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# Kinematic and Chemical Analysis of AEGIS Survey Stars

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**Abstract.** The AAOmega Evolution of Galactic Structure (AEGIS) survey (P.I. Keller) was a moderate scale (45 nights) spectroscopic survey carried out with the AAOmega multi-fiber spectrograph at the Anglo-Australian Telescope. The input catalogue for the spectroscopic observations was derived from photometry of approximately 200 two-degree diameter fields obtained during the commissioning of the SkyMapper survey. The data consists of medium-resolution (R $\sim$ 2,000) spectroscopy for approximately 70,000 thick disk and halo stars spanning a survey footprint of 4,900 square degrees. We plan to use the AEGIS data to further characterize the properties of the disk and halo systems and better constrain the assembly history of the Galaxy based on the behavior of the CEMP-no and CEMP-s stars in the sample.

**Keywords.** Methods: data analysis, Stars: abundances, Galaxy: formation, evolution, disk, halo

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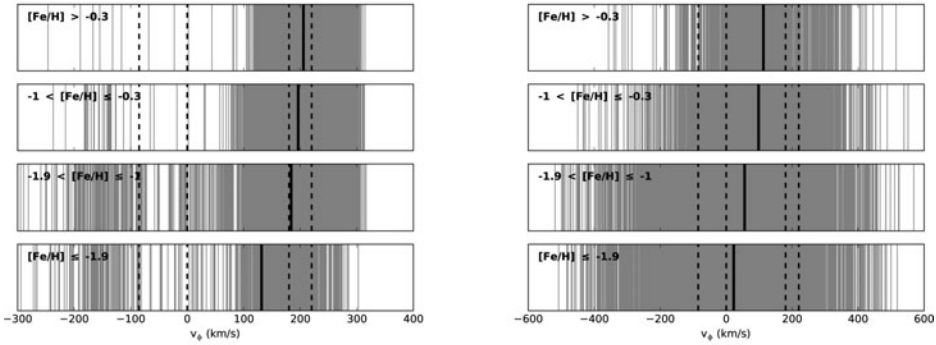
Metallicity and kinematic ranges corresponding to regions associated with the disk and halo systems were examined to summarize the general characteristics of the AEGIS sample, an example of which is shown in Figure 1. These plots revealed the presence of a significant number of metal-weak thick-disk (MWTD) stars, a component we intend to inspect in greater detail. A retrograde halo component could not readily be separated from the rest of the sample, but the analysis has only begun. Mixture-model fitting may provide a more clear answer.

Carbon-enhanced metal-poor (CEMP) stars in the sample are of particular interest, as we wish to isolate bright CEMP stars for high-resolution follow-up and examine the general trends of the CEMP populations present to better understand the star-formation history of the first generations of stars in the Galaxy. CEMP stars can further be subdivided into categories based on the abundance levels of elements associated with neutron-capture processes (Beers & Christlieb 2005) – CEMP-no stars have no over-abundances of such elements while CEMP-s stars exhibit strong over-abundances of s-process elements.

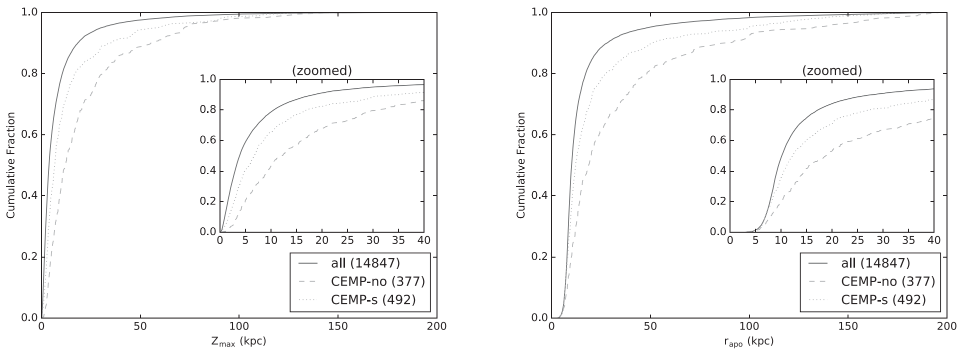
Cumulative distribution functions (CDFs) for CEMP-no and CEMP-s stars in the sample were compared over apocentric radius and $Z_{max}$ in order to search for differences in spatial distributions between the two subsets. As shown in Figure 2, the CEMP-s stars dominate at closer distances than the CEMP-no stars, consistent with previous findings that CEMP-s stars are preferentially found in the inner halo and CEMP-no stars are preferentially found in the outer halo (Carollo *et al.* 2014; Lee *et al.* 2017). A two-sample Kolmogorov-Smirnov (K-S) test firmly rejects ($p < 0.001$) the null hypothesis that the CEMP-s and CEMP-no stars are drawn from the same parent population.

Future analysis of this sample will include: mixture-model fitting of halo velocity distributions, further study of the CEMP-no and CEMP-s populations, and a more comprehensive look at the MWTD stars in the sample, including thick disk versus MWTD




(a) eccentricity $\leqslant 0.4$ (b) eccentricity $> 0.4$

Figure 1: Stripe density plots of rotational velocity over metallicity ranges roughly associated with the thin and thick disk and inner and outer halo. An eccentricity cut was made at e = 4 to approximately divide the disk and halo systems. Solid lines indicate the mean of each sub-sample, dashed lines mark mean velocities associated with each Galactic component (thin disk: 220 km/s, thick disk: 180 km/s, inner halo: 0 km/s, outer halo: −80 km/s; Carollo *et al.* 2010).




(a) $Z_{max}$ CDF (b) apocentric radius CDF

Figure 2: CDFs for AEGIS giants and sub-giants. An $A$(C) division at 7.1 was used to separate CEMP-no ($A(\mathrm{C}) \leqslant 7.1$) from CEMP-s stars ($A(\mathrm{C}) > 7.1$) (Yoon *et al.* 2016). Giants and sub-giants were used because the $A$(C) division may vary for warmer stars.

separability. We also plan to perform follow-up kinematical analyses using *Gaia* DR2 distances and proper motions once that data is released in early 2018.

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