

# Observations Hint at Primeval Galaxy

Peering ever deeper into space and further back in time, astronomers seek the oldest ancestors of ordinary galaxies like the Milky Way. These early relatives would represent objects still in the process of forming their first generation of stars. For more than a decade, several teams of astronomers have sought, but failed to find, compelling evidence of one of these primeval objects.

Now, two researchers say they may have reached that elusive goal.

Their observations, they assert, reveal that a galaxy discovered in the vicinity of a faraway quasar ranks as one of the most distant galaxies ever found. Moreover, its pattern of light emission strongly suggests that it qualifies as a primeval galaxy undergoing its first wave of star-birth. Richard G. McMahon of the University of Cambridge in England and Esther M. Hu of the University of Hawaii in Honolulu shared their early findings with SCIENCE NEWS this week.

"We're excited by this finding because it may represent the way an ordinary galaxy looks [early in the cosmos]," says McMahon. That interpretation isn't completely obvious, he admits, given the galaxy's relative proximity to a distant powerhouse, a quasar dubbed BR2237-0607.

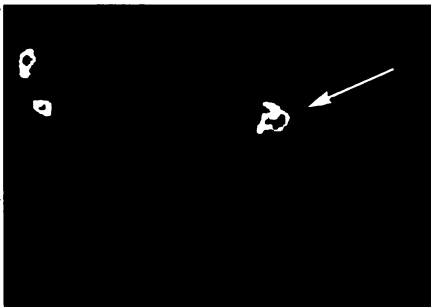
Astronomers often view quasars as the high-energy oddballs of the universe. McMahon explains that galaxies close to these dazzling light beacons don't represent a typical galaxy in the cosmos. Moreover, when quasar light blasts nearby objects, it may make them appear considerably brighter than they actually are.

Observations with the 2.2-meter University of Hawaii telescope atop Mauna Kea, however, show that the galaxy resides several hundred light-years from the quasar—far enough away that the brilliant powerhouse doesn't disturb the faint body, McMahon says. "Our interpretation is that this is a very young, ordinary galaxy," he says.

McMahon adds that spectra taken in July with the W.M. Keck Telescope on Mauna Kea reveal that cosmic expansion has dramatically shifted the wavelength of radiation from the galaxy. The measured redshift of 4.5, roughly the same as that of the neighboring quasar, means that the light now reaching Earth left the galaxy when the universe was less than 10 percent of its current age—under 1 billion years old. Ultraviolet emission from hydrogen gas, typical of young stars, and the absence of significant amounts of other radiation hint that stars formed in the galaxy very recently, Hu adds.

Like other astronomers, cosmologist Edmund Bertschinger of the Massachu-

setts Institute of Technology hasn't seen the new results, but he notes that finding a galaxy so early in the history of the universe "is a bit like finding the oldest



False-color image (arrow) of galaxy near the quasar BR1202-0725.

hominid. . . . As we go further back in time and find the oldest galaxies similar to our own, we have the chance of learning much about how structure formed in our universe."

McMahon began collaborating with Hu after he and his British colleagues discovered some 40 quasars, including BR2237-0607, that rank among the most distant objects known in the cosmos (SN: 9/17/94, p.188). Quasars are thought to reside at the center of galaxies, and galaxies tend to occur in clusters. So McMahon decided to search around the

distant quasars in the hope of finding far-away, possibly primeval galaxies.

Probing the environs of another distant quasar, BR1202-0725, McMahon and Hu told SCIENCE NEWS that they may have pinned down the location of a galaxy imaged by other astronomers in the infrared with the Keck Telescope and in visible light using the European Southern Observatory's (ESO) New Technology Telescope in La Silla, Chile. In a press release last week, ESO astronomers use the color and brightness of the faint galaxy to argue that it is primeval and may account for a huge cloud of hydrogen gas that resides at a distance corresponding to a redshift of 4.38.

