Last year, worries about a continuing tuna decline, based on ICCAT statistics, led the National Oceanic and Atmospheric Administration to ask the NRC to do its own assessment for the benefit of this year's ICCAT meeting in November. The report, "An Assessment of Atlantic Bluefin Tuna," concluded that the situation in the west is not that bad. While ICCAT estimated that the 1993 catch was only 78% of the 1988 catch, NRC found "no evidence that abundance of western Atlantic bluefin tuna has changed significantly" in that period.

The committee, chaired by zoologist John Magnuson, director of the Center for Limnology at the University of Wisconsin, reported that one of the main factors in the revised assessment was the rejection of the "two-stock hypothesis." The panel pulled together all available tagging data for Atlantic bluefin and concluded ICCAT was coming up with "skewed" estimates by treating the two sides of the Atlantic separately. The committee estimated that about 2% of eastern tuna head west each year, and 1% of the westerners go east. An annual transfer rate of 2% may seem small, but it's far from trivial, as it means that over 10 years, some 20% of the fish on one side of the Atlantic may have moved to the other.

Whether ICCAT will revise its policies to accommodate NRC findings and recommendations remains to be seen. Said one NRC committee member, Terrance J. Quinn of the University of Alaska in Juneau: "Our job as scientists, assessors, and managers gets a lot more difficult under the mixing hypothesis," because now data from both sides of the Atlantic have to be integrated. Fish movements and changes in distribution are little understood, Quinn says, and there's not enough genetic data to be able to track subgroups. Getting a handle on Atlantic tuna, it seems, is a slippery business.

–Constance Holden

MEETING BRIEFS

Astronomers Gossip About The (Cosmic) Neighborhood

The Hague, Netherlands, last month welcomed 2000 astronomers from around the world for the 22nd General Assembly of the International Astronomical Union (IAU). From 15 to 27 August, they participated in symposia and discussions on topics ranging from the down-to-Earth issue of light and radio-frequency pollution to the creation of elements at the farthest reaches of time and space, in the big bang. Some of the most striking news, however, came in new findings from our galaxy and its immediate surroundings.

New Galaxy on the Block

Much of the glory in astronomy comes from probing the farthest reaches of the universe with the largest telescopes. But poking around closer to home with more modest instruments has its own rewards—such as finding a sizable galaxy right in the Milky Way's own backyard. That's what happened recently, when radio astronomers turned the 25-meter Dwingeloo radio telescope in the Netherlands—a puny thing next to the 100-meter dishes and miles-long arrays common in radio astronomy—on a neglected patch of sky.

The new galaxy, designated Dwingeloo-1, is massive enough to be influencing the motion of our own galaxy and others nearby, its discoverers reported at the IAU meeting. Yet earlier searches with optical telescopes overlooked it because they tended to bypass the region of sky behind the Milky Way; it was too difficult to distinguish anything behind the dust and stars in the Milky Way's disk. To penetrate that dusty cloud, Renee Kraan-Korteweg of the University of Groningen and collaborators from the Netherlands, Britain, and the United States organized the Dwingeloo Obscured Galaxy Survey last year. By searching not for visible light but for the 21-centimeter radio waves emitted by atomic hydrogen gas in unidentified galaxies, the researchers hoped to spot them through the haze of the Milky Way.

The first hints that they had succeeded came on 4 August, when the Dwingeloo telescope picked up radio emissions with a spectral signature indicating they came from a massive, rotating collection of stars and gas—presumably a spiral galaxy. Soon afterward, the much larger Westerbork Synthesis Radio Telescope confirmed that the signals were emitted by a galaxy spinning at about 100 kilometers a second. Within days, the astronomers contacted colleagues who photographed the galaxy at infrared wavelengths with the United Kingdom Infra-Red Telescope on Mauna Kea, Hawaii. The images revealed starlight and a hint of a spiral pattern.

The Dwingeloo group estimates that the new galaxy lies just 10 million light-years away, about five times farther than Andromeda, the nearest large galaxy. From its size and rotation speed, the researchers estimate the galaxy's total mass to be about a quarter that of the Milky Way. That makes Dwingeloo-1 far too big to be ignored any longer; it's big enough, they say, to be tugging on the Milky Way and dozens of its neighbors, altering their wanderings through space.

