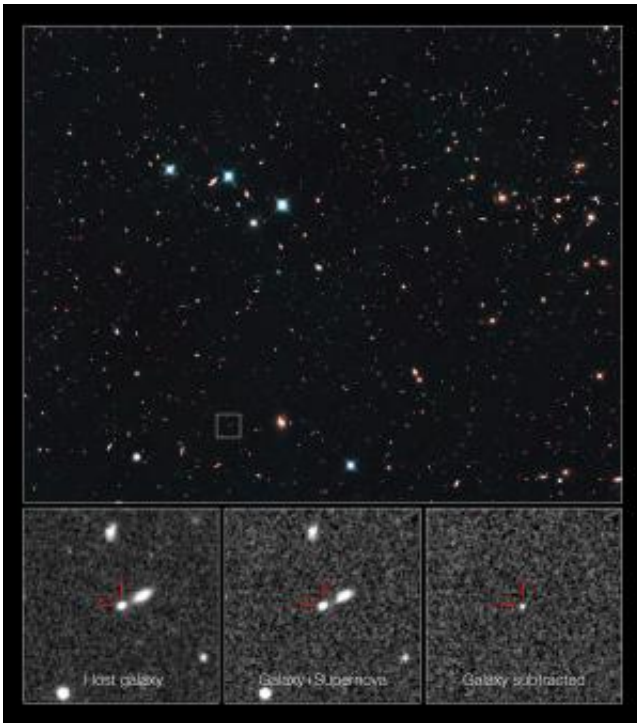


Hubble telescope breaks record for farthest supernova

April 4 2013



This is a NASA/ESA Hubble Space Telescope view looking long ago and far away at a supernova that exploded over 10 billion years ago — the most distant Type Ia supernova ever detected. The supernova's light is just arriving at Earth, having travelled more than 10 billion light-years (redshift 1.914) across space. Astronomers spotted the supernova in December 2010 in the Cosmic Assembly Near-infrared Deep Extragalactic Legacy Survey (CANDELS) field, and named it SN UDS10Wil (nicknamed SN Wilson). The small box in the top image pinpoints the supernova's host galaxy in the CANDELS survey. The image is a blend of visible and near-infrared light, taken by Hubble's Advanced Camera for Surveys (ACS) and Wide Field Camera 3 (WFC3). The search technique involved taking multiple near-infrared images with WFC3 spaced roughly 50

days apart over the span of three years, looking for a supernova's faint glow. The three bottom images, taken in near-infrared light with WFC3, demonstrate how the astronomers found the supernova. The image at the far left shows the host galaxy without the supernova. The middle image, taken a year later, reveals the galaxy with the supernova. The supernova cannot be seen because it is too close to the centre of its host galaxy. To detect the supernova, astronomers subtracted the left image from the middle image to see the light from the supernova alone, shown in the image at far right. The astronomers then used WFC3's spectrometer and the European Southern Observatory's Very Large Telescope to verify the supernova's distance and to decode its light, finding the unique signature of a Type Ia supernova. Credit: NASA, ESA, A. Riess (STScI and JHU), and D. Jones and S. Rodney (JHU)

(Phys.org) —The supernova, designated SN UDS10Wil, belongs to a special class of exploding stars known as Type Ia supernovae. These bright beacons are prized by astronomers because they can be used as a yardstick for measuring cosmic distances, thereby yielding clues to the nature of dark energy, the mysterious force accelerating the rate of expansion of the Universe.

"This new distance record holder opens a window into the early Universe, offering important new insights into how these supernovae form," said astronomer David O. Jones of The Johns Hopkins University in Baltimore, Md., lead author on the science paper detailing the discovery. "At that epoch, we can test theories about how reliable these [detonations](#) are for understanding the evolution of the Universe and its expansion."

One of the debates surrounding Type Ia supernovae is the nature of the fuse that ignites them. This latest discovery adds credence to one of two competing theories of how they explode. Although preliminary, the evidence favours the explosive merger of two burned out stars—small,

dim, and dense stars known as white dwarfs, the final state for stars like our Sun.

The discovery was part of a three-year Hubble program called the CANDELS+CLASH Supernova Project, begun in 2010. This program aimed to survey faraway Type Ia supernovae to determine their distances and see if their behaviour has changed over the 13.8 billion years since the Big Bang, using the sharpness and versatility of Hubble's [Wide Field Camera 3](#).

So far, CANDELS+CLASH has uncovered more than 100 supernovae of all types that exploded from 2.4 to over 10 billion years ago. The team has identified eight of these discoveries as Type Ia supernovae that exploded more than 9 billion years ago—including this new record-breaker, which, although only four percent older than the previous record holder, pushes the record roughly 350 million years further back in time.

The supernova team's search technique involved taking multiple near-infrared images spaced roughly 50 days apart over the span of three years, looking for a supernova's faint glow. After spotting SN UDS10Wil in December 2010, the CANDELS team then used the spectrometer on [Hubble's](#) Wide Field Camera 3, along with the European Southern Observatory's Very Large Telescope, to verify the supernova's distance and to decode its light, hoping to find the unique signature of a Type Ia supernova.

Finding remote supernovae opens up the possibility to measure the Universe's accelerating expansion due to [dark energy](#). However, this is an area that is not fully understood—and nor are the origins of Type Ia supernovae. "This new result is a really exciting step forward in our study of supernovae and the distant Universe," said team member Jens Hjorth of the Dark Cosmology Centre at the Niels Bohr Institute,

University of Copenhagen. "We can begin to explore and understand the stars that cause these violent explosions."

The team's preliminary evidence shows a sharp decline in the rate of Type Ia supernova blasts between roughly 7.5 billion years ago and more than 10 billion years ago. This, combined with the discovery of such Type Ia supernovae so early in the Universe, suggests that the explosion mechanism is a merger between two white dwarfs.

In the single white dwarf scenario—a pathway in which a white dwarf gradually feeds off a partnering normal star and explodes when it accretes too much mass—the rate of supernovae can be relatively high in the early Universe, because some of these systems can reach the point of explosion very quickly. The steep drop-off favours the double white dwarf mechanism, because it predicts that most stars in the [early Universe](#) are too young to become Type Ia [supernovae](#).

Knowing what triggers [Type Ia supernovae](#) will also show how quickly the Universe enriched itself with heavier elements, such as iron. These [exploding stars](#) produce about half of the iron in the [Universe](#), the raw material for building planets, and life.

The team's results will appear in the 10 May 2013 issue of *The Astrophysical Journal*.

More information: The research is presented in a paper entitled "The Discovery of the Most Distant Known Type Ia Supernova at Redshift 1.914", accepted for publication in 10 May 2013 issue of *The Astrophysical Journal*.

Provided by ESA/Hubble Information Centre

Citation: Hubble telescope breaks record for farthest supernova (2013, April 4) retrieved 24 April 2024 from <https://phys.org/news/2013-04-hubble-telescope-furthest-supernova.html>

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