Post T Tauri and young main sequence stars in the solar neighborhood: isolated or members of young stellar kinematic groups

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Abstract

Post T Tauri stars (PTTS) and young main sequence stars (YMS) are late-type stars (Km and F-G respectively) in the age range between 10 and 100 Myr filling the gap between T Tauri (or FeGe pre-main-sequence) and zero-age main-sequence phases. This period of evolution remains ambiguous and until now different studies of young stars have failed to find the numbers of PTTS and YMS that are expected. In the last years some PTTS and YMS have been identified among the X-ray detected pre-main sequence stars in some star-forming regions. More recently, additional candidates have been identified in young associations and moving groups (β Pic, TW Hya, Tucana/Horologium, and the AB Dor). However, many isolated PTTS and YMS still remain undiscovered. In this contribution, we compiled the PTTS and YMS previously identified in the literature, and identified new candidates using the information provided by the high resolution spectra obtained during our surveys of late-type stars possible members to young moving groups (Montes et al. 2005, 2006, López-Santiago et al. 2008), and stars in the RasTyc sample (cross-correlation of the ROSAT All-Sky Survey (RASS) with the TNG catalog, Guillout et al. 2008). To identify PTTS we applied an age-oriented definition using relative age indicators (Lithium abundance, chromospheric emission and kinematics) as well as color-magnitude diagrams and pre-main sequence isochrones.

Fig. 1: Equivalent widths of the Li i line at 6707.8 Å as a function of spectral type for the selected stars, compared with the envelopes of well-known stellar clusters (ages from 10 to 100 Myr).

Fig. 2: As Fig. 1 but in this case different symbols are used to identify the stars members of the Local Association, AB Dor moving group and B4 subgroup (see López-Santiago et al. 2006, IC2391 and Castor moving groups (Montes et al. 2006) and β Pic and Tau-her group (Krivov et al., 2006)). Using the equivalent width of the Li i line at 6707.8 Å, EW(Li i), determined by us plus additional values taken from the literature we have selected the stars with EW(Li i) above the upper envelope of the Pleiades open cluster (78 Myr), see Figs. 1 and 2. The membership to young moving groups like the Local Association, AB Dor, β Pic and Tau-her is defined in Fig. 2 with different symbols (see also the U, V diagram in Fig. 4).

Fig. 3: High resolution spectra of possible members of the β Pic moving group in the Hα and Li i λ6708 Å line region. Note the intense Hα emission of AO Men and HR 23390. HD 155355 is a SA2 system and the Li i line from both components is detected.

Here we show some representative spectra of one young stellar kinematic group, the β Pic association.

Fig. 4: Position in the (U, V) plane of the stars selected as possible PTTS and YMS.

The kinematics (galactic space velocity components, U, V, W) indicate that the whole selected stars are in the region of the young disk stars and very close to the position of the Local Association and other very young stellar associations and moving groups like AB Dor, β Pic, B4 of the Local Association, IC2391 and Castor (Montes et al. 2001, López-Santiago et al. 2006, Torres et al. 2008).

Fig. 5: As Fig. 1 for the stars in our recent survey of FGK stars in the solar neighborhood (d < 25 pc), see Martínez-Arnáiz et al. and Mallama et al. poster. We identify additional stars with gaps between those of the Pleiades and the Hyades, but no new PTTS.

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