# The Supernova 1987A Pulsar: Found?

Astronomers peering into the debris of the Supernova 1987A explosion believe they have finally caught a glimpse of the ultradense object at its heart: a pulsar spinning so furiously—almost 2000 times per second—that it may actually have broken apart. The observation therefore appears to give researchers their first chance to study the youngest, the fastest, and perhaps the most bizarre pulsar ever known.

"I think we're really onto something great here," says University of California, Berkeley, astronomer Carlton R. Pennypacker, who leads the 14-member group in collaboration with Jerome Kristian of the Mount Wilson and Las Campanas observatories, and John Middleditch of the Los Alamos National Laboratory.

Pennypacker, Kristian, Middleditch, and their colleagues have been looking for the pulsar since shortly after the supernova appeared on the night of 23 February 1987. Located only about 170,000 light years from Earth in the Large Magellanic Cloud, a ragged companion to our own Milky Way galaxy, 1987A is the first really accessible supernova since the invention of the telescope. It has therefore given astronomers their first opportunity to verify events that they once could only speculate about.

In particular, they have long believed that a supernova like 1987A marks the explosive collapse of a massive star. Indeed, the collapse is thought to be so catastrophic that the entire core of the star—a quantity of matter roughly a million times more massive than the earth—is compressed into a sphere no bigger than a large city. It essentially becomes a single, giant atomic nucleus.

In the aftermath of the explosion such an object typically behaves like a cosmic lighthouse, generating intense beams of light and radio energy in its fierce magnetic field, and then sweeping the beams around the galaxy as it rotates. Thus the name pulsar. Astronomers have found dozens of these beacons in the decades since they were discovered in 1967. But they have never before caught one in the act of being born.

To accomplish that in the case of 1987A, Pennypacker, Kristian, Middleditch, and company have been trying to monitor very subtle, very rapid fluctuations in the brightness of the supernova. In the beginning, of course, most of the light would be coming from the shell of gas and debris expanding outward from the explosion. But the shell would rapidly fade and become more tenuous, they reasoned. Eventually the clocklike pulsations would shine through. Moreover, with the instrumentation they were using—in particular, with a silicon photodiode capable of measuring the supernova's luminosity 5000 times per second—they ought to be able to detect the pulsar no matter how fast it was rotating.

For 2 years they repeated their observations once per month or so, and got nothing. But on the night of 18 January, during a 7-hour observing run with the 4-meter telescope at Cerro Tololo in Chile, they scored a direct hit. Days of exhaustive data analysis on the Cray II supercomputers at Los Alamos revealed a faint train of pulses repeating precisely 1968.628 times per second. The pulsar, it seemed, had been found.

That figure was striking enough, since the implied rotation rate is more than twice that of any other known pulsar. Indeed, if the interpretation is correct it implies that the 1987A pulsar is on the ragged edge of flying apart; it does not look like a sphere so much as a squashed dinner roll.

Even more striking, however, was the fact that the pulse frequency actually rises and falls by about 3 pulses per second in a nearly perfect sinusoid. If this perturbation is what it seems to be—a Doppler shift—then the most obvious interpretation is that the pulsar is being orbited once every 8 hours by some kind of companion object about the mass of Jupiter.

Coupling all this with the fact that the researchers used the same instrument on another target that same night and saw nothing, thereby minimizing the possibility of spurious instrumental effects, they felt justified in announcing a discovery. As Middleditch says, "If this is not some cruel twist of fate, it is real."

Of course, there is still plenty of room for skepticism here. On the night of 31 January, for example, the group repeated its measurements at the smaller 2.5-meter telescope at nearby Las Campanas and saw nothing. Does that mean that the original observations were wrong, or that the pulsar has temporarily been obscured again by the turbulent supernova shell?

Furthermore, it is hard to imagine how this putative companion could have existed before the explosion, since its current orbit would have placed it well beneath the surface of the star that blew up. Does that mean that the companion is nonexistant? Or was the newborn pulsar actually spinning so fast that a piece of it broke off?

Stay tuned. ■ **M. MITCHELL WALDROP**

# New Trial Evaluates Parkinsonian Therapy

A three-center clinical trial of the transplantation of adrenal medullary tissue into the brains of parkinsonian patients shows the procedure to confer some therapeutic benefit, albeit limited in extent. "The results at six months justify cautious optimism," note the authors of the study, published in the 9 February issue of *The New England Journal of Medicine*.

The trial had been established as a deliberate attempt to replicate precisely the procedures carried out 2 years ago by a clinical team in Mexico City, the results of which were reported to be a spectacular improvement. Spurred by an apparently major breakthrough in the treatment of Parkinson's disease, workers in the United States and Europe immediately embarked on similar transplant procedures, but with disappointing results (*Science*, 22 April 1988, page 390). One possible explanation for the disparity of outcomes was differences in surgical and related procedures performed, hence the need for the newly reported trial.

The trial was carried out at Rush Medical Center, Chicago; the University of South Florida, Tampa; and the University of Kansas, Kansas City; and included 19 severely affected patients. All patients were on conventional drug therapy prior to surgery, and all required its continuance afterwards. "In contrast to the [the Mexican cases] antiparkinsonian medications could not be decreased" following surgery, note the authors. Nevertheless, all but one of the patients were able to function ("on time") for about 75% of the time as compared to about 50% of the time preoperatively. The degree of general improvement was, however, modest.

The key focus of the recent trial was the placement of the adrenal graft. The Mexican team routinely sited the tissue in a broad incision in an area of the brain known as the caudate nucleus, which allows the graft to be bathed with ventricular fluid. Although some observers consider this procedure to be less than perfect, often resulting in the loss of viability in the graft tissue, the Mexican team argues that this technique is crucial to the procedure's success. It has not yet been established, however, whether any therapeutic benefits experienced are due to the dopamine produced by the adrenal cells or to a more general response to surgical trauma, either in the target brain tissue or in the adrenal tissue being implanted.

■ **ROGER LEWIN**