But McMahon and Hu have evidence that the galaxy lies even farther away at about the same distance from Earth as the quasar. They find that light from the galaxy peaks around a wavelength corresponding to characteristic emissions from hydrogen at the quasar's location. With a redshift of 4.7, the quasar is significantly farther away than the hydrogen cloud. If detailed spectra confirm this estimate of the galaxy's location, the galaxy would be the most distant known. But it probably isn't a primeval ancestor of ordinary galaxies, says McMahon, because it lies too close to the quasar.

— R. Cowen

## Can't take the heat? Don't enter the nest

Japanese honeybees have devised a defensive strategy worthy of the best pro football coaches. In fact, this ploy accounts for *Apis cerana japonica's* impressive record of protecting its nest against attacks by the giant hornet, *Vespa mandarinia japonica*.

One might think that the honeybees sting their foes to death.

Nope. They tackle the hornets' offensive linemen, then use body heat to wipe them out, assert Masato Ono and his coworkers at Tamagawa University in Tokyo.

Upon finding a honeybee nest, a hornet kills a few of the bees and takes them home to its young. The forager usually manages to repeat this hunting trip successfully a few times. Then it makes a fatal mistake: It rubs a pheromone on the hive, signaling other hornets to attack the nest, the team reports in the Sept. 28 NATURE.

However, the honeybees also detect

Japanese honeybees form a ball around an invading hornet (above), killing it with their body heat (below).



the pheromone. In response, more than 100 workers go to the entrance of the nest to lure their foes inside. Then, as many as 500 bees tackle each hornet, forming a ball around it. The bees vibrate and raise the temperature of the ball to a killer 47 C for about 20 minutes, the researchers find. The honeybees can withstand temperatures up to about 50 C, but not so hornets.

Such an intricate defense mechanism evolves as an arms race between predator and prey, notes Robert L. Jeanne of the University of Wisconsin, Madison. No other insect that he knows of kills with heat.

The honeybee also uses this hot tackle strategy against the hornet *V. simillima xanthoptera*, although fewer workers are needed to do the job, the Japanese researchers found in earlier studies.

Hornets stage mass attacks only in the fall, when they have many mouths to feed. "This food pressure may force the hornet into high-risk foraging," the team suggests.

Sometimes the hornets stage successful coups, particularly if they can invade the nest before their front line is destroyed. In these cases, they take over the nest and collect the bees' larvae and pupae.

When the researchers put a piece of paper that smelled of the hornet pheromone outside a Japanese bees' nest, 50 to 100 of the insects attacked the paper. However, immigrant European honeybees (*Apis mellifera*) in Japan failed to respond to the scented paper, the team reports. They also failed to mount a timely defense against the invader. Indeed, 20 to 30 hornets can kill a colony of 30,000 bees in 3 hours.

— T. Adler

## Mean streak: Hurricane season roars along

Robert W. Burpee, the new director of the National Hurricane Center in Miami, has endured a trial by storm.

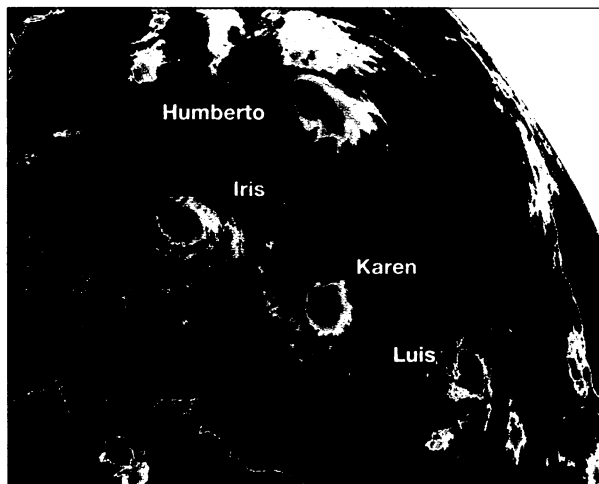
With a month still to go in his first season on the job, the Atlantic Ocean had produced seven hurricanes and six named tropical storms, making this year, as of Sept. 26, the third most active hurricane season in 125 years of records.

