

# Galaxy History Revealed in This Colorful Hubble View (w/ Video)

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Credit: NASA, ESA, R. Windhorst, S. Cohen, M. Mechtley, and M. Rutkowski (Arizona State University, Tempe), R. O'Connell (University of Virginia), P. McCarthy (Carnegie Observatories), N. Hathi (University of California, Riverside), R. Ryan (University of California, Davis), H. Yan (Ohio State University), and A. Koekemoer (Space Telescope Science Institute)

(PhysOrg.com) -- More than 12 billion years of cosmic history are shown in this unprecedented, panoramic, full-color view of thousands of galaxies in various stages of assembly.

This image, taken by NASA's [Hubble Space Telescope](#), was made from mosaics taken in September and October 2009 with the newly installed [Wide Field Camera 3 \(WFC3\)](#) and in 2004 with the Advanced Camera for Surveys (ACS). The view covers a portion of the southern field of a large galaxy census called the Great Observatories Origins Deep Survey (GOODS), a deep-sky study by several observatories to trace the formation and evolution of [galaxies](#).

The final image combines a broad range of colors, from the ultraviolet, through visible light, and into the near-infrared. Such a detailed multi-color view of the universe has never before been assembled in such a combination of color, clarity, accuracy, and depth.

Hubble's sharp resolution and new color versatility, produced by combining data from the two cameras, are allowing astronomers to sort out the various stages of [galaxy formation](#). The image reveals galaxy shapes that appear increasingly chaotic at each earlier epoch, as galaxies grew through accretion, collisions, and mergers. The galaxies range from the mature spirals and ellipticals in the foreground, to smaller, fainter, irregularly shaped galaxies, most of which are farther away, and therefore existed farther back in time. These smaller galaxies are considered the building blocks of the larger galaxies we see today.

Astronomers are using this multi-color panorama to trace many details of galaxy assembly over cosmic time, including the [star-formation](#) rate in galaxies, the rate of mergers among galaxies, and the abundance of weak [active galactic nuclei](#).

The image shows a rich tapestry of 7,500 galaxies stretching back through most of the universe's history. The closest galaxies seen in the foreground emitted their observed light about a billion years ago. The farthest galaxies, a few of the very faint red specks, are seen as they appeared more than 13 billion years ago, or roughly 650 million years after the Big Bang. This mosaic spans a slice of space that is equal to about a third of the diameter of the full Moon (10 arcminutes).

The new Hubble view highlights a wide variety of stages in the galaxy assembly process. Ultraviolet light taken by WFC3 shows the blue glow of hot, young stars in galaxies teeming with star birth. The orange light reveals the final buildup of massive galaxies about 8 billion to 10 billion years ago. The near-infrared light displays the red glow of very distant

galaxies — in a few cases as far as 12 billion to 13 billion light-years away — whose light has been stretched, like a toy Slinky, from ultraviolet light to longer-wavelength infrared light due to the expansion of the universe.



Location of GOODS-S/ERS in the Sky

In this ambitious use of Hubble's observing time, astronomers used 96 Hubble orbits to make the ACS optical observations of this slice of the GOODS field and 104 orbits to make the WFC3 ultraviolet and near-infrared exposures. WFC3 peered deeper into the universe in this study than comparable near-infrared observations from ground-based telescopes. This set of unique new Hubble observations reveals galaxies to about 27th magnitude in brightness over a factor of 10 in wavelength. That's over 250 million times fainter than the unaided eye can see in visual light from a dark ground-based site.

Provided by ESA/Hubble Information Centre

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