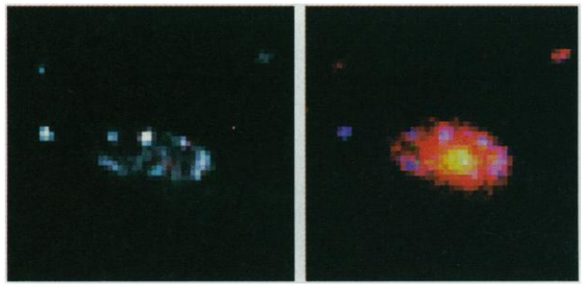
ASTRONOMY

Seeing the Universe's Red Dawn

Hidden in a corner of the nondescript patch of sky called the Hubble Deep Field, astronomers have found what may be the farthest and oldest galaxies ever seen. So distant that the expansion of the universe has stretched their light all the way into the infrared region of the spectrum, they may have formed just a few hundred million years after the universe itself. If the universe was born 13 billion years ago, they are probably 12.3 billion years old.

The discovery, announced last week at a NASA press conference, is a follow-up to the original Deep Field exposure by the Hubble Space Telescope (HST) in 1996. In an exposure lasting 10 days, the HST soaked up light from that patch of sky, revealing a swarm of blue, silver, and gold galaxies 11.7 billion years old. Those galaxies originally shone brightly in ultraviolet light because of the hot young stars populating them, but the expansion of the universe has "reddened" the ultraviolet into visible wavelengths. Even more distant galaxies, reddened all the way to the infrared, would have eluded the original Deep Field observation.



Rosy picture. A distant galaxy that looks fragmentary in visible light *(left)* fills out when seen in infrared light *(right)*.

Last January, Rodger Thompson of the Steward Observatory at the University of Arizona, Tucson, and his team went looking for those galaxies by aiming HST's infrared camera, called NICMOS, at one-eighth of the Deep Field for 36 hours. In a corner of the Deep Field that held more than 300 galaxies in visible light, NICMOS found 100 more. The light from most of those appeared to have been reddened by dust, not great distance, but the light of 10 of the dimmest ones seemed to have been stretched all the way from ultraviolet to infrared, giving them redshifts of 5.0 to 7.0. That would make them the oldest, farthest objects known. "What we see may be the first stage of galaxies in formation," said Alan Dressler, an astronomer at the Observatories of the Carnegie Institution in Pasadena.

"Next, we have to sort them out and find out what they are," said Thompson—"how similar these are to everyday galaxies." For now, these 10 ancient objects are too dim for anyone to see their shapes, estimate how quickly they're forming stars, pinpoint their distance, or even decide whether they're small galaxies or pieces of galaxies. One of them, Thompson thinks, looks a little like an edge-on spiral galaxy and another like a small elliptical. But their identities won't be certain until they're observed with HST's successor, the Next Generation Space Telescope, to be launched in 2007.

NICMOS did reveal details about other galaxies—ones that were seen in the original Deep Field, where they looked, says Thompson, like blue "jumbled-up bunches of things." These jumbles, which some astronomers had speculated might be pieces of galaxies in the process of merging, turned out to be brilliant knots of new stars forming among older, redder stars of fully formed spiral galaxies. "The [early] universe was better organized than we thought," says Dressler. Next, theorists have to figure out how the universe managed to organize itself into galaxies in only a few hundred million years.

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AGRICULTURE RESEARCH

1999 Budget: One Step Forward, Two Back

Last week was a bittersweet moment for agricultural researchers in the United States, as Congress finally agreed on a 1999 budget for the U.S. Department of Agriculture (USDA). The good news is that the bill provides a 23% jump in funding for the department's centerpiece competitive research program, the National Research Initiative (NRI). But the bad news is that Congress killed funding for a major new research initiative and axed a smaller research program focused on rural communities to help pay for NRI's increase. "Every little bit helps," says Louis Sherman, a plant molecular biologist at Purdue University in West Lafayette, Indiana. "But we're disappointed that the funding for the [new research] initiative was not appropriated."

Last June, Congress raised the hopes of plant and animal scientists by approving a $600 million, 5-year program that would support agricultural genomics, nutrition, food safety, biotechnology, and natural resources management (*Science*, 3 April, p. 23). The bill's sponsors and researchers saw the Initiative for Future Agriculture and Food Systems as a way to revolutionize agricultural research with large grants to multi-institution collaborations attacking major problems. Researchers also welcomed a move by the Senate to double the research component of the department's $100-million-a-year Fund for Rural America, now in its second year. That program supports work on animal waste management, alternative fuels, and other subjects important to rural communities.

But when it came time to pay for these ventures, Congress balked. A panel of conferees from the House and Senate cut both research programs and shifted some of the funds into other activities. Instead of the $120 million that the Senate had recommended for the futures' initiative, the conferees upped NRI's budget from $97 million to $119 million. The Agricultural Research Service, which supports USDA scientists, received an additional $26 million, to $782 million, and the $222 million in formula funds allotted to states was increased by 7% instead of the Administration's 3% request. But Terry Nipp, a lobbyist for directors of agricultural experiment stations and extension programs, says that "[the additions] in no way get close to the money we lost. We're deeply disappointed."

The increase for NRI is, at least, welcome news for a program whose budget has been stuck at its initial level of $100 million a year for 7 years—even though Congress itself had once agreed that it should grow to $500 million. That steady state has prevented NRI from making the type of larger, multidisciplinary awards now standard for many cutting-edge research projects or for using the latest molecular techniques in plant and animal science.

Even NRI's new budget falls well short of President Clinton's request for $130 million, however, and the increase is not spread evenly across the program. The funding bill doubles NRI's spending for food safety research,

Counting chickens. Researchers hoping for a new ag initiative must make do with more money in existing programs.

CREDITS: (TOP) RODGER I. THOMPSON/UNIVERSITY OF ARIZONA/NASA; (BOTTOM) BRUCE FRITZ