P33: Tracing the origin of the Moving Group: LAMOST-N1

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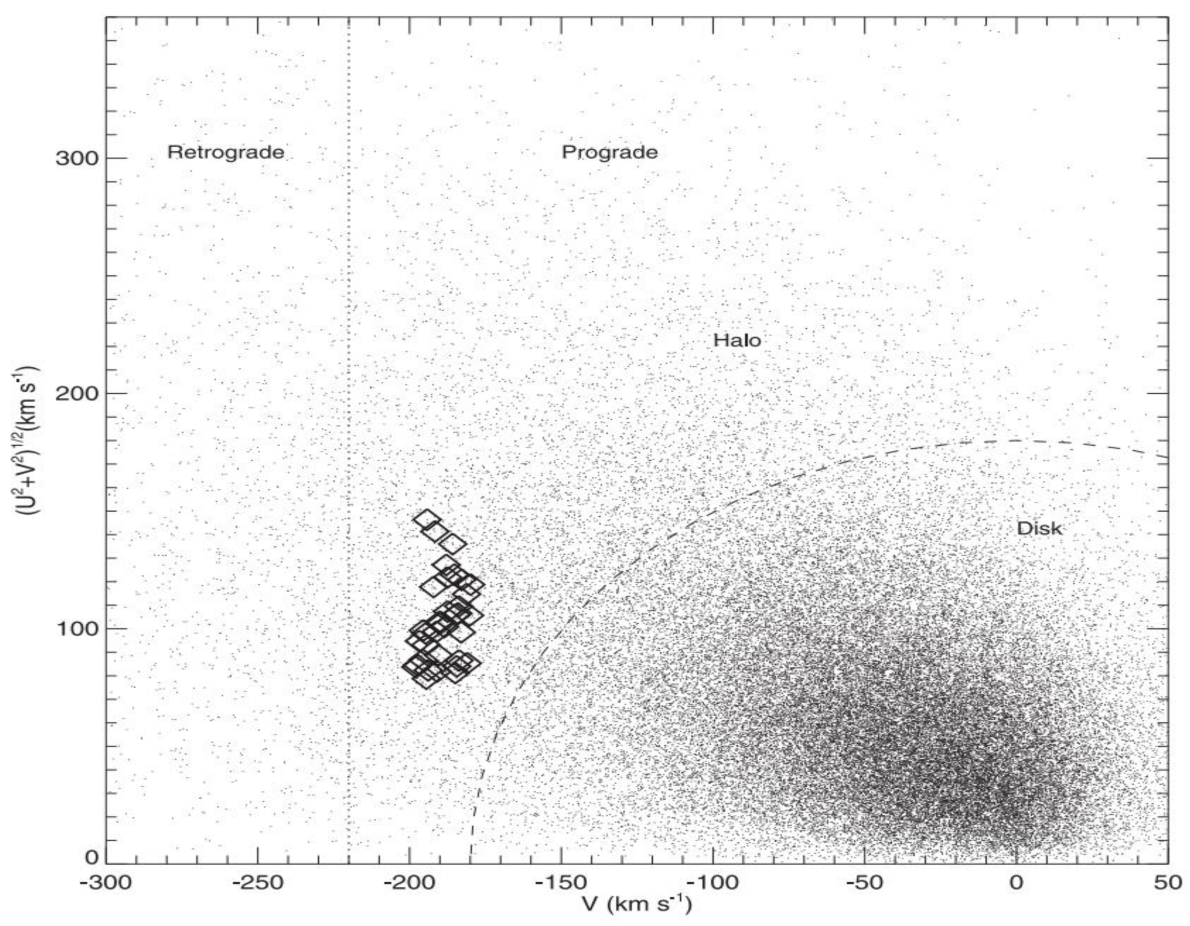
Abstract:

