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Exploring Nuclear Formation Processes at Intermediate Metallicity: The MINCE Project's Insights into Neutron-Capture Element Abundances

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The abundances of neutron-capture elements in metal-poor stars are crucial for understanding the astrophysical sites and mechanisms responsible for heavy-element nucleosynthesis. While the very metal-poor regime ([Fe/H] < -2.5) has been extensively studied, the intermediate metallicity range (-2.5 \leq [Fe/H] \leq -1.5) remains poorly explored, leaving a significant gap in our understanding of nucleosynthesis. This transitional epoch in the Galaxy marks the interaction of slow (s-process), rapid (r-process), and intermediate (i-process) neutron capture mechanisms, shaping the chemical composition of the interstellar medium.

My work focuses on analyzing high-resolution spectra of about 90 stars, observed using FEROS, achieving high quality spectra (signal-to-noise ratio S/N ~ 50). This dataset enables a detailed investigation of star-to-star abundance scatter of neutron-capture elements, including ~ 20 key elements (e.g., Sr, Ba, Eu), as well as lighter elements such as CNO, \alpha-elements, and Fe-peak elements. We will reveal distinct abundance patterns among neutron-capture elements, which could indicate the relative contributions of s-, r-, and i-process nucleosynthesis. To further explore the s- and r-process, I focus on the rarely studied elements Mo and Lu, which provide unique insights into the mechanisms shaping neutron-capture nucleosynthesis and Galactic chemical evolution. Additionally, I will identify and examine stars displaying peculiar abundance signatures to gain deeper insights into their origins and nucleosynthetic history, thereby uncovering new dimensions of the Galaxy's nucleosynthetic history and its chemical evolution.

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