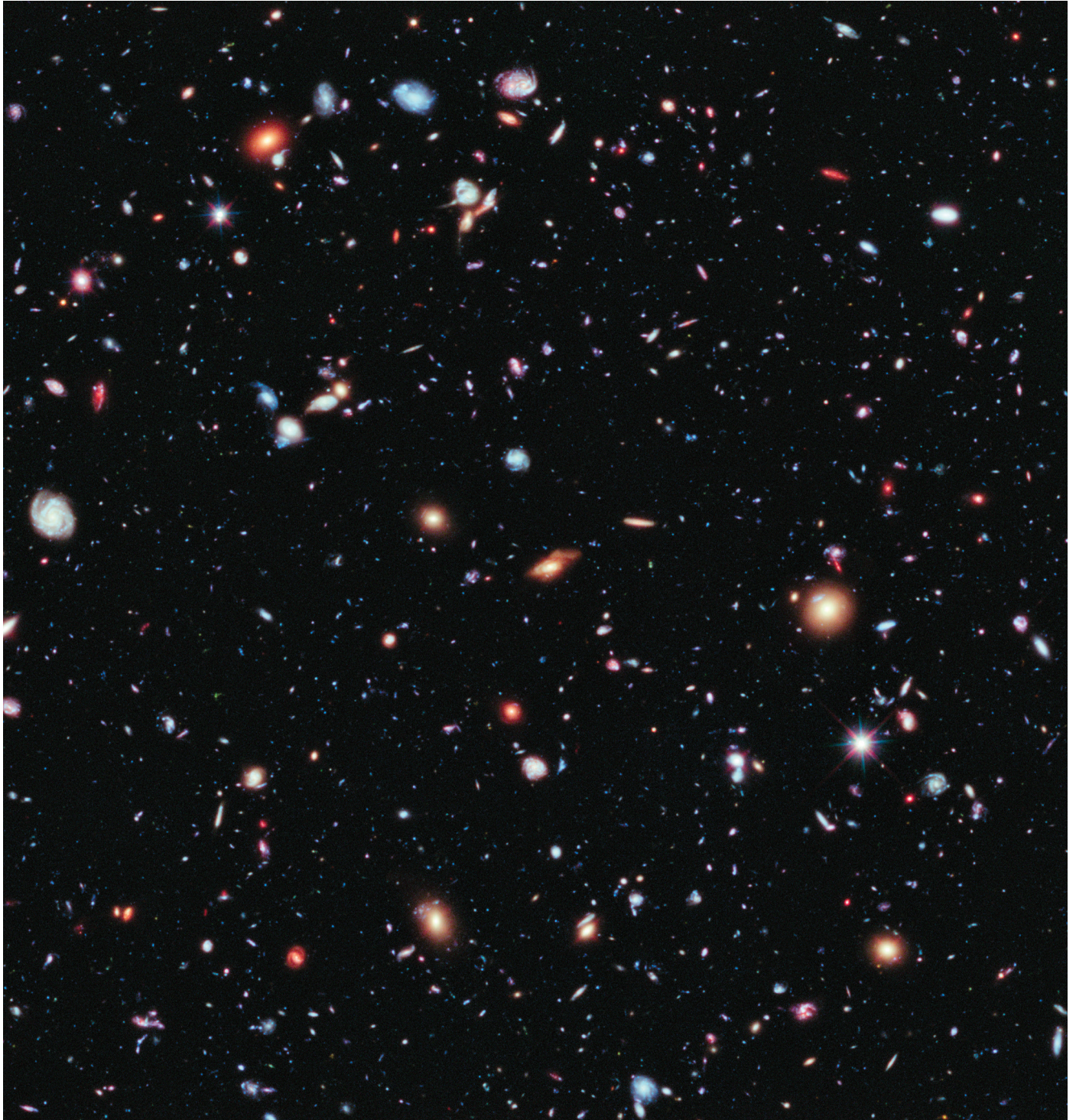
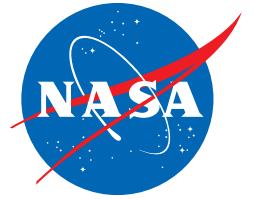


# eXtreme Deep Field

National Aeronautics and  
Space Administration



# Hubble Goes to the eXtreme

Sifting through 10 years' worth of Hubble Space Telescope images of the same patch of sky, astronomers have produced one of the deepest portraits of the universe.

Called the eXtreme Deep Field, or XDF, the image shows a small region at the center of the original Hubble Ultra Deep Field (HUDF), located in the constellation Fornax. Unveiled in 2004, the HUDF image represented the deepest view of the visible universe at that time.

The XDF image reveals much fainter galaxies than the HUDF portrait, and includes very deep observations from Hubble's infrared camera, taken in 2009 and 2012. The XDF contains about 7,100 galaxies, including some of the earliest galaxies in the universe.