Burpee and other weather officials gathered in Washington, D.C., last week to review the storms thus far and to tout several major advances in hurricane forecasting. "This storm prediction season has been very, very good," said Joe Friday, director of the National Weather Service in Silver Spring, Md. "We're seeing the benefits of new observing tools, new computer models, and new procedures that we're using at the hurricane center."

One of the new tools, the GOES-8 weather satellite, gives the weather service more detailed images of the tropical Atlantic, the breeding ground for hurricanes. The hurricane center also started using an improved computer forecasting model this year, boosting the accuracy of its forecasts by 20 percent in some cases.

The weather service this summer flew its two P-3 aircraft on simultaneous criss-

crossing flights into several hurricanes, giving them more information than routine hurricane research flights usually



National Oceanic and Atmospheric Administration

Storm traffic: A satellite image from Aug. 30 shows two hurricanes and two tropical storms marching west. Remnants of another storm, Jerry, appear on far left.

produce. "These are the most complete pictures of hurricanes that we have ever obtained," said Hugh E. Willoughby, acting director of the Hurricane Research Division in Miami.

Hurricane reconnaissance will improve next year, when the weather service acquires a Gulfstream jet. The jet can fly at 45,000 feet, much higher than the turbo-propeller P-3s. The lofty vantage point will enable scientists to survey the tops of hurricanes, where upper-level winds help steer storms.

— R. Monastersky

## DOE to pare costs—and sell some labs

On Monday, President Clinton issued a "decision directive" ordering the Department of Energy to rein in costs and redundancies at its 27 national laboratories. But he also firmly rejected one cost-cutting suggestion tendered earlier this year by an independent task force reviewing the labs: a 5-year transfer of Lawrence Livermore (Calif.) National Laboratory's defense activities to DOE's other two multipurpose, nuclear weapons laboratories.

That move would probably have tolled the death knell for the 43-year-old Livermore facility. Though nearly 75 percent of its work now involves nondefense activities—from climate change studies and biotechnology to medicine—Livermore derives almost 60 percent of its roughly \$1.1 billion annual budget from programs aimed at maintaining the health of U.S. nuclear weapons. Much of the facility's nondefense activities, therefore, rely on the

supercomputers, lasers, and other resources initially acquired for defense work, explains laboratory spokesman David Schwoegler.

"The President has determined that the continued vitality of all three DOE nuclear weapons laboratories will be essential"—especially if the United States hopes to forswear nuclear testing for the next few years, Energy Secretary Hazel R. O'Leary said Monday at a press conference in Washington, D.C. Clinton announced the "zero yield" comprehensive test ban policy on Aug. 11.

Key to ensuring the reliability of the U.S. weapons stockpile in the absence of testing is a new "science-based stockpile stewardship" program. It aims not only to provide surveillance for all elements of the weapons, but also "to understand the way nuclear weapons grow old and to replace parts as required," explains Everett Beckner, DOE's

principal deputy assistant secretary for defense.

Livermore and the other two DOE defense centers—Sandia National Laboratories and Los Alamos (N.M.) National Laboratory—each plan to tackle different parts of the stewardship activities.

O'Leary says it doesn't seem very cost-effective to put a U.S. test ban "at risk by simply folding up a lab [Livermore]." But she acknowledges that administrative activities have bloated DOE's laboratory budgets.

By the end of next month, her agency hopes to announce details of how it plans to cut \$1.6 billion from the labs' spending over the next 5 years—or some 13 to 18 percent, after accounting for inflation.

Moreover, O'Leary notes, "there are willing purchasers" for some of the agency's smaller, single-purpose laboratories. By next spring, she says, DOE will probably have negotiated the sale of at least two.

— J. Raloff