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Astronomers link gamma-ray bursts to supernovas

By DENNIS OVERBYE
New York Times

Alien space wars and antimatter comets are but two of the more exotic explanations that have been proffered in the past three decades for the flashes of high-energy radiation known as gamma-ray bursts that have appeared sporadically in the cosmic night, tantalizing and frustrating astronomers.

An only slightly more prosaic theory has taken hold among astronomers in recent years: that these violent flashes are the yowls of giant stars imploding, perhaps into black holes, the inky gravitational sinks that swallow light and all else.

Now there is evidence that those astronomers are right, at least about some of the bursts. On March 29, a gamma-ray burst was detected that went off unusually near Earth - a mere 2 billion light years away - prompting a deluge of observations that discerned the unmistakable hint of a supernova explosion, the cataclysm in which a massive star ends its life, in the debris of the burst.

"There should no longer be doubt in anybody's mind that gamma-ray bursts and supernovae are connected," said Dr. Thomas Matheson of the Harvard-Smithsonian Center for Astrophysics in Cambridge, Mass.

Stan E. Woosley, an astrophysicist at the University of California, Santa Cruz, said, "It looks like a black hole was born that day." Woosley is an author of a series of three papers on the burst by an international array of astronomers that appeared Thursday in Nature.

In a commentary accompanying the Nature papers, Peter Meszaros, an astronomer at Pennsylvania State University, called the recent work "a watershed event."

Gamma-ray bursts have led astronomers on a merry chase since the 1960s, when they were accidentally discovered by satellites intended to look for nuclear tests on Earth.

A crucial breakthrough came when Dr. Krzysztof Stanek and Matheson, of the Center for Astrophysics, and Dr. Peter Garnavich of the University of Notre Dame, aided by astronomers around the world recording observations 12 nights in a row, discovered the spectral signature of a supernova about a week after the burst. It was the first direct evidence that at least some gamma-ray bursts come from supernovas.

Significantly, both this supernova and one in 1998 were of a type known as IC, which seem to involve certain very massive stars, giving support to what is termed the "collapsar" model of bursts.

Under this theory, Woosley said, the story begins with a rapidly aging rotating star, perhaps 30 times the mass of the sun. When the core of such a star, made of iron, finally collapses, it creates a black hole or a dense neutron star.

Material trying to fall onto this object forms a hot swirling disk and a narrow jet, which shoots out of the star in six or seven seconds. The gamma rays are formed when this jet, moving at nearly the speed of light, plows into material in interstellar space.