Magnificent spiral galaxies similar in shape to our Milky Way and the neighboring Andromeda galaxy appear in this image, as do elliptical galaxies — the large, fuzzy, red galaxies, where the formation of new stars has ceased. These red galaxies are the remnants of dramatic collisions between galaxies and are in their declining years. Peppered across the image are tiny, faint, irregularly shaped, more distant galaxies that were like the seedlings from which today's striking galaxies grew. The history of galaxies — from soon after the first galaxies were born to the great elliptical and spiral galaxies of today — is laid out in this one remarkable image.

The universe is 13.7 billion years old, and the XDF reveals galaxies that span back 13.2 billion years in time. Most of the galaxies in the XDF are seen when they were young, small, and growing, often violently as they collided and merged together. The early universe was a time of dramatic birth for galaxies, which contain brilliant blue stars that are extraordinarily brighter than our Sun. The light from those past events is just arriving at Earth now, and so the XDF is a time tunnel into

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You can get images and news about the Hubble Space Telescope on our website, [hubblesite.org](http://hubblesite.org). For images and information on the Hubble mission, go to [www.nasa.gov/hubble](http://www.nasa.gov/hubble). Follow the Hubble mission on social media: [@NASAHubble](https://twitter.com/NASAHubble).

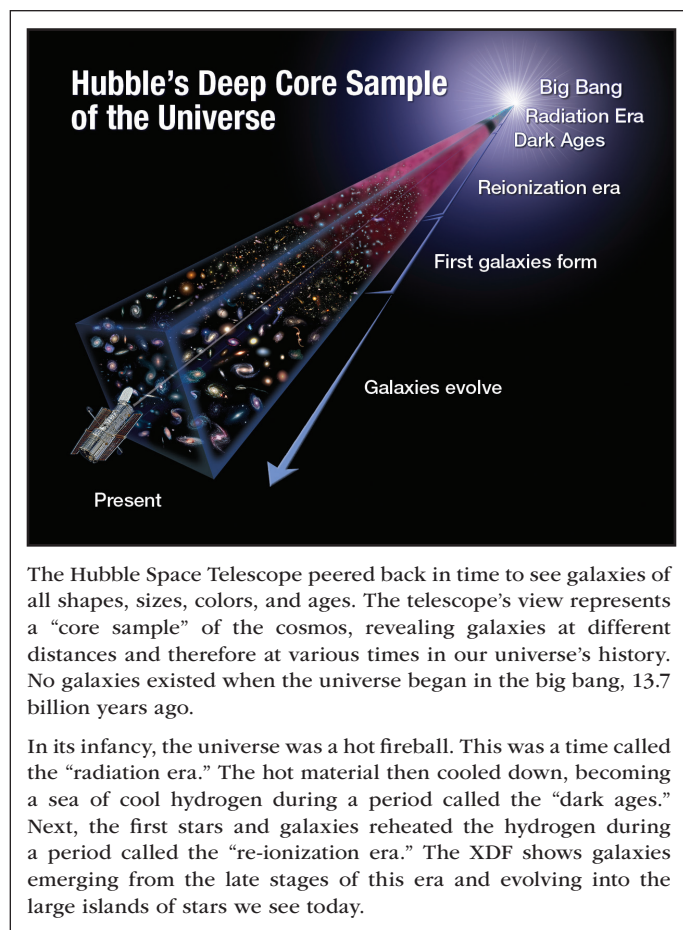
For education activities, go to the Amazing Space website at [amazingspace.org](http://amazingspace.org).

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The Hubble Space Telescope peered back in time to see galaxies of all shapes, sizes, colors, and ages. The telescope's view represents a "core sample" of the cosmos, revealing galaxies at different distances and therefore at various times in our universe's history. No galaxies existed when the universe began in the big bang, 13.7 billion years ago.

In its infancy, the universe was a hot fireball. This was a time called the "radiation era." The hot material then cooled down, becoming a sea of cool hydrogen during a period called the "dark ages." Next, the first stars and galaxies reheated the hydrogen during a period called the "re-ionization era." The XDF shows galaxies emerging from the late stages of this era and evolving into the large islands of stars we see today.

the distant past. The youngest galaxy found in the XDF existed just 450 million years after the universe's birth in the big bang.

Hubble pointed at this tiny patch of southern sky in numerous repeat visits (made over the past decade) for a total of 50 days. The telescope's two premier cameras, the Advanced Camera for Surveys (ACS) and the Wide Field Camera 3 (WFC3), took more than 2,900 images of the same field. The exposure time totaled nearly 2 million seconds. WFC3 extends Hubble's vision into near-infrared light. These images of the original HUDF were combined to make the XDF portrait.

*Image Credit: NASA, ESA, G. Illingworth, D. Magee, and P. Oesch (University of California, Santa Cruz), R. Bouwens (Leiden University), and the XDF Team*

## VOCABULARY

**Galaxy:** A large collection of stars, gas, and dust held together by gravity.



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