Researcher peers into universe's ancient past to better know how stars form

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(PhysOrg.com) -- It takes light from our closest star, the Sun, about eight minutes to reach Earth. But light that leaves stars in distant galaxies takes a lot more time to reach our planet — billions of years more.

Greg Rudnick, assistant professor of physics at the University of Kansas, is observing one of the earliest known clusters of galaxies, which is 10 billion light years away. Because of this "trick" of nature, he is getting a snapshot of the universe when it was 10 billion years younger than it is today, or only about 4 billion years after the Big Bang. For the KU researcher, this period is vital because it saw the highest pace of star formation in forming galaxies.

"If we look at galaxies that are 9 or 10 billion light years away, we're seeing them when the universe was only 20 or 30 percent of its current age," said Rudnick. "We're literally looking back in time. So we can look at galaxies back then and measure how many stars were in each of them — and see that galaxies back then were forming stars at a much higher rate."

Rudnick makes his observations using the Expanded Very Large Array — a vast radio astronomy observatory in New Mexico. The EVLA, consisting of 27 82-foot diameter antennas, was made famous in the movie "Contact."

The radio telescope array will allow Rudnick to gauge the abundance of molecular gasses present in a cluster of seven galaxies. "Stars form from

clouds of molecular gas. So measuring how much molecular gas there is tells us what the fuel supply for star formation was in young galaxies," Rudnick said.

He will conduct some of the deepest-ever observations of carbon monoxide gas in the distant universe. Carbon dioxide is an easy-to-detect molecule that is a telltale sign of molecular hydrogen, the chief building block of new stars.

"We want to measure how much gas there is," said Rudnick. "We want to measure how long that fuel supply will last given the rate in which it's forming new stars. Is the gas enough to supply it for a long time, or is it about to shut off? By looking at the motion of these gas molecules, we can figure how fast the gas in the galaxy is moving around, and that in turn will tell us how much total mass there is in the galaxy."

Because many galaxies are in a small area of the sky, Rudnick can observe multiple objects at once, which make his observations especially efficient. The observation of the distant galaxy cluster will break new ground in understanding how the fueling of star formation is altered when many galaxies are bound to each other by their mutual gravitational force.

"The prediction of galaxy formation models is that the gas supply of galaxies is cut off when they fall into these clusters. These observations will give us the first test of this in the distant universe," said Rudnick.

Provided by University of Kansas