In preparation to Gaia

compilation of late-type stars possible members of stellar kinematic groups

stellar streams, moving groups, and associations

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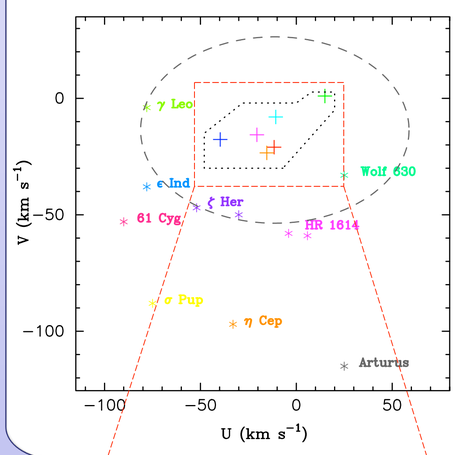
Abstract

In this contribution we present a compilation of **late-type stars (F, G, K and M)** possible members of the different **stellar kinematic groups** analysed in the literature. We include the young and old classical moving groups and superclusters, the recently identified young nearby loose associations as well as other stellar streams identified in recent surveys that contains large number of dwarf and giant stars. These stars was selected by using kinematics (with the precision currently available), by using an age-oriented method using relative age indicators (Li abundances, chromospheric and coronal emission and the kinematics) as well as color-magnitude diagrams and pre-main sequence isochrones or by chemical tagging. However, to add constraints to the membership and be able to discern between different groups of similar age a much better kinematic is needed and this will be only possible with the forthcoming precise data that **Gaia** will provide. The compilation provide here will be ready to use the data of Gaia as soon as will available in order to be able to better understand the stellar kinematic groups and discern between real physical structures of **coeval stars** with a common origin (debris of star-forming aggregates in the disk) and **field-like stars** (structures formed by resonance interactions, associated with dynamical resonances (bar) or spiral structure).

Classical Old Moving Groups

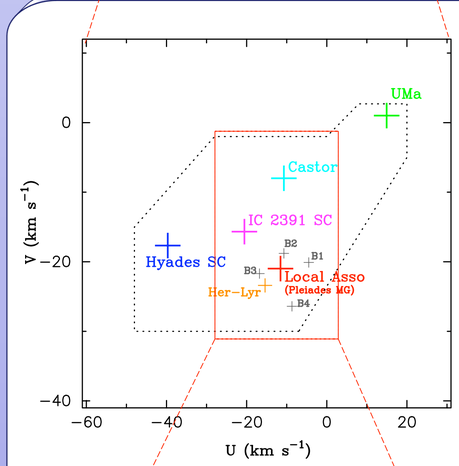


Name	U (km/s)	V (km/s)	W (km/s)
γ Leo	-78.0	-4.0	-1.0
Wolf 630	25.0	-33.0	13.0
ε Ind	-78.0	-38.0	4.0
ζ Her	-52.0	-47.0	-27.0
"	-30.0	-50.0	-
61 Cyg	-90.0	-53.0	-8.0
HR 1614	-4.0	-58.0	-11.0
"	5.8	-59.0	-
σ Pup	-75.0	-88.0	-21.0
η Cep	-33.0	-97.0	10.0
Arturus	25.0	-115.0	-3.0
Groombridge 1830	277.0	-157.0	-14.0
Kapteyn´s star	19.0	-288.0	-53.0

http://www.ucm.es/info/Astrof/invest/actividad/skg/old_skg.html

This table and figure shows the oldest moving groups located outside the boundaries (dotted line) that determine the young disk population as defined by Eggen (see Montes et al. 2001MNRAS.328...45) except Groomb 1830 and Kapteyn groups that have very high velocities.
In this figure it is also plotted in dashed line the velocity ellipsoid determined by Francis & Anderson 2009NewA...14..615 to eliminated high velocity stars.

Classical Young Moving Groups

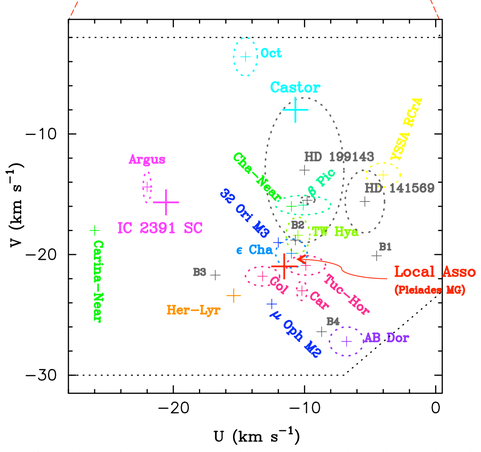


Name	Clusters	Age (Myr)	U (km/s)	V (km/s)	W (km/s)
Local Association (Pleiades moving group) (Stream 0)	Pleiades (M45, Melotte 22) σ Persei (Melotte 20) M34 (NGC 1039) delta Lyr (Stephenson 1) NGC 2516 (Mel 82) IC 2602 (theta Carinae)	20 - 300	-11.6	-21.0	-11.4
Hercules-Lyra	-	150 - 300	-15.4	-23.4	
IC 2391 supercluster	IC 2391 (o Velorum)	35 - (80 - 250)	-20.6	-15.7	-9.1
Castor Moving Group	-	~200	-10.7	-8.0	-9.7
Ursa Major group (Sirius supercluster) (Stream II)	Ursa Major (Collinder 285) M39 (NGC 7092)?	300 - 500	+14.9	+1.0	-10.7
Hyades supercluster (Stream I)	The Hyades (Melotte 25) Praesepe (M44) NGC 1901 (Bok 1)	~650	-39.7	-17.7	-2.4

