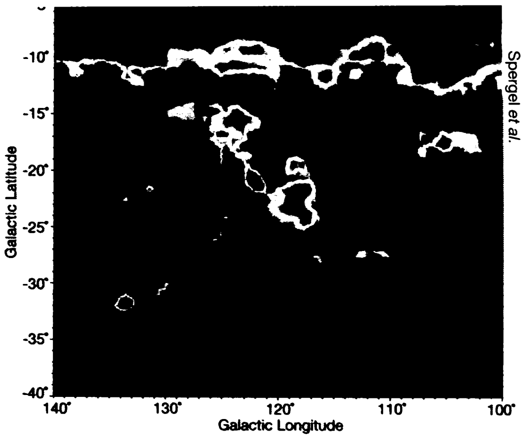
Enigmatic gas clouds may fuel Milky Way



This false-color image depicts a radio emission from hydrogen gas in the high-velocity clouds, shown in yellow and red-orange. The red band at the top is an emission from the Milky Way, and the two red dots, near the center and at lower left, indicate the Andromeda and M33 galaxies, respectively.

Imagine watching a skyscraper go up but never seeing the raw materials—steel, cement, and glass—necessary to build it. Astronomers observing the Milky Way have been similarly perplexed. Our galaxy continues to form huge numbers of stars, but no one has identified the reservoir of gas required to sustain such activity.

Now, researchers say that a collection of high-speed, wispy hydrogen clouds, discovered in 1963, is the remnant of the gaseous reservoir that built the Milky Way, Andromeda, and the rest of the nearby galaxies known collectively as the Local Group. In addition, these gas clouds could fuel starbirth in the Milky Way for another 3 billion years or so, says study collaborator David N. Spergel of Princeton University.

The clouds may also serve as a local repository for dark matter, the invisible, hypothetical material thought to account for more than 90 percent of the mass of the cosmos, he adds.

Spergel and his colleagues, including Leo Blitz of the University of California, Berkeley, Dap Hartmann of the Harvard-Smithsonian Center for Astrophysics in Cambridge, Mass., and Peter Teuben of the University of Maryland at College Park, reported these findings last week at a meeting of the American Astronomical Society in Toronto.

Their study provides an evolutionary link between the mature galaxies seen near the Milky Way today and the youthful galaxies observed during the early history of the universe, says Spergel.

Vast clouds of hydrogen gas, revealed by their absorption of distant quasar light, are commonplace in the early universe and are widely considered the building blocks of galaxies (SN: 9/17/94, p. 188). The remnant clouds seen in the vicinity of the Milky Way may represent nearby examples of the reservoirs in the early universe, Spergel and his colleagues suggest.

Indeed, the sizes, numbers, and densities of the high-velocity hydrogen clouds near the Milky Way are easily explained if the clouds are simply descendants of the early reservoirs, Spergel asserts. Judging from models of structure formation in which small objects in the cosmos coalesce to form larger ones, "there ought to be clouds of dark matter and gas falling into our galaxy, and that's what we believe these high-velocity clouds are," he says.

The researchers base their work on computer simulations and recent studies with three radio telescopes. The telescopes track hydrogen gas emissions in the fast-moving clouds, which have long puzzled radioastronomers. At speeds of about 100 kilometers per second relative to the center of our galaxy, the clouds move too quickly to be bound in a circular orbit. Moreover, some of the clouds flow toward the galaxy while others head away from it.

Even more puzzling, the team's observations place the clouds some 30 times farther away than previously thought and suggest that they may contain up to 1,000 times as much mass.

The distribution of the high-velocity clouds and their speeds can best be explained, says Blitz, if the clouds are orbiting the center of mass of the Local Group. In this view, the clouds provide the material for all of the galaxies in the group. Computer simulations confirm this interpretation, notes Spergel.

Still, additional studies are needed, the team notes. "My view is that the high-velocity clouds [are involved] in a range of phenomena" that may well include fueling nearby galaxies, says Blair D. Savage of the University of Wisconsin-Madison. He adds that astronomers need better measurements of the clouds' positions.

A new imaging spectrograph, scheduled to be installed on the Hubble Space Telescope next month, can record dim stars and improve distance measurements of the clouds, says Spergel.

Alternatively, some astronomers suggest that many of the clouds come from our own galaxy. They may be spewed out by a series of supernova explosions and then rain back down like a huge fountain. If so, they should have the same abundance of heavy elements as gases residing in the galaxy's core.

Researchers hope soon to obtain detailed visible-light spectra of the clouds, which should reveal their chemical composition and settle the question of their origin, Spergel says. —*R. Cowen*

Clues that viral gene causes a skin cancer

Investigators seeking to prove that a recently discovered virus often causes cancer in AIDS patients have uncovered what may be a smoking gun.

Kaposi's sarcoma, until recently a rare cancer, afflicts more than 20 percent of gay men with AIDS. Since 1994, when fragments of viral DNA were found in the cancer's characteristic purplish skin lesions, scientists have suspected that a sexually transmitted virus causes the disease (SN: 9/28/96, p. 206).

Although follow-up studies also placed that virus, human herpesvirus 8 (HHV8), at the scene of the crime, nagging doubts about its guilt remained—in part because scientists couldn't find a cancer-causing weapon wielded by the infectious agent.

Now, researchers at Cornell University Medical College in New York have identified an HHV8 gene whose protein can stimulate cellular proliferation. In the Jan. 23 Nature, they suggest that this gene may explain how the virus triggers cancer. "It's not convincing, but it's tantalizing," comments Philip M. Murphy of the National Institute of Allergy and Infectious Diseases in Bethesda, Md.

The viral gene under suspicion encodes a protein that strongly resembles chemokine receptors, a family of proteins normally found on the surface of immune cells. When chemicals called chemokines bind to the receptors, they signal their respective cells to migrate to sites of inflammation.

While the protein encoded by the HHV8 gene can also bind to chemokines, it provokes a different response by cells. When the scientists simulated an HHV8 infection of cells by adding the viral receptor gene to rat kidney cells, the cells multiplied at an abnormally fast rate. The HHV8 protein "turns on the proliferative response," says Marvin C. Gershengorn of Cornell.

Moreover, the viral receptor does not need to interact with chemokines in order to send signals inside a cell, the researchers report. The viral receptor is permanently "turned on," says Gershengorn.

Researchers caution that the case against the viral gene remains circumstantial. Current tests, such as those to determine whether the gene's protein can induce tumors, may resolve the issue.

Yuan Chang of Columbia University notes that other HHV8 genes have come under suspicion. "It may be very complicated. This gene or three to four genes may be involved," she says.

If the HHV8 chemokine receptor proves to be the key to Kaposi's sarcoma, scientists plan to look for anticancer drugs that interact with the protein. "What I would like to do is turn that receptor off," says Gershengorn. —*J. Travis*