We present the chemical abundances of six stars in the halo stream Large Sky Area Multi-Object Fiber Spectroscopic Telescope (LAMOST)-N1, a new kinematically selected substructure from LAMOST data, from high-resolution spectra obtained with the Subaru/High Dispersion Spectrograph. Atmospheric parameters were determined by an iterative procedure based on spectroscopic analysis. Abundances of 11 elements, including α elements (Mg, Ca, Ti), odd-Z light elements (Na), iron-peak elements (Sc, Cr, Mn, Fe, Ni), and neutron-capture elements (Y, Ba), are measured by local thermodynamic equilibrium analysis procedures. [Fe/H] of the six stars ranges from −1.5 to −0.66. The abundance patterns of α elements show a similar trend to those of low-α stars in Nissen et al. and over 0.1 dex lower than those of Galactic field stars. The Sc, Cr, Mn, and Ni abundances of these six stars exhibit a positive trend with increasing iron abundance, with varying gradients. In addition, abundance distribution between [Na/Fe] and [Ni/Fe] and between that of [Ba/Y] and [Fe/H] of these six stars is different from both Galactic stars and the known dwarf galaxies. Our results suggest that LAMOST-N1 might be a relic of a system with slower chemical evolutions than the Milky Way.



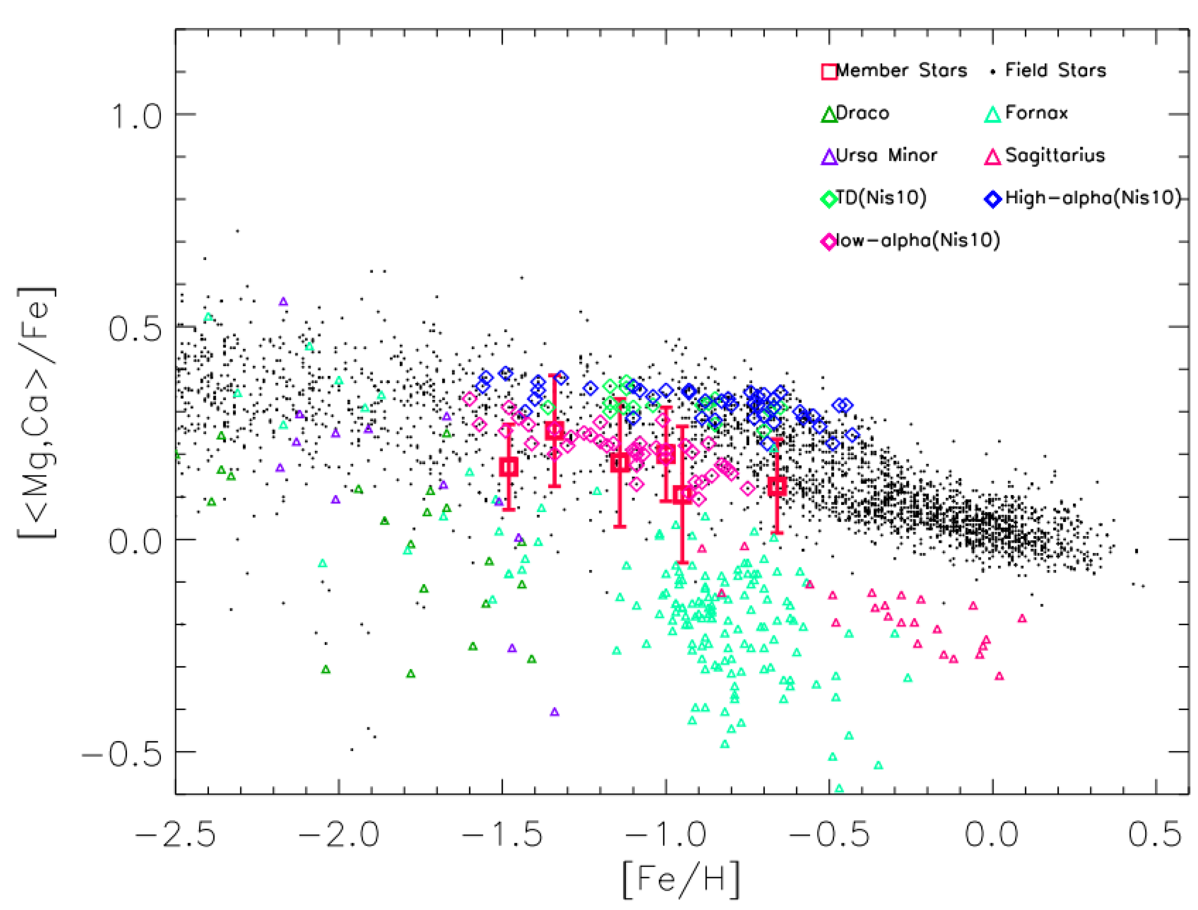
Toomre diagram for stars in Zhao et al. (2015). Diamonds represent the 35 member candidates in LAMOST-N1. The long-dashed line corresponds to Vtotal = 180 km/s.

