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Journey to the Beginning of Time

In the Pristine survey, an international team is looking for and researching the oldest stars in our universe, co-led by Dr. Else Starkenburg from the Leibniz Institute for Astrophysics Potsdam (AIP). The goal is to learn more about the young universe right after the Big Bang. In a recent publication, the scientists now report on the discovery of a particularly metal-poor star: a messenger from the distant past..

For the study of the early universe astronomers have different methods at their disposal: One is to look far into the Universe and back in time, to see the first stars and galaxies growing. Another option is to examine the oldest surviving stars of our home galaxy, the Milky Way, for information from the early Universe. The "Pristine" survey, led by Else Starkenburg (AIP) and Nicolas Martin (University of Strasbourg), is looking for exactly these these pristine stars.

The scientists employ a special colour filter on the Canada-France-Hawaii Telescope to search for stars with relatively pristine atmospheres. In their recent publication (Starkenburg et al., 2018) they have used this technique to discover one of the most metal-poor stars known. Detailed follow-up studies with spectrographs of the Isaac Newton Group in Spain and the European Southern Observatory in Chile have demonstrated that the star has indeed very few heavy elements in its atmosphere. „Most elements are depleted by factors 10.000 to 100.000 compared to the Sun. Additionally, its detailed pattern of different elements stands out. Whereas most heavy element depleted stars do show a large enhancement in carbon, this star does not. This makes this star the second of its kind and an important messenger from the early Universe.“ says Dr. Else Starkenburg.

To find these oldest messengers among the overwhelming population of younger stars is no easy task. Just after the Big Bang, the Universe was filled with hydrogen and helium and a bit of lithium. No heavier elements were around, as these are only synthesized in the hot interior of stars - and those did not exist yet. Our Sun has about 2 % of heavier elements in its atmosphere, as can be seen when we make a spectrum of its light. Because of this fact, astrophysicists can conclude that the sun has emerged as part of a later generation of stars - and "recycled" in its atmosphere the products of some stars that lived long before it and have since died out..

In searching for the oldest stars, scientists look for stars with more pristine atmospheres than our Sun. The more pristine the atmosphere, the earlier the generation in which this star was born. Studying stars of different generations allows us to understand the history of the Galaxy - an area of research that therefore is also called Galactic archaeology.