Galaxies in the young cosmos

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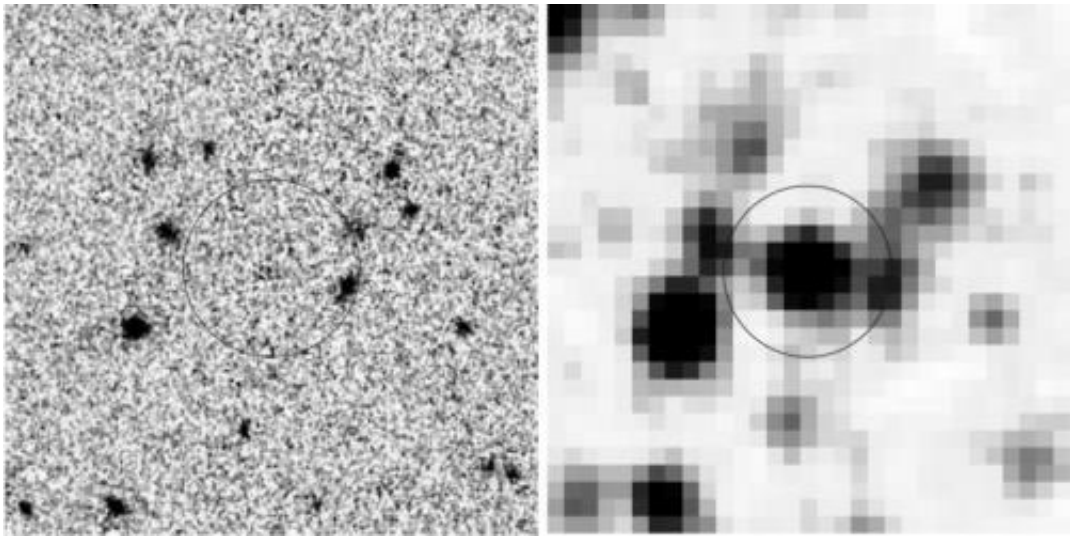

Now you don't see it; now you do - the image of a galaxy from a time when the universe was only a billion years old. The left image, from Hubble, sees nothing in the sky, but the longer wavelength infrared image from Spitzer (right) sees a bright source. The intense star formation activity in the galaxy, its distance, and the expansion of the universe combine to make it appear in the infrared. Credit: K. Caputi

(Phys.org) -- The universe was born about 13.7 billion years ago in the big bang. The Sun and its system of planets formed about five billion years ago. What happened, then, during that long, intervening stretch of nearly nine billion years? This is one of the key questions in modern science. Astronomers think that the very first stars and galaxies appeared only a few hundreds of millions of years after the big bang, and have been evolving ever since. They must have been quite different from the

stars and galaxies of today, however, in part because the young universe lacked most of the chemical elements present today - those elements were made gradually in the nuclear furnaces of those stars.

Modern telescopes and infrared and submillimeter techniques have recently enabled astronomers to spot significant numbers of very distant galaxies and begin to piece together a picture of cosmic evolution. Galaxies often undergo bursts of star formation that make their dust glow in the infrared. In fact, recent results suggest that at some cosmic epochs star formation was as much as ten times more active than it is today. The power of infrared is twofold: It can measure the luminous dust, and, because cosmic expansion shifts starlight into the infrared, it can also see spectral features in that starlight that allow an estimate of the cosmic distance.

Sensitive infrared cameras staring over large fields of view are the best way to find large numbers of very distant objects for analyses SAO astronomers Jia-Sheng Huang, Giovanni Fazio, and Matt Ashby, together with a team of colleagues, used the infrared camera on the Spitzer Space Telescope to undertake a very deep and sensitive search for distant infrared galaxies in an area of the sky one twentieth the size of the full moon. They coordinated their study with infrared images from Hubble.

The scientists discovered twenty five peculiar infrared objects in their field. Follow-up analyses revealed that between eleven and nineteen of them date to cosmic epochs from 1.5 to 3 billion years after the big bang. These galaxies seem to be very massive and to contain significant amounts of warm dust. Two other sources just as massive seem to be even older, dating from a period only one billion years after the big bang. The latter present a serious challenge to current theories about galaxy evolution, which predict very few such objects should exist at such an early time. The new survey is significant not only because it has discovered such distant galaxies, but also because it points to a

previously unrecognized galaxy population whose properties are significantly different from those of known galaxies at similar epochs.

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