Cosmic Lithium Factories

For an element, lithium has a delicate constitution. Originally forged in the big bang, astronomers believe, lithium is quickly destroyed in the hot interiors of stars, leaving only faint traces visible in the light from a star's surface. So it came as quite a surprise 2 years ago when a group of astronomers announced that they had spotted a normal, sunlike star in which lithium was 10,000 times more abundant than it is in ordinary stars. What made the finding even more surprising was that the suspect star belongs to an x-ray–emitting binary system known as V404 Cygni, in which the other member is thought to be a black hole. A black hole's violent surroundings seemed an even less hospitable environment for lithium than normal stars are.

But it now seems that lithium and x-ray binaries are natural companions. At the IAU meeting, the same research team, Eduardo Martin and Rafael Rebolo of the Instituto de Astrofísica de Canarias in Tenerife and Jorge Casares and Philip Charles of Oxford University, announced that they have detected signs of abundant lithium in two other x-ray binaries. One, A0620-00, is also thought to contain a black hole; the other, Centaurus X-4, harbors a different kind of powerhouse, a neutron star. Now the researchers are trying to understand how these violent objects might step out of character to create rather than destroy lithium.

One possibility, they say, is that lithium is created near the neutron star or black hole, where material sucked in by the object's potent gravity is accelerated to very high speeds. High-speed helium nuclei might collide with each other and combine to form lithium through a process known as spallation. The blast of radiation emitted by the superheated matter in the black hole's accretion disk—the last way station for infalling material before it slips into the black hole itself—might then blow some of the lithium-rich material outward onto the sunlike companion star.

An alternative scenario comes from Rashid Sunyaev of the Space Research Institute in Moscow, who believes the lithium might be formed where it is detected—in the companion star's atmosphere. He thinks some high-energy helium nuclei might escape from the black hole or neutron star and plunge into the atmosphere of the sunlike companion before colliding with other helium nuclei and forming lithium.

Wherever it happens, spallation could explain not only the anomalous lithium, but also a mysterious gamma-ray emission from another x-ray binary, Nova Muscae 1991. When the French-Russian GRANAT satellite first detected the gamma rays, which have an energy of 478 kiloelectron volts (keV), astronomers assumed they were emanating from the annihilation of electrons and positrons, their antimatter counterparts—a process expected to take place in the accretion disk of a black hole. The annihilation normally gives off gamma rays at 511 keV, but researchers guessed that because the rays are produced so close to the black hole itself, its powerful gravity might redshift them to a lower energy.

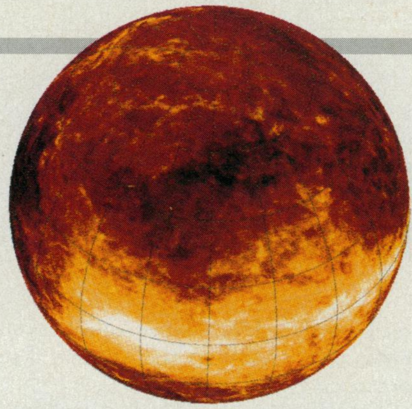
This picture had one serious problem: The 478 keV line didn't show the "broadening" that would be expected if its source were a rapidly rotating accretion disk. But the spallation reaction that may be producing lithium in x-ray binaries also conveniently emits a gamma ray at almost exactly 478 keV. "Most theorists think that this interpretation makes much more sense," says Charles.

If this interpretation is correct, Nova Muscae should also be producing lithium, though so far none has been detected. But more support for spallation scenarios could come when Integral, the European Space Agency's planned gamma-ray observing satellite, is launched early in the next century. Along with the 478 keV signal, the lithium-forging reaction should lead to the emission of a gamma ray at 2.2 megaelectron volts—an energy level beyond the ken of current instruments but well within that of Integral.

A Feat of Mapmaking

Atomic hydrogen seems to be a Dutch specialty. A half century ago, it was a Dutch astronomer—Hendrick van der Hulst—who first suggested that there is so much of the gas in our galaxy that astronomers should be able to detect it by searching for the 21-centimeter radio waves given off by the free atoms. Another Dutchman, Jan Oort, among the first to confirm Van der Hulst's prediction, went on to map the movements of this gas, called HI, to confirm that our galaxy rotates. Now, two more astronomers from the Netherlands, Dap Hartmann and Butler Burton of Leiden University, have taken this Dutch tradition a step further.

After 5 years of painstaking observations on the 25-meter Dwingeloo radio telescope, they have produced the best maps yet of HI emission in our galaxy. Their results, presented at the IAU meeting, constitute "a piece of work of stunning importance," says radio astronomer Gerrit Verschuur of Rhodes College in Tennessee, because atomic hydrogen is a good tracer of the galaxy's shape and internal motions.

