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Galactic archaeology of the old Milky Way using the most metal-poor stars

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Our Galactic halo hosts some of the most metal-poor stars. These are relics from the era of the smallest, earliest galaxies that merged into the Milky Way.
However, finding many of these extremely metal-poor (EMP) stars is challenging because they are rare among the more metal-rich populations in the Galaxy. The staggering Gaia DR3 provides low-resolution spectrophotometry for about 220 million stars. We use these data to mimic a narrow-band CaHK filter used by the successful Pristine survey previously to find these EMP stars. This gives us an all-sky map of the metal-poor Milky Way.
Here I present the first spectroscopic follow-up of ~200 stars with predicted [Fe/H] < -2.5 (EMP) in the Milky Way from this new dataset. We find that 72% of the stars have indeed [Fe/H] < -2.5, while all of them are very metal-poor ([Fe/H] < -2). This means a large improvement over the existing methods that search for EMP stars. Additionally, we probe further out, going beyond 30 kpc. Some of the EMP stars we discovered are on prograde disk-like orbits, which needs further investigation. The most metal-poor stars from this follow-up are on high-energy orbits indicating tracers of low-mass mergers. A chemodynamical analysis of this sample allows us to find more member stars from the same progenitor, and construct their disruption history.
Identifying remnants from these earliest metal-poor low-mass mergers buried in the Milky Way is intriguing and a unique pathway to the past, as even JWST cannot directly observe these low-mass high-redshift galaxies.

Primary author: VISWANATHAN, Akshara (Kapteyn Astronomical Institute, University of Groningen)

Co-authors: Dr ARENTSEN, Anke (Institute of Astronomy, University of Cambridge); Prof. STARKENBURG, Else (Kapteyn Astronomical Institute, University of Groningen); Dr MARTIN, Nicolas (Strasbourg Observatory); Prof. IBATA, Rodrigo (Strasbourg Observatory); Dr YUAN, Zhen (Strasbourg Observatory)

Presenter: VISWANATHAN, Akshara (Kapteyn Astronomical Institute, University of Groningen)

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