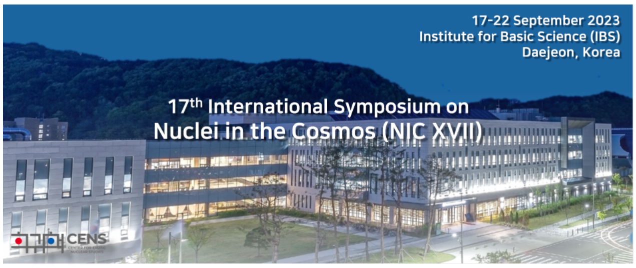

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Chemical compositions of r-process enhanced metal-poor stars discovered by the LAMOST/Subaru telescopes

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Metal-poor stars are thought to have the result of nucleosynthesis in the early stages of galaxy formation in their atmospheres. A variety of surveys and follow-up observations have been performed to determine detailed abundance patterns for many metal-poor stars. The r-process, which provides about a half of the elements heavier than iron, is thought to be caused by neutron star mergers. However, an r-process enhanced extremely metal-poor star ([Fe/H] $= -3.5$) has been discovered (Yong et al. 2021), which should be formed in the early stages of galaxy formation, suggesting that the r-process needs to occur with very short time scale through, for instance, special types of supernovae.

We have obtained chemical abundances by high-dispersion spectroscopic observations with Subaru/HDS for about 400 metal-poor stars estimated to be [Fe/H] < -2, which were discovered by the LAMOST spectroscopic survey (Aoki et al. 2022, Li et al. 2022). These observations have identified many r-process enhanced stars, of which the most metal-poor J1109+0754 ([Fe/H]$= -3.4$) and the brightest J0040+2729 ([Fe/H]$= -2.7$) were followed-up with long exposures with Subaru/HDS. The observations were conducted in the wavelength region around 4000A, where there are many absorption lines for neutron-capture elements including thorium, and for J0040+2729, observations were also conducted in the near-UV region up to around 3300A. We have obtained the abundances for many elements, including thorium, and upper limits for lead and uranium from the spectra. The overall abundance patterns of both stars exhibit a good agreement with the solar r-process pattern as found for r-process-enhanced stars previously studied, but some of the lighter elements show slight deviations from the solar r-process pattern. This result could indicate the diversity of the r-process. The abundance patterns of r-process elements in very metal-poor stars constrain the timing of neutron star mergers in the early stages of galaxy formation and models of supernova explosions.

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