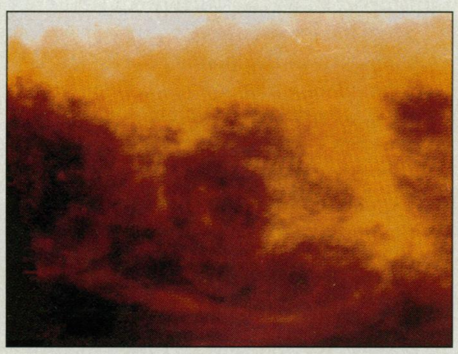


Prevailing winds. A velocity map of the galaxy's atomic hydrogen shows how the gas flows generally away from the sun along the plane of the galaxy *(bright band)*.

Hartmann and Burton mapped all of the sky that is visible from the Netherlands. They recorded the distribution of HI with far more sensitivity and spatial resolution than earlier surveys. And by measuring the frequency shifts that result from motions of the gas along the line of sight, the pair of Dutch researchers was also able to chart how the gas streams toward or away from Earth, clocking its velocity with a resolution of 1 kilometer per second.

One mystery these maps might clear up is whether our galaxy, like many other spiral galaxies, has a warped outer disk, bent up on one side and down on the opposite side—a shape that might be a clue to the processes that formed it. And a comparison of the HI maps with infrared maps from the Infra-Red Astronomy Satellite (IRAS), which trace dust, may reveal how gas and dust interact in the galaxy's star-forming regions. The survey could also pinpoint regions relatively free of dust and gas, which could serve as "viewing ports to the extragalactic world," say Hartmann and Burton.

Astronomers will also examine the texture of the gas, searching for clues to the energetic processes that stir it. Some researchers have predicted that clouds of atomic hydrogen are sailing through a calmer surrounding medium. But at first glance, says Hartmann, "it is difficult to find much evidence for the existence of 'clouds.'" What's more striking, he says, is "the filamentary nature of the gas." Explaining it may be a problem for another Dutch astronomer.



PHOTOS BY BURTON AND HARTMANN

Where stars are born. The distribution of atomic hydrogen in the turbulent Orion cloud.

No Alien Jupiters

Recently astronomers have found planets where they least expected them: around pulsars, those fast-spinning remnants of stars that long ago exploded as supernovae. It would be far more intriguing, however, to find counterparts to our own solar system—planets circling nearby stars that resemble our sun. But that search keeps coming up empty. It's not for want of looking, though, as several groups reported at the IAU meeting.

In one of the most comprehensive planet searches to date, Geoffrey Marcy of San Francisco State University and Gordon Walker of the University of British Columbia independently studied a total of 30 nearby sun-like stars for signs of a planet. As an orbiting planet tugs a star back and forth, it should leave its mark on the starlight in the form of Doppler shifts in certain spectral lines. The surveys detected no Doppler shifts in light from any of the stars, ruling out any planets with more than three times the mass of Jupiter.

The disappointing news continued when a group led by Fritz Benedict of the University of Texas, Austin, reported early results of a study, done with the Hubble Space Telescope, of two of the nearest stars: Proxima Centauri and Barnard's Star. After a 2-year search for tiny shifts in Proxima Centauri's position in the sky—the side-to-side equivalent of the Doppler wobbles—the researchers have no firm evidence of a planet. The study of Barnard's Star is still in its early stages, but it too has so far yielded nothing. And these observations are sensitive enough to find a planet as small as Jupiter.

The lack of evidence for alien Jupiters doesn't mean the stars observed in these studies are completely devoid of planets, Marcy notes; a planet the size of Earth would produce a wobble too small to have been detected. And most planetary systems might not include a gas giant as large as Jupiter, in which case smaller planets could be common. "The critical question [is] whether Jupiter itself is more massive than commonly occurs elsewhere," says Marcy.

Benedict, for one, remains upbeat about the prospects of finding smaller planets around Proxima Centauri, which itself is much smaller than the sun. "I am not disappointed [with the results so far]. The pre-planetary nebula of a star with one-tenth the mass of the sun might produce smaller gas giants." And as long as there's any hope at all, the planet hunt will continue.

–Ray Jayawardhana

Ray Jayawardhana is a science writer based in Cambridge, Massachusetts.