A Study of Low-Metallicity Red Giant Stars in the Ursa Minor Dwarf Spheroidal Galaxy Using APOGEE Data

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Abstract

The APOGEE-2 survey has the potential to expand the available metallicity data on dwarf galaxies by observing larger samples of stars along with elements that are difficult to detect in the optical. We evaluate the performance of the APOGEE pipeline for low S/N spectra taken from faint, low-metallicity stars in the Ursa Minor dwarf spheroidal galaxy. We compare APOGEE metallicities against those found in literature, and examine the spectra for elemental absorption lines. We also attempt to constrain the population of binary stars in the dSph.

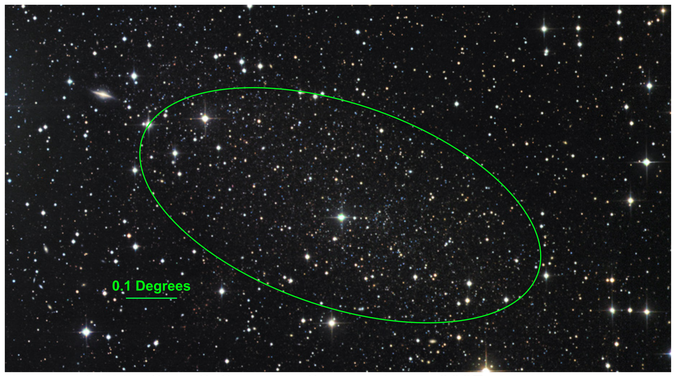
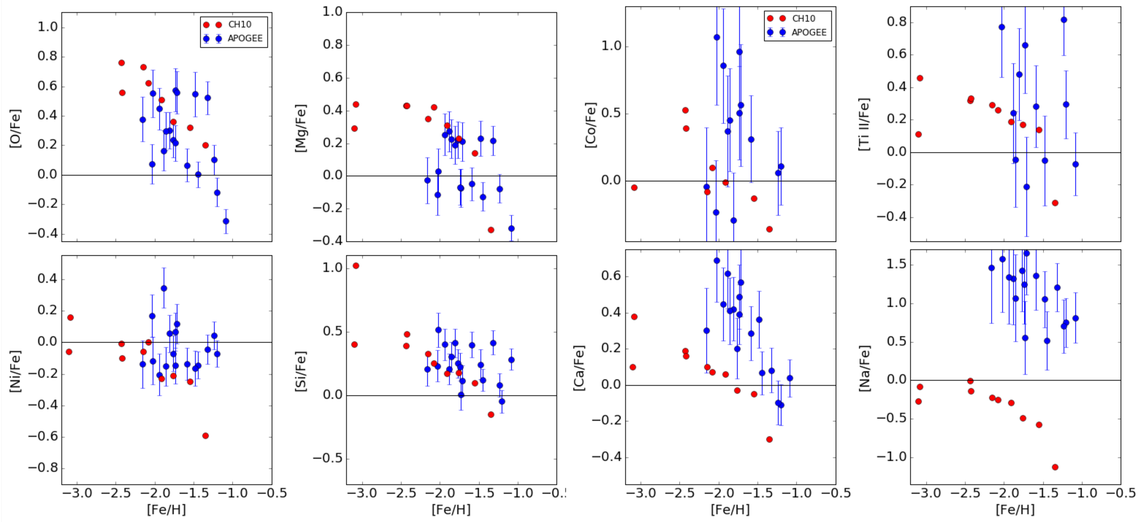


Image of UMi dSph. © Cappella Observatories 2007, All rights reserved

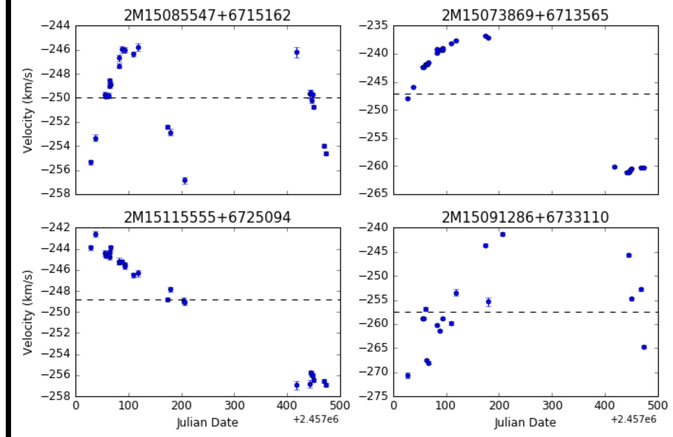
Metallicities from Default ASPCAP Processing

Elements With Good Abundances **Elements With Problematic Abundances**



We compare our metallicity data to that of Cohen & Huang 2010 (CH10), the most comprehensive chemical study of UMi to date. While some elements, shown on the left, are in relatively good agreement with CH10, others, shown on the right, show dramatically different patterns. Thus, the current metallicity data may not be sufficient for analysis and interpretation.

