8.22 Chemical Tagging of Stellar Kinematic Groups: The Hyades Supercluster

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Abstract

Stellar Kinematic Groups are kinematical coherent groups of stars which may share a common origin. These groups spread through the Galaxy over time due to tidal effects caused by galactic rotation and disk heating, however some chemical information remains unchanged. The aim of chemical tagging is to show that abundances of every element in the analysis must be homogeneous between members. We have studied the case of the Hyades Supercluster in order to compile a reliable list of members (FGK stars) based on chemical tagging information. This information has been derived from high-resolution echelle spectra obtained during our surveys of late-type stars. For selected northern stars of the Hyades Supercluster, stellar atmospheric parameters (Teff, log(g), $\xi$, and [Fe/H]) have been determined using an automatic code which takes into account the sensibility of iron EWs measured in the spectra. We have derived absolute abundances consistent with galactic abundance trends reported in previous studies. The chemical tagging method has been applied with a carefully differential abundance analysis of each candidate star, using a well-known member of the Hyades cluster as reference.
Chemical Tagging of Stellar Kinematic Groups: The Hyades Supercluster

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Abstract

Stellar Kinematic Groups are kinematical coherent groups of stars which might share a common origin. These groups spread through the Galaxy over time due to tidal effects caused by galactic rotation and disk heating, however, the chemical information survives. The aim of chemical tagging is to show that abundances of every element in the analysis must be homogeneous between members. We have studied the case of the Hyades Supercluster in order to complete a reliable list of members (FGK stars) based on chemical tagging information. For a total of 61 stars from the Hyades Supercluster, stellar atmospheric parameters (T_eff, log g, and [Fe/H]) have been determined using an own-implemented automatic code (StePar) which takes into account the possibility of iron I/II measured in the spectra. We have derived absolute abundances consistent with galactic abundance trends reported in previous studies. The chemical tagging method has been applied with a careful differential abundance analysis of each candidate member of the Hyades Supercluster, using a well-known member of the Hyades cluster as reference (vB 153). We find 48% of membership candidates based on the differential abundance analysis, proving that the Hyades Supercluster cannot originate solely from the Hyades Cluster.

Sample selection

The sample was selected using kinematical criteria in E, V galactic velocities taking a dispersion of ±20 km/s around the core velocity of the group (Montes et al., 2001). We had taken also additional candidates and spectroscopic information about some of these stars from Lopez-Santiago et al. (2010), Martinez-Amairi et al. (2010), and Mulders et al. (2010). Some exoplanet host star candidates are also taken from Montes et al. (2010).

Differential abundances

Differential abundances ([X/H]) have been determined by comparison with a reference star known to be a member of the Hyades cluster (vB 153) in a line-by-line basis (see Pompéia et al., 2011). We have computed the differential abundances for the following elements: Fe, Na, Mg, Al, Si, Ca, Sc, Ti, V, Cr, Mn, Co, and Ni, the most representative of them are shown in Figs. 6 to 10. A final candidate selection within the sample has been determined by applying a 1-sigma rejection for the Fe abundance results. In this subsample another 1-sigma diagnostic has been applied in order to prove homogeneity in each element (see Figs. 7 to 10).

Conclusions

We have computed the stellar parameters and their uncertainties for 61 single Hyades cluster candidate stars, after that we have obtained the chemical abundances of 12 elements, and the differential abundances. From the chemical tagging analysis we have found that 25 stars from the original sample are homogeneous in abundances for all the elements we have considered (48% of the sample), 3 stars fail to be homogeneous in one element. The selected stars are considered (within the error bars) with the Hyades age (15 Gyr), see Fig. 11. A mass dependent analysis to check consistency between the different age indicators and the chemical homogeneity is in progress.

References