ASTRONOMY

No Hidden Starstuff in Nearby Universe

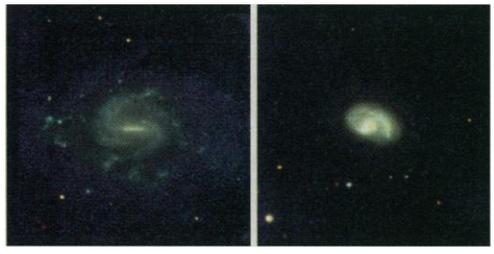
Many astronomers have suspected that there is more to the nearby universe than meets the eye. But, according to a team of Dutch and U.S. astronomers, perhaps it's not very much more.

The team has been analyzing a radio survey of a large swathe of the nearby universe, carried out with the world's largest single-dish radio telescope, to make a comprehensive inventory of neutral hydrogen gas, the principal raw material for stars. Some astronomers had proposed that, besides the hydrogen in the "known" galaxies, large caches of hydrogen—perhaps many times more than in known galaxies—might be hidden in intergalactic clouds or in dim, "low–surface-brightness" galaxies (LSBs). But as the team will report in a November issue of the *Astrophysical Journal*, the extra hydrogen was nowhere to be found. "We're not saying that low–surface-brightness galaxies don't exist," says team member Martin Zwaan of the University of Groningen in the Netherlands. "It's just that they contribute very little to the total mass of neutral hydrogen gas in the local universe."

Although much fainter than normal spiral galaxies, LSBs are not much smaller than our Milky Way—indeed, some are much larger. As a result, the feeble light from their dim stars is spread out over a relatively large area of the night sky, making them notoriously hard to detect using optical telescopes. The first of them was not spotted until 1986, by Gregory Bothun, now at the University of Oregon in Eugene. According to Zwaan, recent deep-optical surveys have turned up many dim LSBs, suggesting that they might be as numerous as normal high–surface-brightness galaxies. If a majority of the LSBs are laden with neutral hydrogen gas, they might represent a major contribution to the universe's hydrogen inventory. Besides implying that the universe has the potential to form many more stars, the extra hydrogen could also make a small, but not insignificant, contribution to "dark matter"—the large quantity of invisible mass that cosmologists believe resides somewhere in the universe.

To find these hypothetical hydrogen reserves, Zwaan and his colleagues Frank Briggs and David Sprayberry (both at Groningen), along with Ertu Sorar of the University of Pittsburgh, analyzed the results of a radio survey of a narrow strip of the sky, carried out a couple of years ago by Sorar with the 300-meter Arecibo radio dish in Puerto Rico. Neutral hydrogen gas emits radio waves at a characteristic frequency, enabling the sensitive Arecibo receiver to detect any significant amounts of hydrogen out to a distance of some 200 million light-years. The researchers then used the Very Large Array of radio telescopes in New Mexico to study in detail any reserves of hydrogen spotted at Arecibo. The radio sources all turned out to be associated with already-known galaxies.

Bothun is not surprised, saying that his belief "has always been that most LSBs have no gas at the present epoch." In the distant, early universe, he explains, the faint galaxies that are probably the precursors of today's LSBs are blue in color, indicating that ample hydrogen reserves were forming hot young stars. But closer to the present, such galaxies appear dimmer and redder, suggesting that they have used up their star-forming gas.



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Gloomy galaxy. A low–surface-brightness galaxy *(left)* compared to a normal one.

Nor did the survey bear out the belief of some astronomers that large, starless clouds of protogalactic mist have survived into the present universe. "Some people have suggested that many intergalactic [neutral hydrogen] clouds would be found," says Rachel Webster of the University of Melbourne, who is currently participating in a large radio survey of the southern sky with the Parkes Radio Telescope in Australia. The Parkes survey, to be completed in 2001, is less sensitive than Sorar's effort at Arecibo, but it covers a much larger area. "I can't exclude the possibility that they will find some intergalactic hydrogen clouds," says Zwaan. However, Webster says that "the numbers must be small if there are any at all. I have adjusted my expectations accordingly."

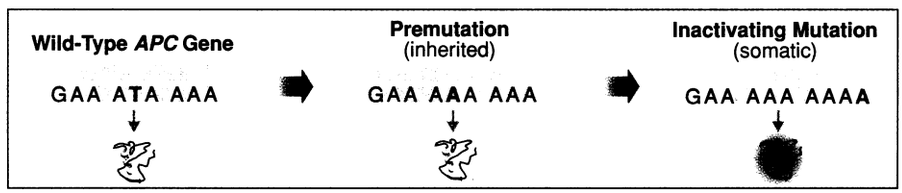
–Govert Schilling

Govert Schilling is a writer in Utrecht, the Netherlands.

CANCER GENETICS

New Kind of Cancer Mutation Found

Researchers studying the genes for colon cancer may have accounted for part of a puzzling shortfall. Somewhere between 15% and 50% of colon cancers and the benign polyps that are often their precursors seem to have some hereditary component. Yet the colon cancer genes found so far have been linked to less than 5% of the total cases. Now, through a meeting of chance and clever detective work, Bert Vogelstein and Kenneth Kinzler at Johns Hopkins University School of Medicine and their colleagues have tracked down a genetic culprit that might explain at least part of the discrepancy—and it works in a way never seen before for any cancer-causing mutation.



Paving the way. A single base change—adenine (A) replaces thymine (T)—leads to further mutations that inactivate the *APC* gene and increase the risk of colon cancer.

In the September issue of *Nature Genetics*, the researchers report that they have found an inherited mutation in a gene called *APC*, which normally holds cell growth in check and can cause colon cancers when mutated. But unlike previously identified mutations, the new one does not directly affect the function of the gene. Rather, the mutation may render the surrounding DNA susceptible to mistakes by the enzyme that copies genes when cells replicate, thereby creating new mutations that do lead to loss of gene function. "This could be a landmark study of a novel mechanism," says molecular biologist Jeffrey Trent of the National Human Genome Research Institute (NHGRI) in Bethesda, Maryland.

Indeed, Trent and others say that the same mechanism might be at work in genes linked to other cancers, such as breast and prostate cancer, which have been found to contain similar "harmless" variations. "Clearly, we should look at other tumor-suppressor genes for other such sequences that people might have walked right past," says NHGRI director Francis Collins.

The discovery may also have immediate applications for early detection of colon cancers, especially in Ashkenazi Jews. The Vogelstein-Kinzler team found that 6% of Ashkenazim carry the mutation, making it the most common cancer-predisposing mutation in a defined ethnic group. Screening for the novel mutation in that population would thus be a good way of identifying people who have a