Basic Parameters of the Six Stars and the Subaru/HDS Observation

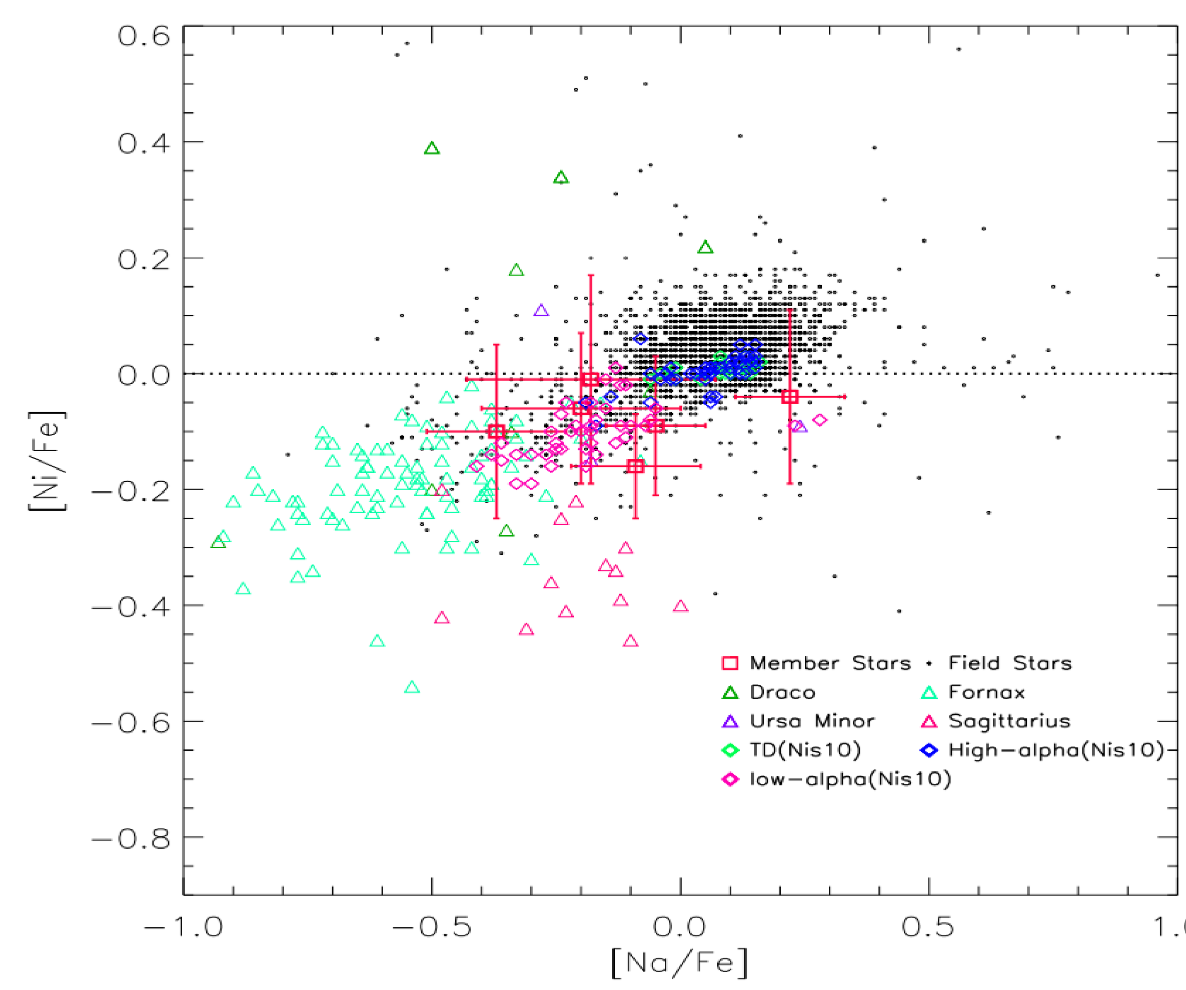
ID	R.A. (degree)	Decl. (degree)	r_0	S/N[a]	Date	RV (km s^{-1})	eRV (km s^{-1})
J0054+3047	13.503481	30.797329	14.2261	40	2016 Nov 18	−169.05	0.19
J0147+2742	26.861045	27.705449	14.4878	35	2016 Nov 18	−198.85	0.41
J2158+2840	329.585999	28.675182	13.9799	38	2016 Nov 18	−196.05	0.29
J2350+2622	357.5523	26.37558	14.6732	34	2016 Nov 18	−174.64	0.17
J1218+2852	184.632775	28.868973	13.9921	52	2017 Feb 16	85.8	0.14
J1046+5004	161.522975	50.067471	14.5725	45	2017 Feb 16	65.08	0.27

