

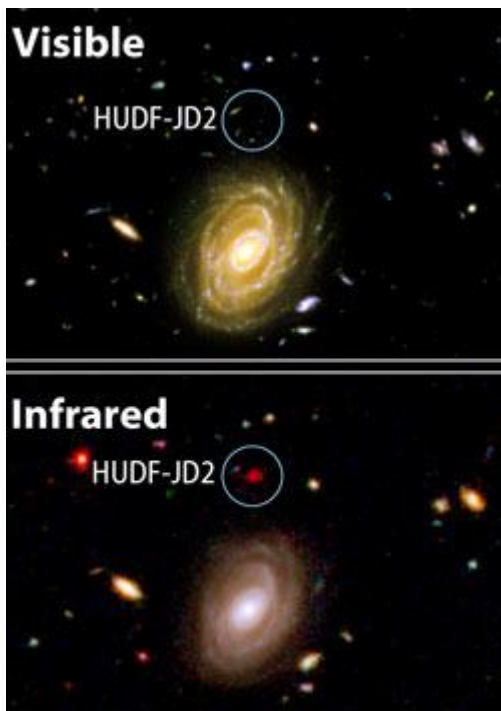
## The Hubble Ultra Deep Field seems to have a lot of dark areas in it. With a more powerful telescope, will we find galaxies in them?

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**A**stronomers believe there are many more galaxies to be found within the Hubble Ultra Deep Field, a patch of sky in the constellation Fornax where the Hubble Space Telescope acquired the most penetrating views of the cosmos at visible and near-infrared wavelengths. Unfortunately, the light from more distant galaxies is so redshifted Hubble cannot detect it.

"With the HUDF, we have reached redshifts of 6.7, about 800 million years after the Big Bang," says Sangeeta Malhotra, an astronomer at the Space Telescope Science Institute in Baltimore and lead investigator of two HUDF observing programs. One, called GRAPES (for Grism ACS Program for Extragalactic Science), captured detailed spectra of faint galaxies, allowing direct measurements of their distances (refer to "As far as Hubble can see," November 2005).

"Unfortunately," she says, "this is nearly the limit of what we can do with the current instrument on Hubble. Higher redshift galaxies are even redder, and we need infrared instruments to observe them."



HUDF-JD2, a massive galaxy discovered in the Hubble Ultra Deep Field, formed in the universe's first 800 million years. There's no trace of the galaxy (circled) in the Hubble Space Telescope's deepest optical-wavelength views, but HUDF-JD2 appears faintly in near-infrared exposures. NASA / ESA / STScI / B. Mobasher [\[larger image\]](#)

The Hubble Space Telescope will be able to look deeper if NASA decides to go forward with a final servicing mission to upgrade it. One instrument slated to be installed is the Wide-Field Planetary Camera 3. According to Malhotra, the device will see far enough into the infrared to give astronomers access to galaxies at redshift 14, or some 300 million years after the Big Bang.

Last September, astronomers came across proof much was going on at this early epoch. A team led by Braham Mobasher of Baltimore's Space Telescope Science Institute and the European Space Agency uncovered a previously unidentified galaxy in near-infrared HUDF exposures.

The galaxy, called HUDF-JD2, contains some 8 times the Milky Way's mass of stars. This challenges the view that all large galaxies were built up gobbling up smaller ones.

What's truly unusual, the team says, is that most of its stars are old and evolved. This means HUDF-JD2

formed rapidly, blazed forth with a massive pulse of star formation, and then, just as fast, shut down

its star-making factories. The galaxy managed to do all this, the astronomers say, before the universe was about 800 million years old.

The team estimates HUDF-JD2's distance is between redshifts 6 and 7.5 but concedes current facilities won't be able to nail this down more precisely.

— **FRANCIS REDDY**, ASSOCIATE EDITOR