Searching for extremely alpha-poor stars in the Galactic Halo

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Abstract. A few alpha-poor stars that show severe departures (over 0.4 dex deficiency in alpha-element abundance) from the general enhanced alpha-element chemical abundance trends of the halo have been discovered in recent years, such as BD $+80°245$, G4-36 and CS 22966-043. These ratios suggest a different chemical enrichment history for these stars than for the majority of the halo. Similarly low-alpha abundance patterns are also seen in the Sagittarius dSph galaxy. We present a method for searching of extremely alpha-poor stars from low-resolution stellar spectra of LAMOST pilot survey and attempt to create a large sample of these particular Galactic halo stars.

The chemical enrichment history of the Galaxy is described to follow the scenario given by Tinsley (1979). In this scenario, the alpha-elements (e.g., Mg, Si, Ca and Ti) are mainly produced in the interiors of high-mass stars during their main-sequence lifetime and later their resulting Type II supernova explosions. These elements are ejected into the interstellar medium (ISM), enhance the stars which formed from this gas. Observed halo stars preserved this pattern by showing $[\alpha/\text{Fe}] \sim +0.4$. In recent years, some studies have found halo stars of intermediately low metallicities that do not follow this pattern of alpha-element enhancement, with abundance ratio differences in the range of 0.4-0.6 dex. Carney *et al.* (1997), King et al.(1997), and Hanson et al.(1998) all found stars with $[\alpha/\text{Fe}]$ ratios lower than what is normally expected for halo stars. In all of these analysis, the abundances and kinematics of the objects have been found to be consistent with the scenario of accretion events in the outer halo.

In this work, we generate a very large grid of synthetic stellar spectra which contains four dimensions: T_{eff}, log g, $[\text{Fe/H}]$ and $[\alpha/\text{Fe}]$. For each given observed spectrum, we search this grid for the best-matching synthetic stellar spectrum and adopt the parameters of this synthetic spectrum. By estimating the $[\alpha/\text{Fe}]$ ratios for metal-poor stars in the LAMOST pilot survey, we find nearly 200 low-alpha $(-0.1 < [\alpha/\text{Fe}] < +0.2)$ metal-poor stars and dozens of extremely alpha-poor $([\alpha/\text{Fe}] < -0.1)$ metal-poor stars. Then we compare interactively the spectrum of each extremely alpha-poor stars with the spectra of normal stars that have similar atmospheric parameters. The majority of our extremely alpha-poor stars are found to be obviously anomalies.

References

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