Stellar Parameters of the Six Stars

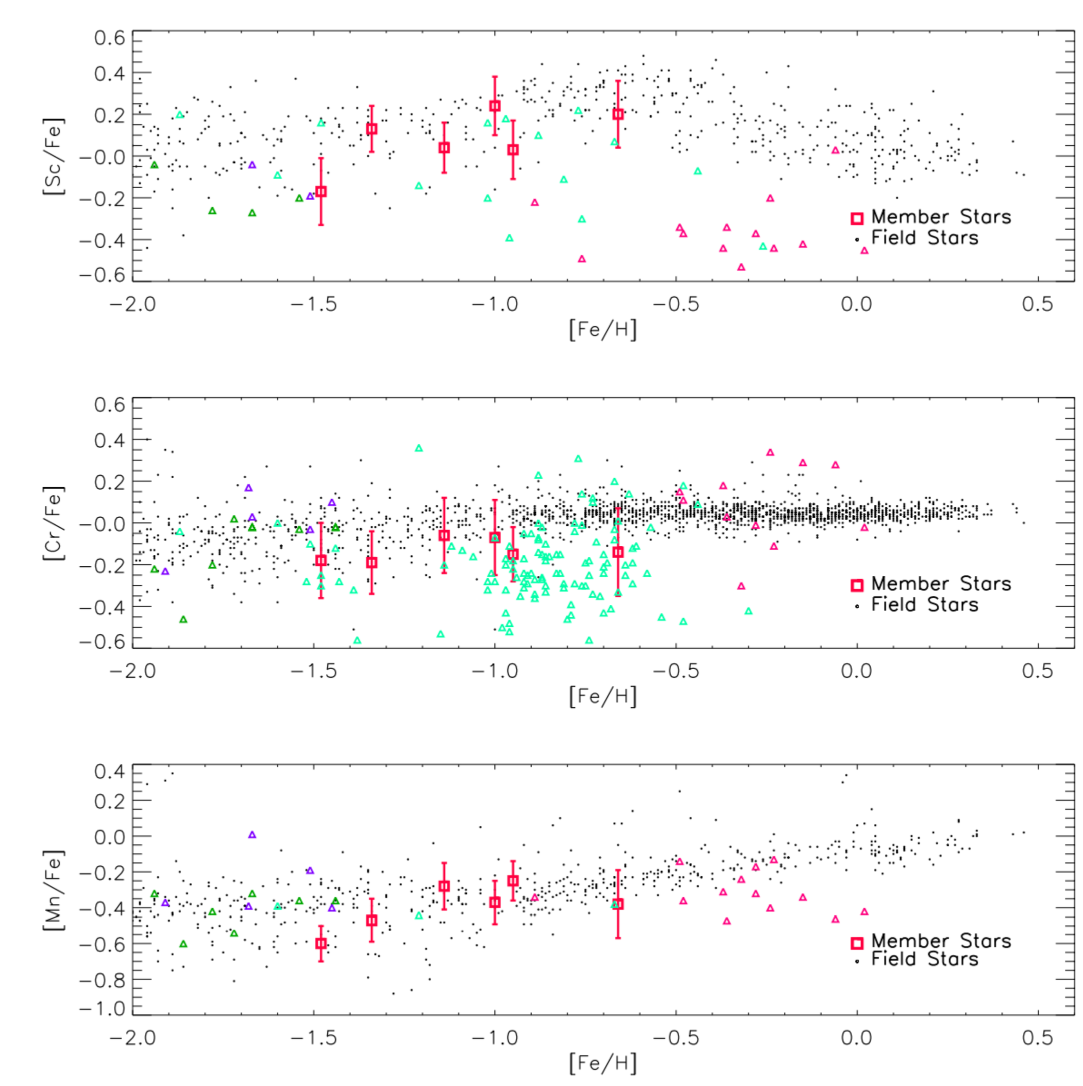
ID	T_{eff}_lasp (K)	log g_lasp	[Fe/H]_lasp	T_{eff}_spa (K)	log g_spa	[Fe/H]_spa	ξ_t (km s^{-1})
J0054+3047	5794	4.286	−1.287	5753	4.80	−1.34	0.7
J0147+2742	5937	4.22	−1.417	5862	4.01	−1.48	1.3
J2158+2840	5667	4.23	−1.074	5745	4.73	−1.00	0.9
J2350+2622	6119	4.254	−0.938	6036	3.95	−1.14	1.9
J1218+2852	6041	4.15	−0.922	5999	4.15	−0.95	1.5
J1046+5004	5703	4.408	−0.783	5899	4.91	−0.66	1.0



