First images of mist dispersing around young galaxy

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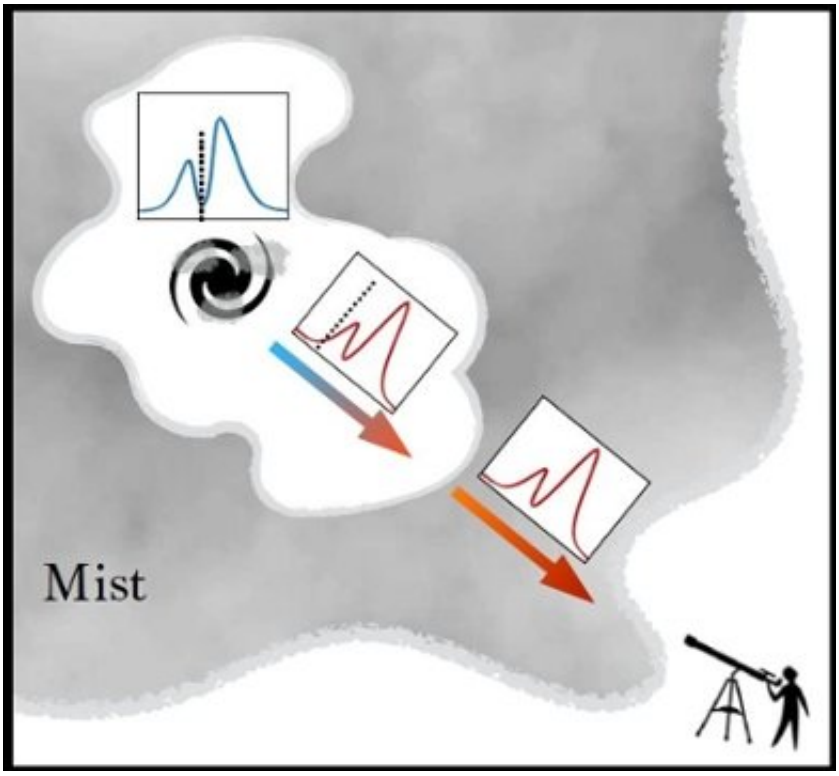


Observation of galaxy COLA1 shows two peaks in the graph for Lyman-alpha radiation (red graph). This indicates the dissipating mist. Credit: Leiden University

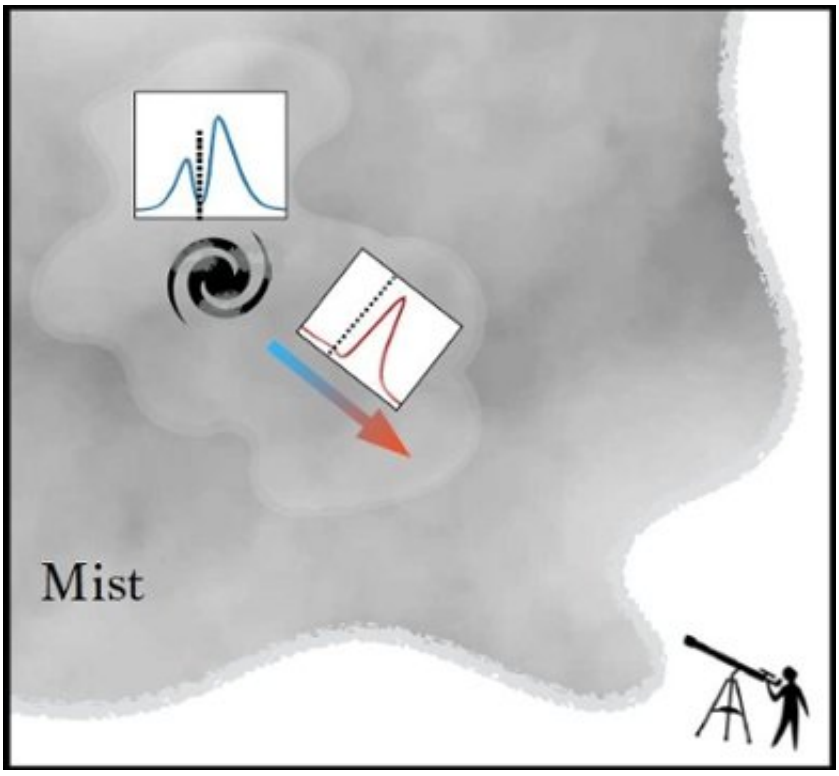
Galaxies in the early universe are shrouded in a kind of mist: a cloud of hydrogen. With galaxies in the later universe this mist has disappeared. Astronomer Jorryt Matthee has made the first images of this dissipating

mist. Ph.D. defence 19 September.

It is an interesting phenomenon: if we look at stars that are a long way off, we are in fact looking back in time. The light from these stars has taken so long to reach us that what we are seeing is actually in the past. 'That's why studying distant galaxies can teach us about the origin of our own galaxy,' Jorryt Matthee explains. For his Ph.D. research he is therefore looking more deeply into these distant galaxies.

Astronomers have thought for a long time that when galaxies are formed they are surrounded by a ring of hydrogen gas, a kind of mist that was present throughout the early universe.' In the later universe, when galaxies are generally older, we no longer see this mist; it has dispersed,' Matthee tells us. But so far there have been no direct images showing that mist dissipating.'

Matthee observed a very distant galaxy—COLA1. 'We didn't choose that name; it was the research group from Hawaii that discovered the galaxy,' he laughed. And this very bright galaxy shows us something very special: the hydrogen cloud was still visible, but some parts of it had disappeared. 'What we were seeing were the first images of the mist dispersing. That means that we can now start to explore what's behind this process.'



Observations of other galaxies - mainly shrouded in mist - show only one peak can be seen in the Lyman-alpha radiation (the red graph). Credit: Leiden University

An image of a galaxy shrouded in mist is very different from what you might think. Matthee: 'When we look at a galaxy with a telescope—in this case the Very Large Telescope in Chile – we are looking at the spectrum of light that it emits. The image is actually a graph with different lines for the different colours of the light.' A specific characteristic of the galaxy can be deduced from each colour. Matthee was able to determine the presence of the mist, the cloud of hydrogen, from the graph of the so-called Lyman-alpha radiation. The COLA1 galaxy showed not one, but two peaks in the graph, while for a galaxy where the mist is still largely present only one peak is visible (see the illustrations).

The mist acts as a kind of nursery for young galaxies: it provides the optimum conditions for galaxies to form. If the mist around our Milky Way galaxy had remained, we would now have been able to see many more small satellite galaxies in the skies, like the Magellanic clouds. They would have continued to form all around us.'

COLA1 is not the only distant galaxy that Matthee and his team have studied. In 2015 they discovered an interesting distant galaxy,CR7. This is an unusual galaxy that does not seem to contain any elements heavier than helium. Astronomers have been looking for these kinds of 'first-generation' galaxies for decades. Further studies have shown that the original assumption was wrong and that CR7 also contains a lot of carbon. 'That's a clear demonstration that scientific research is a continuous process, and that findings are not always hard facts.' Did Matthee look for signs of dispersing mist around his own CR7? 'CR7 does seem to be surrounded by some mist. Less than around most galaxies in the early universe, but more than COLA1. It is important for future research to find out how these differences come about.'

Provided by Leiden University

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