Birth of a Black Hole

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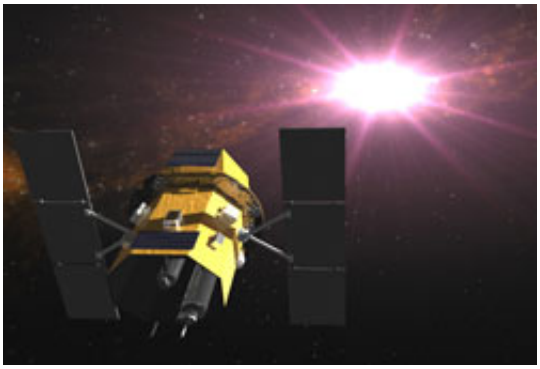

The NASA-led Swift mission has detected and imaged its first gamma-ray burst, likely the birth cry of a brand new black hole.
The bright and long burst occurred on January 17. It was in the midst of exploding, as Swift autonomously turned to focus in less than 200 seconds. The satellite was fast enough to capture an image of the event with its X-Ray Telescope (XRT), while gamma rays were still being detected with the Burst Alert Telescope (BAT).

"This is the first time an X-ray telescope has imaged a gamma-ray burst, while it was bursting," said Dr. Neil Gehrels, Swift's Principal Investigator at NASA's Goddard Space Flight Center, Greenbelt, Md. "Most bursts are gone in about 10 seconds, and few last upwards of a minute. Previous X-ray images have captured the burst afterglow, not the burst itself."

"This is the one that didn't get away," said Prof. John Nousek, Swift's Mission Operations Director at Penn State University, State College, Pa. "And this is what Swift was built to do: to detect these fleeting gamma-ray bursts and focus its telescopes on them autonomously within about a minute. The most exciting thing is this mission is just revving up."

Swift has three main instruments. The BAT detects bursts and initiates the autonomous slewing to bring the XRT and the Ultraviolet/Optical Telescope (UVOT) within focus of the burst. In December the BAT started detecting bursts, including a remarkable triple detection on December 19. Today's announcement marks the first BAT detection autonomously followed by XRT detection, demonstrating the satellite is swiftly slewing as planned. The UVOT is still being tested, and it was not collecting data when the burst was detected.

Scientists will need several weeks to fully understand this burst, GRB050117, so named for the date of detection. Telescopes in orbit and on Earth will turn to the precise burst location provided by Swift to observe the burst afterglow and the region surrounding the burst.

"We are frantically analyzing the XRT data to understand the X-ray emission seen during the initial explosion and the very early afterglow," said Dr. David Burrows, the XRT lead at Penn State. "This is a whole new ballgame. No one has ever imaged X-rays during the transition of a gamma-ray burst from the brilliant flash to the fading embers."

When the UVOT is fully operational, both the XRT and UVOT will provide an in-depth observation of the gamma-ray burst and its afterglow. The burst is gone in a flash, but scientists can study the afterglow to learn about what caused the burst, much like a detective hunts for clues at a crime scene.

The origin of gamma-ray bursts remains a mystery. At least some appear

to originate in massive star explosions. Others might be the result of merging black holes or neutron stars. Any of these scenarios likely will result in the formation of a new black hole.

Several of these bursts occur daily somewhere in the visible universe. No prompt X-ray emission (coincident with the gamma-ray burst) has been previously imaged, because it usually takes hours to turn an X-ray telescope towards a burst. Scientists expect Swift to be fully operational by February 1.

Swift, still in its checkout phase, is an international collaboration launched on November 20, 2004. It is a NASA mission in partnership with the Italian Space Agency and the Particle Physics and Astronomy Research Council, United Kingdom.

The spacecraft was built in collaboration with national laboratories, universities and international partners, including Penn State University; Los Alamos National Laboratory, New Mexico; Sonoma State University, Rohnert Park, Calif.; Mullard Space Science Laboratory in Dorking, Surrey, England; the University of Leicester, England; Brera Observatory in Milan; and ASI Science Data Center in Frascati, Italy.

Source: NASA