Astronomy

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

A hint of gamma rays

The various physical processes going on in and behind the exploding front of supernova 1987A produce radiation over most of the electromagnetic spectrum. As the front expands and thins out, it becomes transparent to more and more wavelengths. The only major part of the spectrum not yet seen is gamma rays, but participants at the meeting heard a report that may hint at an imminent discovery of them.

Gamma rays are the "hardest" (most energetic and highest frequency) of electromagnetic radiation. They are produced in processes of nucleosynthesis that ought to go on in the supernova. Because supernovas are the only place in the universe where physicists can imagine the conditions necessary to form the heaviest elements, they are eagerly awaiting evidence from the supernova that will confirm the theory.

A given nuclear process produces gamma rays of a particular energy. One such energy is 847 kilo-electron-volts. The Solar Maximum Mission satellite (SMM), which was originally put up to observe the sun, has been watching for gamma rays from the supernova since the explosion began last February. Steven Matz of the Naval Research Laboratory in Washington, D.C., reported that SMM saw a slight rise above background noise in the intensity of gamma rays of this energy at the very end (in September) of the latest period for which they have analyzed their data. He emphasized that no claim of discovery of gamma rays was yet being made, but the observers will watch the data for the next period to see whether the hint becomes a discovery.

Blank about Mont Blanc

One of the mysteries about supernova 1987A is what to think of the Mont Blanc neutrinos. On the night the supernova exploded, a neutrino detector called LSD, located under Mont Blanc on the French-Swiss border, recorded bursts of neutrinos that its operators think came from the supernova.

P. Galeotti of the University of Turin, Italy, was at the meeting to argue for consideration of LSD's observation. However, most observers of SN1987A consider that the bursts of neutrinos recorded about four hours later by the IMB detector in Fairport Harbor, Ohio, and the Kamiokande detector in Kamioka, Japan, are the neutrinos that astrophysicists would expect a supernova to produce at the moment of its explosion. As W. David Arnett of the University of Chicago pointed out, they can extrapolate the supernova's light curve, its graph of brightness over time, back to an appropriate starting point at the moment IMB and Kamiokande recorded their neutrinos, so they feel that was the moment the explosion began. Reportedly a Soviet experiment at Baksan in the Caucasus Mountains also detected neutrinos at about the same time as IMB and Kamiokande, but no one from Baksan was at the meeting to confirm this.

No one faulted LSD's experimental technique, but nobody seems to be able to do much with Mont Blanc's early neutrinos. However, Galeotti was not about to let them fade away. Guido Pizzella of the University of Rome, who is not involved in the neutrino experiments, said he sensed in his colleagues "an Aristotelian attitude not to consider experimental evidence one does not like." Instead, he proposed that each group write papers and then the scientific community can decide which is good.

Others were less harsh on themselves. "I can't explain it," said Adam Burrows of the University of Arizona in Tucson. "It may take a lot of time to find out what happened," said Arnett.

Stirling Colgate of the Los Alamos (N.M) National Laboratory suggested the possibility of some kind of binary system being involved with the supernova, but he pointed out that many observational findings in science at large stand unexplained for long times: "You may need 10 years."

Behavior

Stefi Weisburd reports from Irvine, Calif., at the third conference on the neurobiology of learning and memory

Piano playing preserved in dementia

When Alzheimer-like dementia wastes a mind, can oases of cognitive functions, such as artistic abilities, survive? According to psychologist William W. Beatty and his colleagues at North Dakota State University in Fargo, there have been anecdotal reports suggesting that demented patients can remain proficient at music or painting. But few researchers have probed the cognitive landscape of these individuals in any detail.

Beatty's group recently ran a battery of tests on a demented 81-year-old woman, who once taught music at the college level. Beatty found, for example, that she cannot identify pictures of famous people, say where she lives or perform simple motor skills on command such as waving.

But she can still play the piano, albeit not superbly. Musical judges rank her playing (which is also impaired by trembling of her hands) somewhere between that of a young, rusty amateur and that of an elderly, once accomplished pianist who has arthritis.

According to Beatty, the woman has also been able to transfer her piano skills to an unfamiliar instrument, the xylophone. "We think in some sense she's retained the concept of how to play," he says. "It's not just an overlearned motor act that she's spitting out." Only her learned motor responses related to music are preserved. "It's consistent with her inability to do simpler things, like wave goodbye."

Beatty says he's not sure whether his study will have any implications in treating dementia. But it is possible, he says, that "you might be able to use the patient's preserved skills to get at some other memories that aren't normally accessible." For example, his patient could play songs, requested by title, that she could not name when they were played for her.

Dissecting learning in *Aplysia*

To understand how a machine works, an engineer might take it apart. One way for a neurobiologist to discover the mechanisms underlying various forms of learning is to trace how these are put together in the nervous system as a young animal matures. Thomas J. Carew at Yale University and his co-workers have applied this developmental approach to the study of nonassociative learning in *Aplysia*, a marine snail whose adult form became famous in pioneering studies of the molecular basis of memory (SN: 1/22/83, p.58).

Carew's group looked for the onset of three kinds of learning — habituation, dishabituation and sensitization — by testing how readily *Aplysia* contracts its siphon when this organ is sprayed with a jet of water. After a series of such stimuli, the snail habituates, ignoring the water jets. If the researchers then shock *Aplysia's* tail, it again becomes responsive to water jets. This is dishabituation. Sensitization occurs when a unstimulated animal first gets a tail shock, prompting its siphon to contract even more readily than usual.

Conventional thinking has held that sensitization and dishabituation are part of the same process. But Carew has now shown that the two are separate because they emerge at different times in development. Moreover, he discovered a fourth kind of learning, called inhibition, which had not been seen in adults until now because it is masked by other processes.

The researchers are now working to uncover the cellular and neural mechanisms that are "turned on" when *Aplysia* begins to show each kind of learning. Carew notes that the beginning of sensitization is accompanied by an eight-fold increase in the number of cells in the nervous system. "Either there's new circuitry being added [for sensitization]," he says, "and/or the signal that's [triggering the proliferation of new cells] is also turning on sensitization."