Astronomy

Dietrick E. Thomsen reports from Fairfax, Va., at the Fourth George Mason University Workshop in Astrophysics, "Supernova 1987A"

'Out, damned spot'

The incriminating spot that Lady Macbeth wanted to be rid of would not disappear. The spot that has perplexed astronomers lately — and been damned by some of them — seems to have disappeared, but its discoverers say it could come back again. This is the strange "companion" to the supernova 1987A, the bright object that suddenly appeared next to the supernova itself (SN:8/22/87,p.122).

The leader of the group that discovered the spot, Costas Papaliolios of the Harvard-Smithsonian Center for Astrophysics in Cambridge, Mass., says that although the spot had appeared in observations taken on March 25 and April 2, it was not present in observations on May 30 and June 2. At least one member of the audience, Nolan Walborn of the Goddard Space Flight Center in Greenbelt, Md., expressed doubt about the existence of the spot at any time. However, others expressed confidence in Papaliolios's observational technique.

Known as speckle interferometry, the technique uses computer analysis of thousands of images taken through a mask with seven pinholes. Scientists look for correlations that reveal details that turbulence in the atmosphere normally blurs.

Papaliolios maintains that the earlier observations were not spurious. The spot was really there, he says. It may have faded, or the location of the supernova during the May-June observations, which was much closer to the horizon than earlier in the year, may have made the spot harder to see. The group is currently analyzing observations made later in the summer to see whether the spot reappears.

Doing the pulsar twist

This "mystery spot," the supernova's bright "companion," also perplexes astronomers because they have a hard time figuring out what could produce it. Stirling Colgate of Los Alamos (N.M.) National Laboratory suggests what might have made the spot, which he calls "son of supernova." It is part of his explanation of why a supernova explosion doesn't fall back on itself, and it involves the magnetic field of the pulsar that may form inside the supernova.

In 20 years of calculating how supernova explosions occur, Colgate says, he has always been puzzled by the question why the supernova explosion doesn't re-collapse. A supernova explosion begins with the collapse of the core of a massive star — one with 15 or 20 times the sun's mass. The sudden implosion of the core sends a shock wave outward that blows away the outer layers of the star.

But, says Colgate, as the shock proceeds it should meet discontinuities, boundaries between layers of different density. Eventually it should come to a layer 10 times its own density. That should reflect the shock, and the blow-back should cause much or all of the matter in the star's mantle to collapse back onto the core.

Observation, shows, however, that supernova explosions continue to expand. The only way to provide for this, Colgate says, is to use the magnetic energy of the collapsed core. With the proper amount of mass, the core collapses into a neutron star, and if it rotates and has the proper magnetic field, the neutron star will be a pulsar, producing radio waves, light or X-rays that terrestrial observers see in pulses. As the pulsar rotates, its magnetic field twists up into a helical shape that fills the cavity inside the exploding supernova front. That helical shape will exert a magnetic pressure that prevents the shock front from blowing back. Furthermore, as the shock front thins out with expansion, the magnetic pressure could pierce it at some point, sending out a stream of magnetic energy into space. The stream, by encountering and energizing some interstellar matter that happened to be in the neighborhood, he says, could produce the glowing "son of supernova."

Biomedicine

From the American Dental Association's 128th annual meeting in Las Vegas

New approach to treating gum disease

Today, treating gum disease usually involves removing plaque from teeth and also pus from pockets between the teeth and gum. The pockets are supposed to shrink but if they don't, they're surgically removed. The patient then is told to follow good preventive measures, such as brushing correctly and flossing. The recurrence rate is between 5 and 10 percent, and if not properly treated, bleeding along the gums, which is gum disease's first sign, may not be the only concern; teeth may loosen and eventually fall out.

Now, however, there is a way to reduce the recurrence rate to less than 1 to 2 percent, says Robert J. Genco, chairman of oral biology at the State University of New York at Buffalo. "Instead of treating the signs and symptoms," he says, "we now can treat the infection itself."

During the last two years, his laboratory and others helped identify the gum disease-causing bacteria, which had eluded researchers because they're difficult to grow in the laboratory. And last February, the first commercial test, which detects the three major types of bacteria, was available for people with symptoms.

Because dentists now can determine the type of bacteria causing gum disease, they can use antibiotic therapy. With *Bacteroides gingivalis* and *Bacteroides intermedius*, a local antibiotic is used because they penetrate only the gum's outer surface. With *Actinobacillus actinomycetemcomitans*, however, a general antibiotic is used because the bacteria penetrate deep into the gum. Conventional treatment also is used, and both inflammation and the bacteria are monitored.

"The profession is in transition," Genco told SCIENCE NEWS. "More and more clinicians are using these forms of diagnosis and treatment." Genco will discuss the topic in an upcoming ADVANCES IN DENTAL RESEARCH.

As for the source of these bacteria, Genco says they are not found naturally in humans. Possible sources include dogs and cats, which have two types of the bacteria, and soil, which has not yet been studied.

A different kind of oral sensation

In about five years, researchers predict, most people will be able to sit in a dentist's chair and control their own anesthesia — not the conventional type but rather the electronic variety where electrodes attach to certain parts of the mouth and send electrical impulses to the brain faster than pain stimuli. The result is said to be a pleasant, pulsing sensation, similar to the twitching of an eyelid.

While this electronic dental anesthesia (EDA) can be used in about 90 percent of dental procedures, it can't be used during surgery because the pulsing increases blood flow. It also does not provide any postoperative pain relief because when patients let go of a hand device, which allows them to find the level of comfort needed, the pain relief stops.

Studies at the University of Southern California in Los Angeles have shown a 85 to 90 percent success rate with EDA, but some patients may not like the twitching sensation or may not want to be bothered with controlling their own anesthesia. "Some would prefer an injection to having to control a machine," says Stanley F. Malamed, a professor of anesthesia and medicine at the USC School of Dentistry.

Although the technology used in EDA has been around in medicine since the late 1960s, especially for treating both acute and chronic pain, the machines for dental offices have been available for only one year. The problem was developing small enough electrodes for the mouth. Currently, about 1,000 of the nation's 140,000 dentists use EDA, and in about five years, people will be able to find dentists who use EDA in most cities, Malamed told SCIENCE NEWS.