

'Green peas' provide clues to the early days of the universe

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This is a long-exposure image from NASA's Hubble Space Telescope of massive galaxy cluster Abell 2744. It shows some of the faintest and youngest galaxies detected in space. Credit: NASA/ESA/STScI

It is probable that primordial galaxies triggered the period in the history of the universe known as "cosmic reionization." The Geneva-based astronomer Anne Verhamme has succeeded in demonstrating this by studying green pea galaxies. In recognition of this work, the SNSF will award her this year's Marie Heim-Vögtlin prize on 16 September 2019.

Following the Big Bang some 14 billion years ago, the [universe](#) gradually cooled down, allowing electrons and protons to fuse together to form hydrogen atoms. This was the beginning of the Dark Ages of the universe, which lasted until the first stars were formed. These stars must have emitted large quantities of ultraviolet radiation that was capable of ionizing the hydrogen atoms, because astronomers observed that electrons and protons separated again a billion years after the Big Bang. This is what we call the cosmic reionization period.

Successful new measurement technique

For a long time, astronomers could not explain where the powerful UV radiation needed for reionization had come from. The majority of observed [galaxies](#) do not emit ionizing photons and the few known exceptions emit too little to keep the universe ionized.

Anne Verhamme, professor of astronomy at the University of Geneva, proposed that green pea galaxies—a new type of galaxy discovered ten years ago—probably emit large quantities of ionizing photons. This assumption was based on the highly specific properties of rays emitted by the [hydrogen atoms](#) in these galaxies, known as Lyman-alpha radiation. Astronomers believe that green pea galaxies resemble primordial galaxies as they are extremely compact, are creating their first generations of stars, and are still rich in gas.

Using data from the Hubble Space Telescope, Anne Verhamme and a international team of collaborators were able to demonstrate that green

pea galaxies do indeed emit large quantities of ionizing photons. If green peas are analogous to primordial galaxies, it seems very likely that it was galaxies that triggered the reionization of the universe more than 13 billion years ago.

More information: Anne Verhamme et al. Using Lyman- α to detect galaxies that leak Lyman continuum, *Astronomy & Astrophysics* (2015). [DOI: 10.1051/0004-6361/201423978](https://doi.org/10.1051/0004-6361/201423978)

A. Verhamme et al. Lyman- α spectral properties of five newly discovered Lyman continuum emitters, *Astronomy & Astrophysics* (2016). [DOI: 10.1051/0004-6361/201629264](https://doi.org/10.1051/0004-6361/201629264)

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