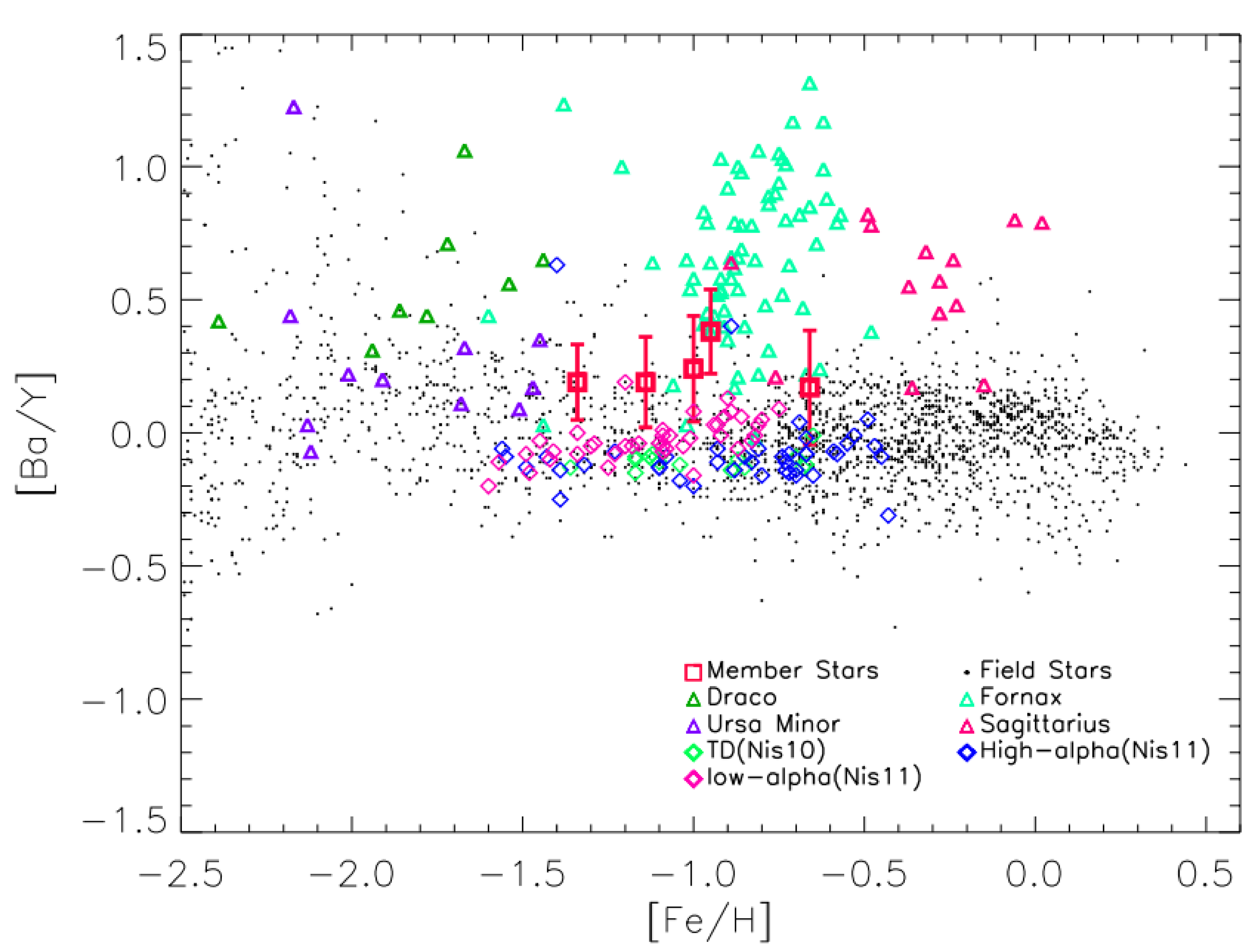
[α/Fe] vs. [Fe/H]. The red squares represent the member stars of LAMOST-N1. The open circles are field stars of the Milky Way from the SAGA database. Green diamonds are stars in the thick disk from Nis10. Halo stars with high-α are marked with blue diamonds from Nis10. The magenta diamonds represent the halo stars with low-α from Nis10. Stars of the dwarf galaxies are shown with triangles. Dwarf galaxies are distinguished by different colors.



[Ni/Fe] vs. [Na/H].



Top: [Sc/Fe] vs. [Fe/H], middle: [Cr/Fe] vs. [Fe/H], and bottom: [Mn/Fe] vs. [Fe/H]



[Ba/Y] vs. [Fe/H].

Conclusion:

1. The abundance distributions of [α/Fe] versus [Fe/H], [Na/Fe] versus [Ni/Fe], and [Ba/Y] versus [Fe/H] of LAMOST-N1 are very similar to low-α halo stars of Nissen & Schuster (2010)

2. [Ba/Y] of LAMOST-N1 is higher than Galactic field stars （~0.2dex）

3. the LAMOST-N1 might be an accreted population of halo stars, formed in conditions similar to those in early dwarf galaxy satellites.

4. The progenitor of LAMOST-N1 might originate from systems with a slower chemical evolution, characterized by additional enrichment from Type Ia supernovae and low-mass AGB stars.

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