Astronomy

Did supernovas pop top off galaxy?

For decades, scientists have wondered what could make the unusual galaxy M82 look so spectacular. Its polar caps seem to be blown off, and hot filaments of gas stream forth from those regions. In 1963, astronomers proposed that a giant explosion in the center of the galaxy caused the unusual formation. However, there are no good proposals for how such an explosion would take place, according to R. Brent Tully of the University of Hawaii's Institute for Astronomy in Honolulu.

Tully and colleague Jonathan Bland propose a somewhat different history for the galaxy in the July 7 NATURE. They suggest galactic gas was blown off not by a huge explosion of a type previously unknown, but rather by many smaller explosions of the more familiar supernova type.

Part of the evidence they cite for this is that the gas coming out of the galaxy keeps accelerating as it gets farther from the galactic center – something that would happen only if explosive activity is still going on and pushing at the gas as it leaves.

M82 may contain many more supernovas than usual because the galaxy recently (in astronomical terms) had a close encounter with the nearby galaxy M81, which probably stirred up M82 and lead to a burst of star formation, Tully says. Many of the larger stars formed would pass quickly through their life cycles and become supernovas, he adds.

At first, the supernovas "blew off the caps" of the galaxy; later explosions have created a "galactic wind" that keeps blowing gas out of the galaxy, Tully says. As additional evidence for this, he and Bland point out that radiotelescopes have spotted more supernova remnants in M82's galactic center than might be expected.

The new theory has wider significance. Supernova activity has long been proposed as the mechanism for keeping elliptical galaxies free of interstellar gas, but such a mechanism has been "rather speculative," Tully says. Although M82 is not an elliptical galaxy, it makes a good case for such a mechanism, he says.

Pulsar cannibalizes companion

The companion star of one of the fastest-spinning pulsars yet found is evaporating, and Columbia University scientist Wlodzimierz Kluzniak and his colleagues have proposed a model that explains the behavior of this pair and the dearth of other such pairs in the universe.

Observations suggest the pulsar is eating away at its companion, tearing it apart with gamma-ray bombardment and then using its gases to feed the pulsar's appetite for more mass and faster spin. In the early stage of the pair's evolution, according to Kluzniak and his associates, the pulsar – a rapidly spinning, very dense neutron star – is surrounded by an accretion disk of matter that falls onto the surface of the pulsar and makes it spin faster. The accretion disk also radiates gamma rays that "evaporate" matter from the companion's surface, Kluzniak and his co-workers propose in the July 21 NATURE. In the second stage of the pair's evolution, after the accretion disk is consumed by the neutron star, the pulsar itself radiates enough energy to tear matter from the companion star.

This matter is pulled onto the ever-more-rapidly spinning pulsar. After about 100 million years the companion should be completely gone, Kluzniak says.

Such parasitism was proposed in December, but this is the first good example of it, Kluzniak says. Kluzniak and two Dutch astronomers have suggested this mechanism may account for the scarcity of certain binary-system pulsars with low-mass companion stars. When a companion star is small enough and close enough to a pulsar, Kluzniak and his colleagues suggest, the pulsar consumes it in a relatively short period.

Biomedicine

Carol Eron reports from New York City at the American Academy of Pediatrics Medical/Science Writer's Conference

Children and AIDS

From the AIDS battlefield in Newark, N.J., James M. Oleske reports that the vast majority of pediatric AIDS cases nationwide are now acquired perinatally – that is, from early pregnancy through the time of birth – through infection of the mothers with the human immunodeficiency virus (HIV). "What we're seeing more and more of in Newark, and the same will be seen elsewhere," Oleske says, are "women who are infected although they are not drug users, but they were exposed to high-risk males." Because approximately half the children born to HIV carriers are expected to develop fatal AIDS, this represents an area of great concern, he says. Previously, blood transfusions accounted for the majority of pediatric AIDS cases nationwide.

Although perinatal AIDS cases reported to the Centers for Disease Control represent just a tiny fraction of total cases, the latest CDC figures reflect almost a doubling in one year. Of the 828 U.S. perinatal cases cumulatively reported through July 11, 391 were reported in the previous 12 months, CDC statistician Margaret Oxtoby told SCIENCE NEWS.

By 1991, Oleske predicts, the cumulative number of infected children will range from 10,000 to 20,000, most with symptoms, and one of every 10 to 15 U.S. hospital beds will be occupied by a child with HIV infection, says Oleske, a pediatric immunologist from the University of Medicine and Dentistry of New Jersey.

Meanwhile, he says, other researchers are conducting studies to determine whether boosting the immune system of young AIDS patients with intravenous gamma globulin is effective. In addition, studies are planned to determine whether gamma globulin in combination with the drug zidovudine (also known as AZT) – the most helpful treatment for AIDS developed so far – is more effective than either alone.

Preliminary results in nine children with AIDS being treated in a long-term zidovudine study are favorable. Oleske reports they tolerate the drug better than adults. "It may be effective, and it may be less toxic in children," he says. "We're excited about it." He notes that other researchers will attempt to prevent the disease in the fetus by giving infected women zidovudine during the third trimester of pregnancy.

Nothing exceeds like success

Vaccines for diphtheria, tetanus, whooping cough, polio, measles, mumps and congenital rubella have led to more than a 99 percent reduction in these diseases in the United States, but a fall in the numbers of children getting immunized greatly concerns pediatricians, says Samuel Katz of Duke University School of Medicine in Durham, N.C. He attributes the trend to young parents who have not lived with the diseases vaccines have nearly eliminated in the past 40 years, and who are thus unaware of their dangers. In addition, he cites a "perverted focus" on the rare complications vaccines can cause and a "failure to appreciate the enormous reduction of disease" due to vaccines. Factors deterring pharamaceutical firms from developing new vaccines, he says, include the large economic investment necessary and the legal risks.

Nonetheless, some new vaccines under development should be available within the next three years, Katz reports. Among them are an acellular pertussis vaccine, expected to reduce some of the adverse reactions associated with the current vaccine (but not necessarily caused by it, Katz says), and a vaccine for Haemophilus influenzae B in infants. The Haemophilus bacterium is responsible for up to 20,000 cases of meningitis in children each year in the United States, and the vaccine now available cannot be given to infants (SN: 9/26/87 p.198). A vaccine for respiratory syncytial virus, the single agent most responsible for illness and death in the first months of life, is also well along in development, he reports.