Researchers probe the 'Great Annihilator'

Like hunters in search of an enigmatic quarry, astronomers armed with a variety of Earth-based and space-borne detectors have begun to zero in on the structure and exact location of one of the most powerful, but puzzling sources of high-energy photons in our galaxy. New observations suggest that the object, which lies about 340 light-years from the center of the Milky Way and intermittently spews out energetic photons, may be a rare type of star-sized black hole.

Identified as an ordinary X-ray source more than a decade ago by the orbiting Einstein Observatory, this Milky Way resident recently began drawing special attention. Based on balloon studies conducted in Australia during 1988, Thomas A. Prince and his colleagues at the California Institute of Technology in Pasadena concluded that the object emits an abundance of gamma rays — photons more energetic than X-rays (SN: 1/21/89, p.44). For years, researchers had attributed these emissions to sources at the exact center of our galaxy, rather than slightly off center, as Prince's team found.

Prince noted that this celestial radiator, designated 1E1740.7-2942, is only slightly less luminous than Cygnus X-1, a black-hole candidate and the brightest known gamma-ray emitter in the sky. (He and his coauthors detail their 1988 studies in the May 10 ASTROPHYSICAL JOURNAL LETTERS.)

The puzzling gamma-ray emitter returned to the limelight late last year when data from a gamma-ray telescope aboard the Soviet orbiter GRANAT showed that on one day in mid-October, 1E1740.7-2942 emitted gamma rays within one narrow band of wavelengths at the astonishing rate of 10^{44} per second. Afterward, the celestial object dimmed substantially. That surge in radiation — 50,000 times the total luminosity of the sun — exceeded the luminosity of even Cygnus X-1.

Moreover, the peak wavelength of these high-energy photons matched the value expected of gamma rays produced when an electron fatally collides with a positron, its antimatter counterpart. If 1E1740.7-2942 steadily emitted gamma rays at such an outrageous rate, it could account for all the Milky Way gamma rays ever detected, notes Marvin Leventhal of AT&T Bell Laboratories in Murray Hill, N.J. That finding prompted him to dub the object the "Great Annihilator."

Several researchers have proposed that the Annihilator may be a black hole. Matter falling onto such a compact object would produce low-energy gamma rays, which in turn would generate the positrons needed to produce the annihilation radiation.

Astronomers suspect that most black-hole candidates, such as Cygnus X-1, steal matter from an orbiting companion. But Leventhal and his colleague, John Bally of AT&T Bell Laboratories in Holmdel, N.J., now report that the Annihilator may belong to a rarer breed of black hole that lacks a companion.

Using a 7-meter microwave antenna to observe telltale emissions from carbon monoxide and other compounds, the AT&T scientists found evidence for a large molecular cloud closely associated with the Annihilator. Bally told SCIENCE NEWS that the finding — reported in an April 1 circular of the International Astronomical Union (IAU) — suggests the Annihilator may lie inside the cloud and use it as fuel to produce the observed gamma rays.

Astronomers have also begun probing the Annihilator at other wavelengths. Using the Very Large Array (VLA) radio telescope at Socorro, N.M., Prince and his colleagues report in an April 25 IAU circular that they detected a source of radio waves that seems to coincide with the gamma-ray-emitting object. Prince notes that his high-resolution VLA measurements should help to pinpoint the location of the Annihilator. He adds that he expects to receive X-ray data soon that were collected in March with a high-resolution detector aboard the British-German satellite ROSAT. These should help further resolve the Annihilator's size and location.

In an April 19 IAU circular, the French-Soviet GRANAT team reports that the Annihilator's luminosity has fallen to less than one-third the peak brightness recorded last October. The Annihilator's sporadic emission of gamma rays suggests several other sources must also emit copious amounts of high-energy photons in our galaxy, Leventhal says. Otherwise, he notes, fewer balloon and satellite detectors over the past two decades would have observed such emissions from near the center of the Milky Way.

He adds that such radiation may provide one of the only telltale signatures of "small" black holes — those just a few hundred times the mass of the Sun.

This coming fall, several research groups will return to Australia to survey the Annihilator from balloons using both imaging cameras and detectors designed for high-resolution spectral studies. At roughly the same time, a GRANAT telescope and a high-energy gamma ray detector aboard NASA's Gamma Ray Observatory will also study the Annihilator, says James D. Kurfess of the Naval Research Laboratory in Washington, D.C.

— R. Cowen

Regrets, countercharges mark fraud dispute

Introducing yet another twist in an extraordinarily long-running probe of scientific fraud, Nobel laureate David Baltimore says he now regrets his vigorous defense of a coauthor on a 1986 paper published in CELL. The National Institutes of Health completed a report in March charging that the CELL paper contained false statements and that data used to support that paper's principal findings had been fabricated.

NIH's office of scientific integrity also found evidence that notebooks used to defend the disputed paper contained concocted data (SN: 3/30/91, p.196). The notebooks belonged to immunologist Thereza Imanishi-Kari, one of six authors on the now-disputed paper.

"I recognize that I may well have been blinded to the full implications of the mounting evidence [against my coauthor] by an excess of trust," says Baltimore, now president of Rockefeller University in New York City.

The challenged study described the indirect insertion of a foreign gene into the immune cells of mice. The authors claimed that the mouse's natural gene then began to mimic the inserted gene, producing a special antibody.

The specter of scientific misconduct arose when Margot O'Toole, a postdoctoral scientist working for Imanishi-Kari, discovered evidence in May 1986 that research notebooks did not support the CELL paper's conclusions.

Although Baltimore had previously dismissed O'Toole's allegations, he now lauds her courage in pursuing the case. In his new statement, obtained by SCIENCE NEWS last week, he says, "I regret and apologize to [O'Toole] for my failure to act vigorously enough in my investigation of her doubts."

Says O'Toole, "I appreciate Dr. Baltimore's words of praise for me, but his apology does not go to the heart of the question." Baltimore has stated he had no knowledge of false statements in the 1986 paper or of fabricated data in the lab notebooks. Yet on June 16, 1986, Imanishi-Kari told Baltimore that she had not obtained the results reported in their paper, according to O'Toole. "Dr. Baltimore told me that 'this kind of thing' was not unusual, and that he would take no corrective action," O'Toole recalls.

Indeed, the NIH report quoted Baltimore as saying: "In my mind, you can make up anything that you want in your notebooks . . ." Baltimore's new statement says that the earlier comment was not intended to condone fraud: "I wish to state unequivocally that I have never condoned falsity by a scientist."

Though Baltimore was not the subject of the initial NIH investigation, he may face additional questions as NIH probes a possible cover-up of the fraud.

— K.A. Fackelmann