Did Geminga Create Our Hole in Space?

For some 20 years, astronomers have pondered evidence that our sun and a few other nearby stars reside inside a huge, relatively gas-free hole in space. Yet they have been unable to identify the violent outburst that might have swept most of the gas away from our tiny corner of the universe, leaving behind a hot, low-density bubble extending about 300 light-years beyond the solar system.

Now researchers say they have a likely suspect. The explosive birth of the powerful gamma-ray emitter Geminga – until recently one of the most mysterious objects in the heavens – could have pushed gas out of the nearby interstellar medium and created the bubble, says Neil Gehrels of NASA's Goddard Space Flight Center in Greenbelt, Md. He announced this speculative finding last month at a joint meeting of the Texas Symposium on Relativistic Astrophysics and the Symposium on Particles, Strings, and Cosmology in Berkeley, Calif.

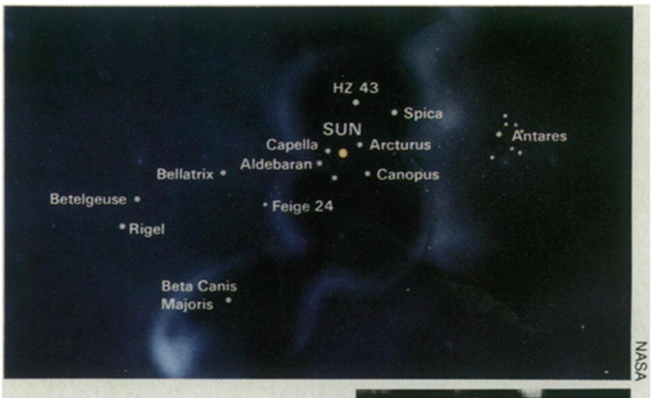
Gehrels and his Goddard colleague Wan Chen base their work on new data from orbiting observatories and ground-based telescopes, which enabled the astronomers to trace the general location and approximate time of Geminga's formation. If further work verifies that the birth of Geminga was indeed a holey event, it could shed new light on the nature of this pulsating star, as well as on the evolution of the interstellar medium surrounding the sun and its neighbors.

A key piece of the puzzle came to the fore earlier this year, when other astronomers discovered that Geminga wasn't the oddball it had seemed. Unlike the two other very bright gamma-ray emitters in the sky – the Crab and Vela pulsars – Geminga hadn't appeared to pulsate or emit low-energy radiation. But data from the X-ray observatory ROSAT showed that Geminga did in fact emit faint X-ray pulses, with a period of .237 second (SN: 5/23/92, p.340). In addition, a review of data from NASA's Compton Gamma Ray Observatory (GRO) and other instruments found that Geminga spews out gamma rays with the same period, verifying that the object is a pulsar – a type of superdense star, called a neutron star, that spins rapidly.

An isolated pulsar forms when a massive star sheds its outer layers in a supernova explosion, leaving behind a dense, collapsed core. But when might the explosion that formed Geminga have occurred? Using GRO data to calculate the rate at which the spinning pulsar is gradually slowing, researchers earlier this year reported that Geminga was probably created about 340,000 years ago – a time frame consistent with the formation of the bubble surrounding our solar system, Gehrels notes.

To pin down Geminga's location at birth, Gehrels and Chen relied on another team's comparison of new and older observations of Geminga in visible light. The comparison shows that Geminga appears to move across the sky so much faster than most stars that it probably lies close to Earth – within 300 light-years, Italian astronomers reported in a Nov. 12 circular of the International Astronomical Union. The team also estimates that Geminga has a velocity of about 80 kilometers per second, placing it somewhere in the Orion constellation at birth, Gehrels says.

Both the general location and the time of the explosion make Geminga a promising candidate for creator of the local bubble, he asserts. Gehrels adds that the birth of a pulsar as close as Geminga should have created an observable local hole, and the only one nearby is the bubble in which the sun is embedded. Virginia L. Trimble of the University of Maryland in College Park and the University of California, Irvine, says that the argument seems plausible but that creating the local hole in space may have required more than one supernova explosion. *– R. Cowen*



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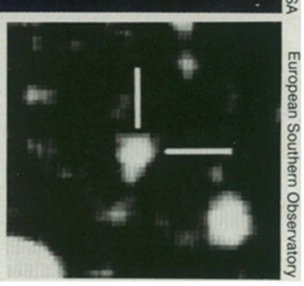

European Southern Observatory

Above: The sun and some nearby stars reside inside a hot hole in space known as the local bubble. Right: Visible-light image of the powerful gamma-ray emitter Geminga, as seen by the New Technology Telescope in November.

Preventing AIDS pneumonia

Daily doses of the sulfa drug trimethoprim-sulfamethoxazole (TMP/SMX) help AIDS patients fend off recurrences of a life-threatening form of pneumonia more effectively than do monthly treatments with aerosolized pentamidine, according to a pair of studies comparing the two widely used preventive medications.

However, the authors of the studies conclude that because it produces fewer side effects than TMP/SMX, aerosolized pentamidine may still prove preferable for protecting some AIDS patients from *Pneumocystis carinii* pneumonia.

This form of pneumonia strikes many people with AIDS, and kills a large number of them. In the mid-1980s, physicians began prescribing pentamidine or TMP/SMX – both of which are also used to treat established cases of *Pneumocystis carinii* pneumonia – for AIDS patients as a preventive measure. Without such therapy, 65 percent of patients taking the anti-AIDS drug zidovudine (AZT) who survive an initial episode of the pneumonia suffer further bouts.

In the first study, researchers led by Robert S. Holzman of New York University School of Medicine in New York City and W. David Hardy of the University of California, Los Angeles, found that 150 AIDS patients who inhaled an aerosol form of pentamidine once a month ran more than three times the risk of developing a recurrence of *Pneumocystis carinii* pneumonia as the same number of patients taking daily TMP/SMX. However, the researchers report in the Dec. 24 NEW ENGLAND JOURNAL OF MEDICINE, roughly one-fourth of the TMP/SMX patients had to stop taking the drug because it caused severe weakness or abdominal pain.

Researchers led by Margriet M.E. Schneider of the University Hospital Utrecht in the Netherlands report similar results in another study in the same journal. Schneider's team found that none of 142 AIDS patients taking daily TMP/SMX developed *Pneumocystis carinii* pneumonia, while six of 71 AIDS patients receiving pentamidine treatments monthly fell ill. *– C. Ezzell*