

# Approaching the Edge of Space & Time

Hubble's latest image provides a view of the early universe, when the first galaxies were coming together.

by Robert Naeye

Every week or two it seems scientists release another breathtaking image from the Hubble Space Telescope. This latest Hubble photo is in many respects the most spectacular one yet. It provides a look deeper into space, and thus further back in time, than any photograph ever taken. It gives us a snapshot of the universe when it was less than 1 billion years old. We're looking across 10 to 20 billion light-years of space, and 10 to 20 billion years of time.

The image captures 1,500 to 2,000 galaxies at various stages of evolution. We see the faintest galaxies, unassuming red smudges, as they existed less than 1 billion years after the big bang. "The variety of galaxies we see in the early universe is amazing. There are large ones and small ones, red ones and blue ones, very structured ones and also very amorphous ones," says Robert Williams, director of the Space Telescope Science Institute in Baltimore,

Maryland. "We are clearly seeing some of these galaxies as they were more than 10 billion years ago, in the process of formation. As the images have come up on our screens, we

have not been able to keep from wondering if we might somehow be seeing our own origins in all of this. This has been an unbelievable experience."

The dimmest objects are nearly 30th magnitude, which is how bright the glow of a cigar would appear from the Moon. To capture objects this faint, Hubble had to stare at a tiny spot in space for 10 consecutive days, over 150 Earth orbits. These 10 straight days of observing time were broken into 342 exposures, lasting 15 to 40 minutes each. Separate images were taken in ultraviolet, blue, red, and infrared light and then combined into a single color picture. Astronomers can infer the galaxies' distances, ages, and compositions based on their color.

Hubble beamed this image to scientists this past December, so scientific analysis has just begun. Astronomers expect the photo to help answer questions about how soon after the big bang galaxies first appeared, and how galaxies evolved over the lifetime of the universe.

The image will answer questions about the universe's destiny as well as its past. By carefully measuring the sizes and brightnesses of the distant galaxies, and comparing them to nearby galaxies, astronomers will be able to determine how much space-time is curved. This in turn will tell them whether the universe is destined to expand forever, or whether it will collapse back upon itself in a fiery death some unimaginable time in the future. □



Robert Williams and the Hubble Deep Field Team (STScI) and NASA

**DEEEEEEP GALAXIES.** The faintest smudges represent galaxies that formed less than 1 billion years after the big bang, eons before our solar system was born. This field covers a patch of sky the width of a dime 75 feet away.

**A LOOK THROUGH TIME.** In this enlarged detail, blue objects tend to be close, while the red objects tend to be farther away. The most distant galaxies will help astronomers unlock the secrets of galaxy formation.

