Rare radio supernova in nearby galaxy is nearest supernova in five years

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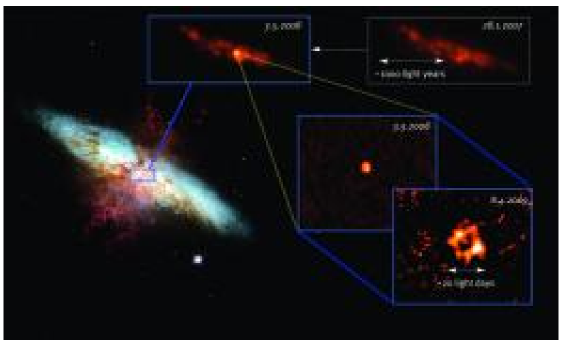

Zooming into the center of the galaxy M82, one of the nearest starburst galaxies at a distance of only 12 Million light years. The left image, taken with the Hubble Space Telescope (HST), shows the body of the galaxy in blue and hydrogen gas breaking out from the central starburst in red. The VLA image (top left) clearly shows the supernova (SN 2008iz), taken in May 2008. The high-resolution VLBI images (lower right) shows an expanding shell at the scale of a few light days and proves the transient source as the result of a supernova explosion in M82. Graphics: Milde Science Communication, HST Image: /NASA, ESA, and The Hubble Heritage Team (STScI/AURA); Radio Images: A. Brunthaler, MPIfR.

(PhysOrg.com) -- The chance discovery last month of a rare radio supernova - an exploding star seen only at radio wavelengths and undetected by optical or X-ray telescopes - underscores the promise of new, more sensitive radio surveys to find supernovas hidden by gas and dust.

"This supernova is the nearest supernova in five years, yet is completely obscured in optical, ultraviolet and X-rays due to the dense medium of the galaxy," said Geoffrey Bower, assistant professor of astronomy at the University of California, Berkeley, and coauthor of a paper describing the discovery in the June issue of the journal *Astronomy & Astrophysics*. "This just popped out; in the future, we want to go from discovery of radio supernovas by accident to specifically looking for them."

Sky surveys like the one just launched by the Allen Telescope Array, which will look for bright but short-lived radio bursts from supernovas, will provide better estimates of the rate of star formation in nearby galaxies, Bower said. Radio emissions from supernovas also can help astronomers understand how stars explode and what happens before their cores collapse, since radio emissions are caused when debris from the explosion collides with the stellar wind previously shed by the stars.

Bower's colleagues are Andreas Bunthaler, Karl M. Menten and Christian Henkel of the Max Planck Institute for Radioastronomy in Bonn, Germany; Mark J. Reid of Harvard University's Center for Astrophysics; and Heino Falcke of the University of Nijmegen in the Netherlands.

The radio supernova was discovered on April 8 in M82, a small irregular galaxy located nearly 12 million light years from Earth in the M81 galaxy group, by the Very Large Array, a New Mexico facility operated by the National Radio Astronomy Observatory (NRAO). It was subsequently confirmed by NRAO's Very Long Baseline Array (VLBA), a 10-telescope array whose baseline stretches from Hawaii to the Virgin Islands, providing the sharpest vision of any telescope on Earth.

The Allen Telescope Array, comprising 42 of a planned 350 radio dishes and supported by UC Berkeley and the SETI Institute of Mountain View, Calif., last week began a major survey of the radio sky that should turn up many more such radio supernovas, Bower said. While the VLA and VLBA have very narrow fields of view unsuited to all-sky surveys, the ATA's wide-angle view is ideal for scanning the full sky once a day, which is necessary to find sources that brighten and dim over several days.

"The ATA can detect objects at least 10 times fainter than this radio supernova, which pushes our survey an order of magnitude deeper than other radio surveys with more attention to transient and variable sources. Radio supernovas are a really strong aspect of that survey," he said. "This (new radio supernova) is the kind of discovery that we would like to make with the Allen Telescope Array."

The ATA will compile an updated catalog of radio sources much as the Sloan Digital Sky Survey updated the older Palomar Observatory Sky Survey of visible and infrared objects. At the same time, it will look for radio signals indicative of intelligent life around other stars.

Not all supernovas produce radio emissions, Bower said. If the star has not sloughed off much of its envelope before collapsing inward to form a neutron star or black hole - a classic Type II supernova - then few radio emissions are produced from gas collisions.

On the other hand, supernovas in very active star-forming regions, like the center of M82, should produce copious radio emissions because of the density of gas and dust in the interstellar medium. That same gas and dust blocks optical, ultraviolet and X-rays, however, making radio surveys one of the few options to find and observe such supernovas.

Bower and his colleagues were studying the motion of M82 with the VLBA, which links the VLA and nine other radio telescopes into a very high resolution instrument, when they noticed a very bright radio source - five times brighter than anything else in the galaxy - in the VLA data.

The team looked at earlier observations and found the same source, but almost twice as bright, in data taken May 3, 2008. Data from March 24, 2008, showed an even brighter source - 10 times brighter than in April 2009 - while Oct. 29, 2007, data showed no bright radio source.

Extrapolating backward in time, the research team estimates that the star exploded sometime in January 2008, apparently near the very center of the galaxy. The team rejected alternative explanations for the dimming radio source, such as a flare created by a star falling into a supermassive black hole.

The newly discovered supernova is thus the brightest in radio wavelengths in the past 20 years, Bower said, and is one of only a few dozen radio supernovas observed to date.

The team also looked at the complete data from the VLBA and detected a ring structure indicative of a shock wave plunging through the interstellar medium, bolstering its conclusion that it is a supernova. The ring is about 2,000 astronomical units across, consistent with a year-old supernova. (An astronomical unit 93 million miles, the average distance between Earth and the sun.)

Source: University of California - Berkeley (news : web)

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