Hubble gets multiple views of distant galaxy

When hunting the most distant galaxies, astronomers often have to content themselves with but a single image. Now, scientists have obtained a trio of images of one of these extraordinarily faint, starlit bodies.

Taken with NASA's Hubble Space Telescope, the portraits range in wavelength from visible light to the near-infrared and provide an unprecedented look at the shape and rate of star formation of one of the most distant objects known in the universe. "It is fair to say this is the best-characterized very distant galaxy so far," says Daniel Stern of the University of California, Berkeley.

Ray J. Weymann and Lisa J. Storrie-Lombardi of the Carnegie Institution of Washington in Pasadena, Calif., and their colleagues, including Stern and Hyron Spinrad of Berkeley, describe their work in an article posted on the Internet (http://xxx.lanl.gov/abs/astro-ph/9807208).

The galaxy lies in an extensively studied patch of sky known as the Hubble Deep Field (HDF). The Hubble Telescope observed the region in visible light in late 1995 and surveyed about one-third of it in the near-infrared this January.

Analyzing images of the galaxy, dubbed HDF 4-473.0, Weymann and his colleagues strongly suspected that it is distant. The galaxy did not show up in a picture taken in yellow light, appeared only as a dim blob in an image at slightly longer wavelength, and was considerably brighter viewed in near-infrared light. That's indicative of a galaxy whose short-wavelength emissions can't be seen because they are absorbed by hydrogen gas, which is plentiful between Earth and distant galaxies.

The astronomers then used the Keck I Telescope atop Hawaii's Mauna Kea to obtain spectra of the galaxy, which revealed that it is more than 12 billion light-years from Earth. This makes HDF 4-473.0 the second most distant galaxy known (SN: 5/2/98, p. 280). Because the light left the galaxy so long ago, the images provide a snapshot of the object when the cosmos was less than 1 billion years old.

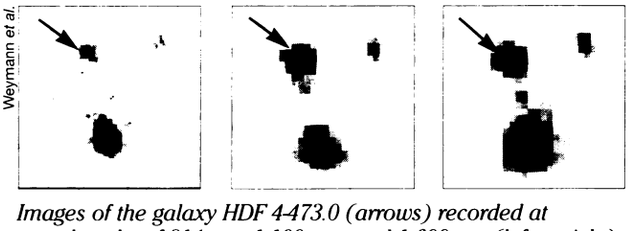
Spinrad notes that several other galaxies glimpsed at that early epoch appear to be composed of two or more parts. In contrast, says Weymann, HDF 4-473.0 "seems not only quite compact but also quite regular, as if it had not just been assembled but had been around for a while." It would be puzzling if so mature a galaxy was present when the cosmos was still in its infancy.

Alternatively, the galaxy may have irregular features that are too faint for Hubble to have discerned, notes Mark Dickinson of Johns Hopkins University and the Space Telescope Science Institute, both in Baltimore.

The HDF 4-473.0 galaxy is about half the size of ordinary, nearby galaxies. It appears to be making the equivalent of 13 suns per year, a star-formation rate typical of young, distant galaxies, Stern says.

Unlike other extremely distant galaxies, this one was found by a systematic analysis of images, he adds. With this method, "we can now start estimating the star formation rate . . . in the early universe and compare it to the values [today]."

If astronomers hope to use Hubble's near-infrared camera to do so, they'll have to hurry. The camera is expected to run out of coolant and cease operation in December. —*R. Cowen*



Weymann *et al.*

Images of the galaxy HDF 4-473.0 (arrows) recorded at wavelengths of 814 nm, 1,100 nm, and 1,600 nm (left to right).

Ant queens with wrong genes lose heads

After more than 20 years of debate and not much data, researchers may finally have found an example of what has been colorfully referred to as a green-beard gene. The discovery was made in fire ants, who attack and rip to pieces some of their own queens.

Ants bearing the gene do not really sprout emerald goatees, although codiscoverer Laurent Keller of the University of Lausanne in Switzerland admits that in moments of enthusiasm he has included a colored tuft on a lecture slide.

Exactly what the gene does is not clear, but it creates some recognizable physical sign, perhaps an odor, say Keller and Kenneth G. Ross of the University of Georgia in Athens. Whatever the cue, ants seem able to tell which variation of the gene their queens carry.

The gene under study comes in two forms, or alleles, that the researchers label B and b. All ants carry two copies of the gene, and any queen with the BB combination gets mobbed and killed just before she's ready to start laying eggs, Keller and Ross report in the August 6 NATURE. That slaughter makes the b allele more likely to continue into the next generation; any queen who lives long enough to lay an egg must carry at least one copy.

After examining more than 2,500 mature egg-laying females in wild multi-queen colonies, Ross reports finding no BB's.

Another oddity ensures that the b allele doesn't ultimately replace B, however. Ants with the bb configuration, whether workers or queens, die early in life. Researchers don't know why.

The queen-killing behavior fits a view of genes as selfish, the molecular equivalents of gangsters who hustle to get the biggest advantage. One of the creators of this view, W.D. Hamilton, suggested that such rough-and-tumble genetic shenanigans could in theory lead to an extreme case: A certain allele could allow bearers to recognize and favor each other. Theorist Richard Dawkins of the University of Oxford in England whimsically imagined an allele for green beards that prompts partisanship among the similarly endowed.

To test for a green-beard effect among red fire ants, Keller and Ross introduced young queens into colonies. The Bb queens survived, but the workers ganged up to kill 90 percent of BB queens. The aggressive ants grabbed the BB queens by the legs and antennae and pulled, bit, and stung. "It takes about 5 or 10 minutes until they cut the queen in two pieces," Keller says.

The cue for such attacks might be a transferable odor, the researchers speculate. Ant workers who had been rubbed against BB queens in the laboratory got attacked themselves, sometimes fatally. Perhaps that transferable substance could lead to a control for fire ants, Keller speculates.

Kristin Ardlie of the Whitehead/MIT Center for Genome Research in Cambridge, Mass., hesitates to label the behavior as altruistic cooperation among trait bearers. However, she finds the example "extraordinary." The intrinsic lethality of the bb combination ought to eliminate the allele, she points out, but the genetically linked aggression is "keeping a bad gene in the population." —*S. Milius*

USDA

A red fire ant may provide the first example of a long-sought type of gene.