Chemical tagging of kinematic substructures in the solar neighborhood with LAMOST

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NAOC
Outline

- Disentangling HR1614 branch with LAMOST MRS
- Evolution of main moving groups in the solar neighborhood with LAMOST LRS
- A new Moving Group in UV and elemental abundance space
Chemical abundance will help us to know the origin of those moving groups

Kinematic over-densities:
Part of a much more complicated structures seen as arches and ridges

Caused by spiral arms or a phase-mixing due to a past merger event
- First advocated by Eggen (1978);
- Smith (1983) using DDO photometry showed enhanced cyanogen bands in Eggen (1978) sample stars
- Feltzing & Holmberg (2000)
  - there is a distinct stellar population of metal rich stars centered at $U = 10$ km/s, $V = -60$ km/s and tilted in the UV plane
De Silva et al. 2007: The only one true Moving Group in thin disk
18 member star candidates:
4: solar metallicities, 3 nonmembers or binaries
14: $[\text{Fe/H}] \geq 0.25 \text{dex}$ age=2Gyr age and abundance are very consistent
remnant of a dispersed star-forming event
• More member stars of HR1614 branch with LAMOST MRS
• Abundance pattern
• Formation mechanism
e_parallax/parallax < 20%
d < 500pc

Wavelet transform

Scale=3

Scale=4

Scale=5
-70 < V < -60 & -20 < U < 50
1200 < Jz < 1500 & 20 < J⊥ < 80

Bimodal distribution
Stellar parameters:

- Teff, logg, [Fe/H] from LAMOST pipeline
- Microturbulence: calibration from Teff and logg from Edvardsson et al. 1993

Linelist: Single line without clear mixing by the comparison of solar atlas

Spectral Fitting Method: Iteration with Levenberg-Marquardt technique (MPFIT idl code); Initial values: solar abundance
HR1614 Branch—Abundance
# Linelist

<table>
<thead>
<tr>
<th>Wavelength</th>
<th>E.P.</th>
<th>logf</th>
<th>f6</th>
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<tbody>
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**blue arm**

<table>
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**Red arm**
Initial tentative conclusion:
HR1614 branch includes two populations (A and B):
A. HR1614 moving group: $[\text{Fe/H}] > -0.2$
   remnants from an open cluster
B. $[\text{Fe/H}] < -0.2$
   Field stars clumped by perturbation
Evolution of moving groups

Sample: LAMOST DR5 dwarfs & distance < 0.5 kpc, SNRg > 50
Age: chromospheric activity

1. The Hercules branch is detected in subsamples with ages older than 2 Gyr.
2. Sirius, Coma and Hydes branch is well established in [0.2,0.5].
3. Branches might be formed by the combination of remnants of clusters, perturbation of bar, spiral arm and merge event.
New moving group in velocity and chemical plane

Sample: LAMOST DR5 Giants & Gaia 2; distance < 0.5 Kpc
Elemental abundance: AstroNN C N O Mg Al Si S Ca Ti Cl Mn Ni

astroNN: Leung & Bovy 2018  
Liang et al. to be submitted
New moving group

Gray points: background stars
Blue points: clumped in spatial space
Green points: clumped in velocity space
Red points: clumped in both spatial and velocity space
New moving group
New moving group

Spatial position: close to Orion nebula
Origin: classical moving group
similar abundance
clumped in velocity and spatial space
THANKS