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Homogeneous analysis of 10 highly r-process enhanced stars

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A small fraction of old, metal-poor stars exhibits significant enhancement in elements produced through the rapid neutron capture (r-) process, offering a unique laboratory to investigate this process. The R-Process Alliance's initial data release uncovered numerous highly r-processed (r-II) stars. In my work I delve into a detailed chemical analysis of ten such stars, utilizing high-quality spectra and examining over 2000 absorption lines spanning 330 to 940 nm across 49 chemical species. This meticulous examination yields the most comprehensive and uniformly analyzed collection of r-II stars to date. A systematic approach ensures reliable abundance distributions, facilitating the identification of potential variations in chemical compositions among the stars, indicative of r-process variability. The research aims to discern patterns, differentiate genuine abundance disparities from instances of r-process Universality, and utilize these findings to constrain r-process site and nucleosynthesis pathways. Two specific regions of elements are investigated: the region from Ru-Ag, where signatures of fission fragment deposition have recently been discovered by Ian Roederer and published in Science (Roederer, 2023), and the region of the third peak elements Os and Ir, which is still poorly explored in these stars.

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