

ROSAT Data Hint at a Closed Universe

Using an X-ray satellite to detect that a vast cloud of hot gas envelops a small group of galaxies, astronomers have calculated that the group must contain an extraordinarily high proportion of dark matter — material that doesn't emit light, yet exerts a gravitational force.

If the distribution of dark matter within this group is typical of that in the myriad other small groups of galaxies elsewhere in the cosmos, the universe might have enough mass to halt its expansion and eventually collapse in on itself, says Richard F. Mushotzky of NASA's Goddard Space Flight Center in Greenbelt, Md.

He and his colleagues, David S. Davis of Goddard, John S. Mulchaey of the Space Telescope Science Institute in Baltimore, and David Burstein of Arizona State University in Tempe, reported their findings this week at an American Astronomical Society meeting in Phoenix.

When Mushotzky and his team asked that the X-ray observatory ROSAT cast its eye on a trio of galaxies known as NGC 2300, the astronomers merely wanted to find out why one of the galaxies appeared distorted, as if it had slammed into a massive object. Their observation had such low priority on ROSAT's work list that they weren't certain the satellite had ever carried it out until a data tape arrived at Goddard last June.

As they expected, ROSAT detected a hot gas cloud that emits X-rays but not visible light. A collision with hot gas could account for the distorted shape of the spiral galaxy in NGC 2300. But surprisingly, the researchers found that the gas cloud was both huge and hot, with a diameter of 1.3 million light-years and an average temperature of 10 million kelvins. To keep such a hot, energetic cloud from flying off into space, the team calculated, NGC 2300 must contain 10 to 30 times as much mass as the total visible mass of its three galaxies.

That range ranks among the highest proportions of dark matter yet inferred for any galaxy system, Mushotzky notes. Until recently, he adds, most researchers searching for dark matter have used visible-light studies, focusing on individual galaxies or clusters of 100 or so galaxies. These researchers have calculated that dark matter exceeds visible matter by a factor of three to five, he adds.

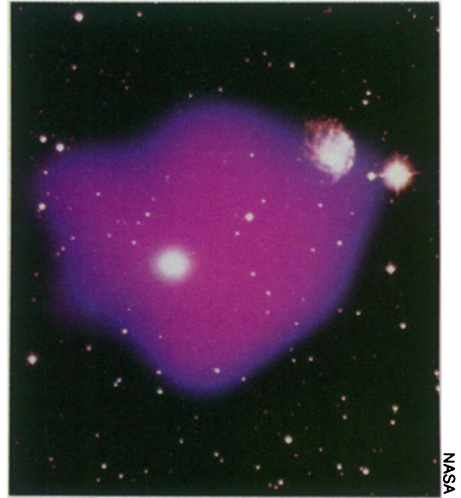
But roughly half of all galaxies, including our Milky Way, are members of small groups. So if NGC 2300, which lies 150 million light-years from Earth, isn't some oddball group — and that's a big if, Mushotzky admits — then the dark-matter estimate could mean that the expanding universe has enough mass to eventually collapse back on itself. The single ROSAT

Visible-light image of three galaxies that make up the group NGC 2300, combined with false-color X-ray image of a gas cloud (pink) that envelops the group.

measurement, Mushotzky adds, makes it impossible to predict whether the universe is in fact absolutely closed or is poised between expanding forever and undergoing collapse.

Calling the new study "exciting and important," Douglas O. Richstone of the University of Michigan in Ann Arbor cites other studies that support it. Earlier ROSAT findings that many galaxies have collided or merged relatively recently suggest that the universe has a high density, Richstone argues. Only a high-density universe would have enough mass to produce large mergers and collisions billions of years after the universe began expanding, he notes.

Nonetheless, cautions Burstein, "One massive group does not a closed universe make." He and his colleagues hope to



refine their temperature measurement of the gas cloud using an X-ray detector aboard Astro-D, a Japanese satellite scheduled for launch next month. The team also plans to observe other small galaxy groupings with ROSAT. — R. Cowen

AIDS codiscoverer censured for misconduct

The U.S. Department of Health and Human Services released a report last week concluding that government AIDS researcher Robert C. Gallo committed scientific misconduct in connection with his codiscovery with French scientists in 1984 of the virus that causes AIDS. The report found that Gallo misrepresented his laboratory's ability to grow the virus from a sample donated by the French, a move that had the potential to obscure the significance of the French contribution to the discovery of the cause of AIDS.

The report — produced by HHS's Office of Research Integrity (ORI) — adds fuel to an eight-year-old international controversy over the lucrative patent rights to blood tests for AIDS that use pieces of the AIDS-causing virus to detect antiviral antibodies in infected individuals. It also prompts questions about Gallo's future as director of the National Cancer Institute's Laboratory of Tumor Cell Biology, one of the largest federal biomedical laboratories.

The report's findings center on a key sentence in one of the 1984 scientific papers in which Gallo describes his team's discovery of an AIDS-causing virus and cites evidence suggesting that the virus differs from the one called LAV, which was isolated by Luc Montagnier and colleagues at the Pasteur Institute in Paris. In that paper, Gallo wrote that the apparent difference between LAV and his group's virus may result from "insufficient characterization of LAV because the

virus has not been transmitted to a permanently growing cell line for true isolation and therefore has been difficult to obtain in quantity."

By examining earlier drafts of the paper and records from Gallo's laboratory, the authors of the ORI report obtained evidence that Gallo and his colleagues had in fact transferred LAV to a permanent cell line — a crucial step in producing sufficient viral proteins for the development of an AIDS test. ORI concludes that while the misrepresentation "did not invalidate the basic findings of [Gallo's] research . . . [it] had the potential to impede the rapid advancement of research efforts with LAV" by dissuading other researchers from working with the virus.

Gallo terms the entire investigation "endless and incompetent" and contends that the disputed sentence pertained only to the French team's inability to grow significant quantities of LAV, not to the work of his own laboratory. "After reviewing everything I and my colleagues have ever published on the discovery of the AIDS virus and the development of the AIDS blood test, ORI could only take issue with a few trivial mistakes and a single sentence written by me," he says.

The ORI asserts that by "falsely reporting" his laboratory's work with LAV, Gallo committed scientific misconduct — a finding that reverses the conclusion reached in 1991 by a National Institutes of Health investigative office that examined the matter. The ORI confirms the NIH finding