

## 'King' of star explosions seen

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Astronomers have detected the brightest stellar explosion, or supernova, on record. They say it may be a new type of supernova that may also occur before long in our own galaxy – what one researcher said would be his team's most awesome star show.

The finding comes from observations by NASA's Chandra X-ray Observatory and ground-based telescopes. It indicates violent explosions of extremely massive stars were fairly common in the early universe, scientists said. "This was a truly monstrous explosion, a hundred times more energetic than a typical supernova," said Nathaniel Smith of the University of California at Berkeley, who led a team of astronomers in the search. "That means the star that exploded might have been as massive as a star can get, about 150 times [the weight] of our sun. We've never seen that before." Astronomers think many of the first generation of stars were this massive, and this new supernova may thus provide a rare glimpse of how the first stars died.

The top panel is an artist's illustration that shows what SN 2006gy may have looked like if viewed from nearby. The bottom left panel is an infrared image from the Lick Observatory, of NGC 1260, the galaxy containing SN 2006gy. The panel to the right shows Chandra's X-ray image of the same field of view, again showing the core of the galaxy and SN 2006gy. (Image credits: Illustration: NASA/CXC/M. Weiss; X-ray: NASA/CXC/UC Berkeley/N. Smith et al.; IR: Lick/UC Berkeley/J. Bloom & C. Hansen)

The supernova, known as SN 2006gy, provides evidence that the death of such massive stars is fundamentally different from the ordinary predictable ones, researchers claimed. "Of all exploding stars ever observed, this was the king," said Alexander Filippenko, leader of the ground-based observations at the Lick Observatory at Mt. Hamilton, Calif., and the Keck Observatory in Mauna Kea, Hawaii. "We were astonished to see how bright it got, and how long it lasted." The Chandra observation allowed the team to rule out the most likely alternative explanation for the supernova, the astronomers said: that a white dwarf star only slightly heavier than the sun exploded into a dense, hydrogen-rich environment. In that event, SN 2006gy should have been 1,000 times brighter in X-ray light than what Chandra detected, they said. "This provides strong evidence that SN 2006gy was, in fact, the death of an extremely massive star," said Dave Pooley of the University of California at Berkeley, who led the Chandra observations. The star that produced SN 2006gy apparently blew off a large amount of mass before exploding, astronomers said. This large mass loss is similar to that seen from Eta Carinae, a massive star in our galaxy, raising suspicion that Eta Carinae may be poised to explode as a supernova. Although SN 2006gy is intrinsically the brightest supernova ever, it is in the galaxy NGC 1260, some 240 million light years away. However, Eta Carinae is only about 7,500 light years away in our own Milky Way galaxy. A light year is the distance light travels in a year. "We don't know for sure if Eta Carinae will explode soon, but we had better keep a close eye on it just in case," said Mario Livio of the Space Telescope

Scientists in Baltimore, who was not involved in the research. Eta Carinae's explosion could be the best star-show in the history of modern civilization. Super-novas usually occur when massive stars exhaust their fuel and collapse under their own gravity. In the case of SN 2006gy, astronomers think something else may have triggered the blast. Under some conditions, a massive star's core could produce so much radiation in the form of gamma rays that some of the energy from the radiation converts into matter. This takes the form of particles paired up with anti-particles that are in a sense their evil twins, called antiparticles. This leads to a drop in energy that causes the star to collapse under its own mighty gravity. Next, runaway thermonuclear reactions ensue and the star explodes, spewing the remains into space. The SN 2006gy data suggest that it may have been more common than previously believed for the first stars to die in spectacular supernovas, astronomers said. An alternative fate theorized for these objects is to collapse into black holes, objects so compact that their gravitational force runs out of control and they start to suck in everything nearby, including light. In terms of the effect on the early universe, there's a huge difference between these two possibilities, said Smith. "One pollutes the galaxy with large quantities of newly made elements and the other locks them up forever in a black hole." The findings are to appear in a forthcoming issue of the research publication *Astronomical Journal*.

Courtesy NASA Marshall Space Flight Center and World Science staff

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