

Black hole birth captured by cosmic voyeurs

November 21 2013



Los Alamos National Laboratory astrophysicist Tom Vestrand poses with a telescope array that is part of the RAPTOR (RAPid Telescopes for Optical Response) system. RAPTOR is an intelligent visual system that scans the skies for optical anomalies and zeroes in on them when it detects them. This unique capability allowed the system to witness the rare birth of a black hole in the constellation Leo recently. Credit: Los Alamos National Laboratory

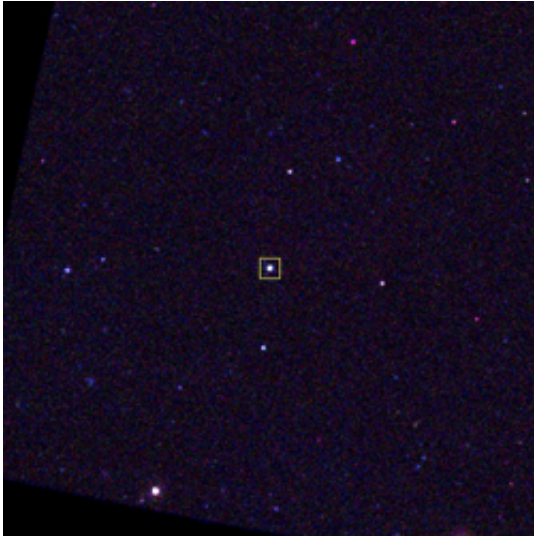
Intelligent telescopes designed by Los Alamos National Laboratory got a front row seat recently for an unusual birth.

"Los Alamos' RAPTOR telescopes in New Mexico and Hawaii received a very bright cosmic birth announcement for a black hole on April 27," said astrophysicist Tom Vestrand, lead author of a paper appearing today in the journal *Science* that highlights the unusual event.

"This was the burst of the century," said Los Alamos co-author James Wren. "It's the biggest, brightest one to happen in at least 20 years, and maybe even longer than that."

The RAPTOR (RAPid Telescopes for Optical Response) system is a network of small robotic observatories that scan the skies for optical anomalies such as flashes emanating from a star in its death throes as it collapses and becomes a black hole—an object so dense that not even light can escape its gravity field. This birth announcement arrived from the constellation Leo in the form of an exceptionally bright flash of visible light that accompanied a powerful burst of cosmic gamma-ray emissions.

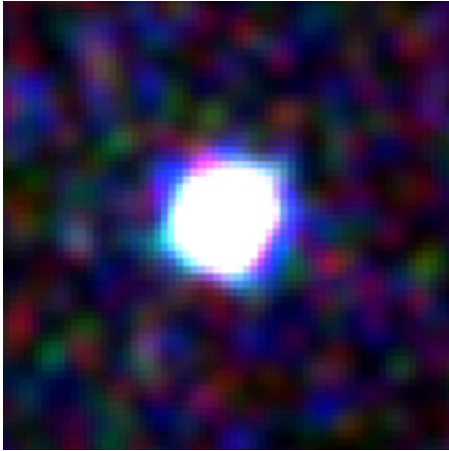
What made such an extremely rare event even more spectacular for scientists, however, is that, in addition to the RAPTOR sighting, it was witnessed by an armada of instruments—including gamma-ray and X-ray detectors aboard NASA's Fermi, NuSTAR and Swift satellites. While the NASA instruments recorded some of the highest-energy gamma-ray bursts ever measured from such an event, RAPTOR noticed that the massive and violent transformation of a star into a black hole yielded a lingering "afterglow" that faded in lock-step with the highest energy gamma-rays.



The gamma-ray burst is extremely bright and is the most luminous object in the field, as seen in the image from Swift. All the other luminous objects seen in the image are stars from our own galaxy, while the gamma-ray burst is millions of times farther away. This section shows an area of the sky that roughly corresponds to a quarter the size of the full moon. Credit: Swift Satellite

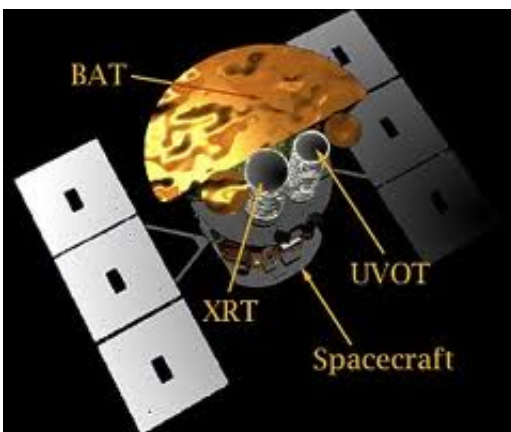
"This afterglow is interesting to see," said paper co-author Przemek Wozniak of Los Alamos's Intelligence and Space Research Division. "We normally see a flash associated with the beginning of an event, analogous to the bright flash that you would see coinciding with the explosion of a firecracker. This afterglow may be somewhat analogous to the embers that you might be able to see lingering after your firecracker has exploded. It is the link between the optical phenomenon and the gamma-rays that we haven't seen before, and that's what makes this display extremely exciting."

All things considered, the event was among the brightest and most energetic of its type ever witnessed.



This is a close-up of the gamma-ray burst, taken by the ultraviolet/optical telescope on the Swift satellite. Credit: Swift Satellite

"This was a Rosetta-Stone event that illuminates so many things—literally," Vestrand said. "We were very fortunate to have all of the NASA and ground-based instruments seeing it at the same time. We had all the assets in place to collect a very detailed data set. These are data that astrophysicists will be looking at for a long time to come because we have a detailed record of the event as it unfolded."



The Swift satellite has three instruments on board. They work together to get as

much information about each gamma-ray burst as possible. The Burst Alert Telescope is a monitoring telescope, and the first to detect a burst. The X-ray telescope and the ultraviolet/optical telescope have a coordinated field of view, so the radiation can be observed in all three wavelengths together. Credit: Swift Satellite

Already the event, labeled GRB 130427A by astrophysicists, is testing some long-held assumptions about the nature of the universe. For example, scientists recorded energy levels for gamma rays that are higher than what some researchers thought theoretically possible. This revelation may require physicists to modify existing theories about radiation. No doubt, the data set could yield more surprises in the future, Vestrand said.

More information: "The Bright Optical Flash and Afterglow from the Gamma-Ray Burst GRB 130427A," by W.T. Vestrand et al. *Science*, 2013.

Provided by Los Alamos National Laboratory

Citation: Black hole birth captured by cosmic voyeurs (2013, November 21) retrieved 26 April 2024 from <https://phys.org/news/2013-11-black-hole-birth-captured-cosmic.html>

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.