

Galaxy in the early universe contains carbon after all

July 2 2018



Credit: ESO/M. Kornmesser

In 2015, Jorryt Matthee thought he discovered an extremely distant galaxy called CR7, which lacked elements heavier than helium. Three years later, he shows with measurements using the ALMA telescope that the galaxy does have carbon after all, and even in normal concentrations. The American Astronomical Society recently paid attention to Matthee's research.

During their earlier research in 2015, Matthee and his colleagues speculated that they – for the first time – had discovered a galaxy with stars from the first generation: very heavy and hot stars that do not

contain [heavy elements](#), but only consist of helium and hydrogen. First-generation stars are sought after, because they provide insights in how stars formed after the Big Bang. In addition, they were the first objects that enriched the universe with heavy elements such as carbon, oxygen and nitrogen. Matthee's new research now shows that the galaxy CR7 does contain heavy elements.

In 2015, Matthee and his colleagues used the Very Large Telescope (VLT) in Chili, that measures in the spectrum of visible light. He performed his new research with the ALMA [telescope](#) in Chili, that measures microwaves – radiation that is comparable with the waves with which a microwave oven heats food. "With the ALMA telescope we observed the same galaxy in a different way. ALMA looks at the gas that is situated between the stars, instead of directly at the light of stars. In this gas we found carbon."

"We see the galaxy at a distance of 13 billion light-years. That means that we look back 13 billion years in time," Matthee explains. "At that moment, the universe is 700 million years old. That's the time when the first bigger [galaxies](#) start to form." In order to look back so many years, the measuring techniques are extremely important. "The VLT measures from Earth, so you always have noise from our atmosphere. Measuring from space is ideal, because you do not suffer from the atmosphere. Therefore, astronomers are looking forward to the James Webb Space Telescope – the most advanced space telescope ever – which will be launched within a few years.

This research is a clear example of how science works in practice. Discoveries are not always hard facts that are fixed forever, but can be falsified with new data. "Sometimes we can learn more from a falsification than from a confirmation," says Matthee. "In order to find first-generation stars, we will have to investigate galaxies that are even further away than CR7 in detail. We already knew what signals of the

first [stars](#) we had to look for, but now we have also learned which signals should not be visible."

The abbreviation CR7 reminds many football fans of a different kind of star, namely the Portuguese footballer Cristiano Ronaldo. But according to Matthee, CR7 does not stand for the footballer, but for the 'zip code' of the galaxy in the universe. "COSMOS is the area in the sky where it is situated and Redshift 7 is a measure of the distance," he smiles. Incidentally, it is striking that the colleague with whom Matthee discovered the star system, David Sobral, comes from Portugal, just like Ronaldo.

Provided by Leiden University

Citation: Galaxy in the early universe contains carbon after all (2018, July 2) retrieved 6 May 2024 from <https://phys.org/news/2018-07-galaxy-early-universe-carbon.html>

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