

Estimating the Age of Exoplanet's Host Stars by their Membership in Moving Groups and Young Associations

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Abstract. We present a detailed study of the kinematics of known exoplanets host stars with known parallactic distance, and precise proper motion and radial velocity measurements, from where the Galactic space motions (U , V , W) were computed. For the stars with U and V velocity components inside or near the boundaries that determine the young disc population, we have analyzed the possible membership in the classical moving groups and nearby loose associations with ages between 10 and 600 Ma. For the candidate members, we have compiled the information available in the literature in order to constrain their membership by applying age-dating methods for late-type stars. We identify several dozen young exoplanet host star candidates, many of which were considered to have solar-like ages.

Context, Aims, and Methods

Young exoplanetary systems with ages $\tau < 600$ Ma (i.e., Hyades-like or younger) can provide constraints on the time scale and mechanism of planet formation, and on planet evolution. Apart from the very young planet candidates found by direct imaging (around e.g. HR 8799, 2M1207-39 or AB Pic), some young planet candidates have been found with the radial velocity method, such as HD 70573b (Setiawan et al. 2007) in the Hercules-Lyra association or the controversial TW Hya b (Setiawan et al. 2008).

We search for bright *Hipparcos* stars with radial-velocity planets that are member candidates in young ($\tau = 100 - 600$ Ma) moving groups (Montes et al. 2001), such as the Hyades, IC 2391, Ursa Majoris, Castor and the Local Association, and very young ($\tau < 100$ Ma) nearby loose associations (Torres et al. 2008). Generally, these stars are discarded from accurate radial-velocity searches based on activity indicators, but there might be young stars that passed the rejection filter (e.g. HD 81040, $\tau \sim 700$ Ma; Sozzetti et al. 2006).

On 2009 Sep 1, the Extrasolar Planets Encyclopaedia (exoplanet.eu) tabulated 346 planet candidates in 295 planetary systems detected by radial velocity (35 multiple planet systems). Of them, 228 have *Hipparcos* stars as host stars.

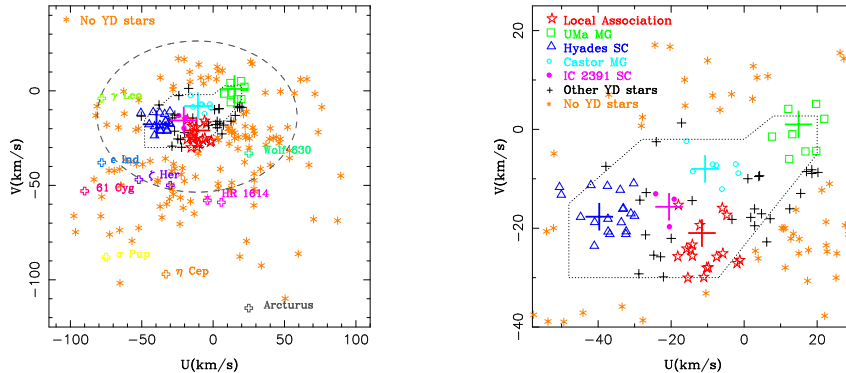


Figure 1. *Left*: position in the UV -plane of all the exoplanets host stars. *Right*: zoom of UV -plane in the region of the young disk stars.

We have computed Galactocentric space velocities UVW derived from star coordinates, proper motions, and parallactic distances (from van Leeuwen 2007), and systemic radial velocities, V_r (γ), from a number of works, including Nordström et al. 2004, Famaey et al. 2005 and planet discovery papers. To date, we have collected UVW velocities for 215 planetary systems (94%).

Results and Future Work

In Figure 1 (Böttlinger diagram) we plot the computed UV velocities. A total of 69 planet host stars satisfy the Eggen criterion for the young disc population (Figure 1 right) i.e., they are young star candidates. Five of them have values of vertical Galactocentric space velocity, W , that are too large with respect to young stars in the thin disk. The remaining 64 stars are the subject of a dedicated data compilation, including published values of effective temperature, T_{eff} , lithium abundance, $\log \epsilon(\text{Li})$, rotational velocities, $v \sin i$, activity indicators ($\log R'_{\text{HK}}$) and membership in a moving group. Interestingly, a relatively large number of stars have been tabulated as probable nearby young stars. Most of them are candidate and confirmed members in the Hyades Supercluster, such as ι Hor, HD 50554, HD 108147 or τ Boo, but there also candidate stars in the IC 2391 (94 Cet, HD 168746) or Castor (HD 217107) moving groups and the Local Association (HD 130322, V376 Peg - the transiting star HD 209458).

The data compilation will finish soon, and we will check if stellar kinematics are consistent with the other spectroscopic age indicators.

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