova 1987a, a peculiar type 2 or core-collapse supernova, was detected soon after exploding.

In the days after the new stellar outburst, the Hubble Space Telescope turned to peer at the brightening spot, located near a kink in the Big Dipper's handle. The star, called PTF 11kly, is still getting brighter. Scientists think it will reach peak brightness during the second week of September, when a good pair of binoculars on a dark night could reveal the object to the casual observer.

Type 1a supernovas occur when white dwarf stars gain a bit of weight, probably from material shed by a companion star. When the tiny white dwarf exceeds about 1.4 times the mass of the sun, a runaway thermonuclear reaction ignites and the star violently combusts, producing a bright cosmic pockmark.

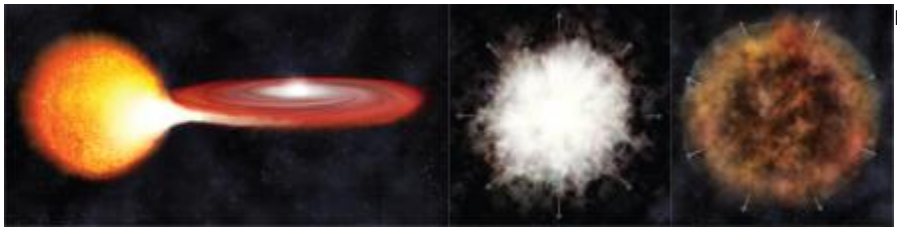
Because the starting mass of type 1a supernovas is so uniform, these explosions reach predictable peak luminosities. Astronomers use these supernovas to measure relative extragalactic distances and the universe's expansion rate.

Catching one of these explosions so early will help scientists understand more about the parent star's composition and how supernovas evolve in different galaxies, or with different starting ingredients.

Scientists are looking through archival Hubble Space Telescope images hoping to spot the now-destroyed white dwarf and any companion star that may have fed it until it burst. And they will continue to observe the object for years, until only the dregs remain. Of course, it's all dust and gas now, since astronomers are glimpsing a 21-million-year-old event.

"It's probably evacuated out a little hole in the gas," Nugent says. "All of its material has been flung off. It's perhaps started the process of collapsing to form new stars, depending on the local environment, and you have blobs of things like calcium and silicon and iron flying around."

Back Story - WHITE DWARF'S DEMISE



M. Weiss/CXC/NASA

A stellar explosion observed last month, designated PTF 11kly, is what astronomers call a type 1a supernova. Supernovas of this type occur after a white dwarf star, typically not much heavier than the sun, adds enough material to exceed about 1.4 times the sun's mass. One likely scenario for acquiring the extra mass is siphoning it from a nearby star (left). Once the mass limit is exceeded, the white dwarf ignites in a thermonuclear explosion (center), leaving behind nothing but debris (right).