Binary Stars

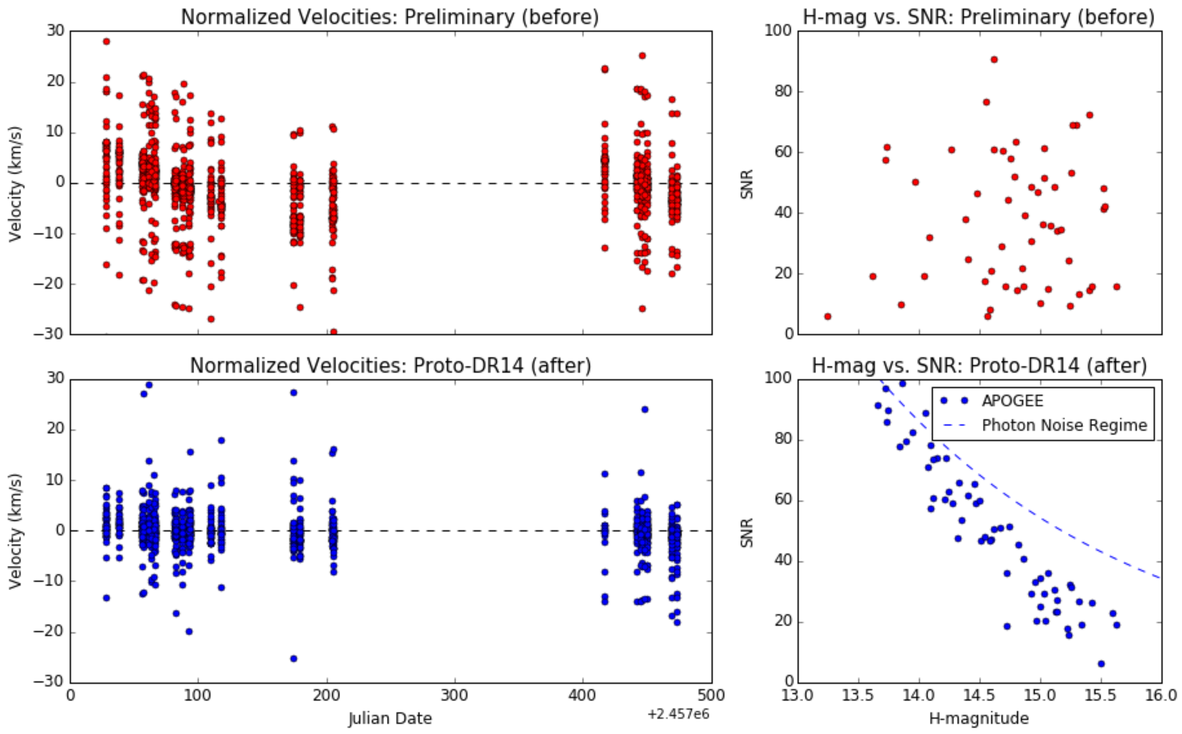


From the proto-DR14 reductions, we visually identify four binary stars out of 59 UMi members. The top two stars are the binary star candidates UMi K (left) and UMi VA335 (right) from Olszewski et al. 1996.

Future Work

We will measure equivalent widths of strong elemental absorption lines from the new spectra, and measure UMi abundances using MOOG. We are also waiting for new ASPCAP metallicity results.

Radial Velocities & SNR Between Preliminary Processing & Proto-DR14



In the results from the preliminary reductions pipeline, which is similar to that of DR13, we find that the SNR of UMi stars does not vary as expected with apparent brightness. Moreover, we identify a systematic variation in stellar radial velocities with time, which resulted from faulty heliocentric corrections. Incorrect velocities would lead to slight, erroneous doppler shift adjustments. For faint stars like those in UMi, even slightly misaligned spectra, stacked together, would wash out absorption features. We tentatively suggest that this issue only affects fainter APOGEE stars. After correspondence with the APOGEE-2 reductions team, the proto-DR14 pipeline appears to fix both the velocity and SNR problems.

References

Cohen, J. G., & Huang, W. 2010, ApJ, 719, 931

Olszewski, E. W., Pryor, C., & Armandro, T. E. 1996, AJ, 111, 750

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