Chemical Signatures of an Ultra-Faint Dwarf Progenitor in the Leiptr Stellar Stream

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Stellar streams in the Galactic halo—fossil records of tidally disrupted globular clusters (GCs) and dwarf galaxies—are powerful probes of the Galaxy's assembly history. Among the more than 100 known streams (Mateu 2023), Leiptr has been debated as the remnant of either a GC or an ultra-faint dwarf galaxy (UFD) (Ibata et al. 2019; Bonaca et al. 2021). Importantly, no surviving progenitor has yet been identified, making the origin of Leiptr particularly enigmatic.

Atzberger (2025) first proposed a UFD progenitor based on high-resolution spectroscopic observations. However, this conclusion was drawn from a relatively small sample and therefore requires independent confirmation. To address this issue, we obtained high-resolution spectra of candidate member stars using the High Dispersion Spectrograph (HDS) on the 8.2-m Subaru Telescope. We derived chemical abundances, including α-elements and iron-peak elements, together with precise radial velocities to assess stream membership.

Our results broadly support a UFD origin for the Leiptr stream. However, we also identify a subset of stars with significantly higher metallicities than the majority of stream members. It remains unclear whether this population reflects an intrinsic metallicity spread within the stream or contamination by unrelated field stars. Interestingly, these metal-rich stars are predominantly located on one side of the stream, suggesting the presence of a spatial metallicity gradient and potentially a more complex star-formation history than expected for a simple progenitor system. Independent photometric metallicities from the Pristine survey (Martin et al. 2024) provide a more robust metallicity distribution and likewise support this interpretation.

In this presentation, we report chemical signatures consistent with a UFD progenitor, together with evidence for a metallicity gradient, and discuss the implications of these findings for the origin and evolution history of this enigmatic stellar stream.