Contribution ID: 21

First measurement of the r-process abundance at the Galactic Center using a hyper velocity star

Tuesday 10 June 2025 16:40 (20 minutes)

The Galactic-Center (GC) region of the Milky Way has been a focal point for astronomers for many years, yet its formation history remains a subject of debate. So far, thanks to near-infrared spectroscopic observations, which suffer least from interstellar extinction, abundances of Fe-peak, alpha, and s-process elements have been determined for dozens of stars residing within the GC region. However, the r-process elemental abundances have not yet been determined for any stars in the GC region because r-process elements do not show detectable absorption lines in the near-infrared.

To address this limitation, here we present optical high-resolution spectroscopic measurement of [Eu/Fe] of a hyper-velocity star (HVS) originating from the GC region. Leveraging the very mild extinction towards the HVS, optical spectroscopy offers an unprecedented opportunity to access absorption lines from a wide range of elements, including r-process elements for the first time. We find that the star has enhanced [Eu/Fe] along with mildly enriched [alpha/Fe]. These chemical signatures indicate an enhanced contribution of neutron-star mergers to the chemical enrichment at the Galactic Center.

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