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FINDING THE ASHES OF THE FIRST STARS

Hubble zooms on the sky (0:39)

A new observation by the Earth-orbiting NASA/ESA Hubble Space Telescope has profound implications for the understanding of the earliest years of our Universe.

A team led by the astronomer Wolfram Freudling has revealed that the first stars in the Universe were formed only 200 million years after the Big Bang. Several hundred million years earlier than previously thought.

The team used Hubble's infrared instrument NICMOS to observe light from some of the most distant, exotic and ultra-luminous sources known to mankind: quasi-stellar objects, sometimes known as quasars.

Hubble's position above the atmosphere allows it to observe infrared light normally obscured by the Earth's atmosphere and unavailable to Earth-bound telescopes.

Animation: From first stars to the quasars (0:42)

Information about the very first generation of stars has been one of the Universe's best-kept secrets. When the first stars ended their lives as supernovae, the explosions spread their 'ashes' out into space. These ashes contained heavier elements such as oxygen, carbon, silicon and iron processed in the nuclear furnaces at the stars' centres.

The astronomers used Hubble to discover substantial fractions of iron in three quasars. This is the first time that elements created purely by the first generation of stars have been found. The light from the quasars has travelled for 12.8 billion years before reaching Hubble and had left the quasars only 900 million years after the Big Bang.

Interview with scientist Wolfram Freudling (European Southern Observatory) (0:44)

Freudling: "Iron is a good indicator of the evolutionary state of a quasar. This element is not created during the Big Bang, but in stars. These have to form, burn their fuel and

explode before iron can be detected. This process takes times, up to 500 or 800 million years. This is the reason why we believe that the iron we detected with Hubble was created in the very first generation of stars which formed soon after Big Bang."

"We have had clues and theories about what happens in the early Universe before these observations. But this is the first time that we actually detect elements that we believe were created in the very first generation of stars. It is like holding the ashes of these stars in our hands."

Animation: The revised history of the Universe (0:48)

This new result allows astronomers to construct a revised timescale for the history of the Universe.

13.7 billion years ago the Universe is created in the Big Bang - a cataclysmic hot explosion-like event initially composed almost entirely of hydrogen and helium.

As the gas cools the Universe becomes transparent and the gas starts to clump together.

After 200 million years the first generation of stars.

500 to 800 million years after their creation these first stars explode as supernovae, dispersing elements as iron and other elements into the surroundings.

These new observations also suggest that the first stars formed before the super-massive black holes that power the quasar engines in the centres of galaxies.

Astronauts repairing Hubble's NICMOS camera during Servicing Mission 3B in 2002 (0:23)

This is the first major scientific result to emerge from the NICMOS instrument that was repaired during the last Hubble Servicing Mission in 2002. This Servicing Mission was the last successful mission of the Space Shuttle Columbia that was lost on 1 February 2003. The scientists respectfully dedicate this discovery to the memory of the crew of the Space Shuttle Columbia.

Shotlist

TIMECODE	DESCRIPTION
	A-ROLL
10:00:40	Hubble zooms on the sky: 1. sky map showing the stars as seen by the naked eye (data from ESA's Hipparcos satellite) 2. 1.67 degree image from Digitized Sky Survey 2 3. The Hubble Space Telescope image (NICMOS camera)
10:01:19	Animation: From stars to quasars
10:02:01	Interview 1 Wolfram Freudling (European Southern Observatory): About the significance of finding iron in very distant galaxies in the early Universe.
10:02:33	Interview 2 Wolfram Freudling (European Southern Observatory): About being the first to find elements created in the first generation of stars.
10:02:45	Animation: The revised history of the Universe
10:03:33	Astronauts repairing Hubble's NICMOS camera during Servicing Mission 3B
10:03:56	END A-ROLL
	B-ROLL
10:04:04	A-roll animations: • Hubble zooms on sky • From stars to quasars • Scientist interview 1 • Scientist interview 2 • Repair of the NICMOS camera
10:07:18	Stock footage of the NASA/ESA Hubble Space Telescope
10:10:51	END B-ROLL

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