http://www.ucm.es/info/Astrof/invest/actividad/skg/skg.html

The youngest (age < 650 Myr) and best documented moving groups (MG) in the solar vicinity are the Hyades, Ursa Major (UMa), Local Association (LA), IC 2391 and Castor (see Montes et al. 2001MNRAS.328...45 and references therein). Substructures in these MG have been found like the B1-B4 subgroups of the LA (Asiain et al. 1999A&A...341..427) and some possible new MG as Hercules-Lyra has been identified more recently (López-Santiago et al. 2006ApJ...643.1160).

Young Nearby Loose Associations

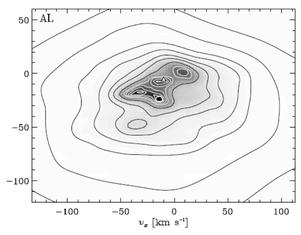


Name	d (pc)	Age (Myr)	U (km/s)	V (km/s)	W (km/s)
TW Hydrae	~50 (48+-13)	~10 (8)	-10.5	-18.0	-4.9
ε Chamaeleontis	~110 (108+-9)	6	-11.0	-19.9	-10.4
η Chamaeleontis Cluster	~97	8 (4-9)			
β Pictoris	~36 (36+-21)	~12 (10)	-10.1	-15.9	-9.2
HD 199143 (Capricornius Asso)	~48	~12 (10)	-10.0	-13.0	-13.0
"	"	"	-9.8	-15.5	-11.1
Great Austral Nearby Young Asso (GAYA)					
Tucanae - Horologium	(48 +- 7)	40 (30)	-9.9	-20.9	-1.4
Columba	(82 +- 30)	30 (30)	-13.2	-21.8	-5.9
Carina	(85 +- 35)	(30)	-10.2	-23.0	-4.4
Octans	(141 +-34)	(20?)	-14.5	-3.6	-11.2
Argus = IC 2391	(106 +-51)	(40)	-22.0	-14.4	-5.0
AB Doradus	(34 +-26)	50-120 (70)	-6.8	-27.2	-13.3
YSSA, Young Sco-Sgr Asso (ρ Oph & R CrA)	~100	8	-4.0	-13.4	-8.0
HD 141569	~100	~5	-5.4	-15.6	-4.4
μ Oph Cluster (Mamajek 2)	~170	~120	-12.5	-24.1	-4.9
32 Ori (Mamajek 3)	~92	~25	-12.0	-19.0	-9.0
Carina-Near	~30	~200	-26.0	-18.0	-2.0
Cha-Near	~90	~10	-11.0	-16.0	-8.0

http://www.ucm.es/info/Astrof/invest/actividad/new_associations_ys.html

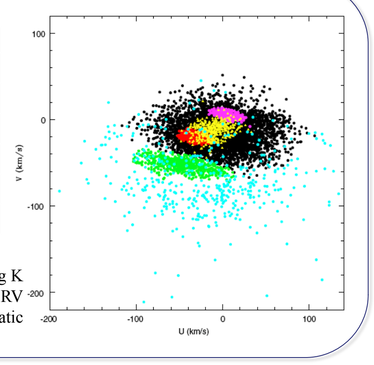
Several nearby associations of young stars have been identified in the last years, and a large number of then have U, V velocities in the region of the Local Association (Pleiades MG). In this table and figure we compile the more recent results from Torres et al., 2008hsf2.book..757; Zuckerman & Song 2004, ARA&A, Vol. 42, 685, and some other authors. Some initially indentified groups like HD 199143 later result to be part of the β Pic. Some recently identified associations result to be part or to be related with known MG or open clusters (like Argus = IC 2391).

Other Possible Moving Groups and Stellar Streams

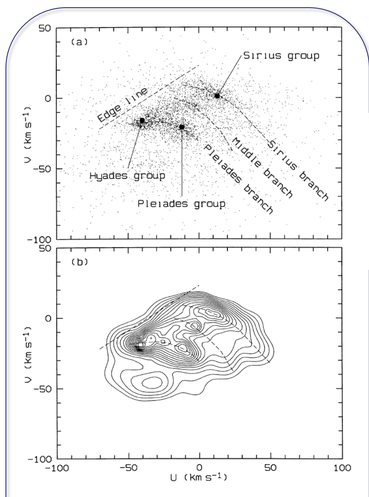


Dehnen 1998AJ....115.2384

Name of the group:	MG
Y: The young giants	-
HV: The high-velocity stars	-
HyPl: Hyades-Pleiades SC	HS, LA
Si: Sirius moving group	UMa
He: Hercules stream	Hercules
B: Smooth background	-



Famaey et al. 2005A&A...430..165 using K and M giants with HIP distances and RV from CORAVEL identified 6 kinematic groups.

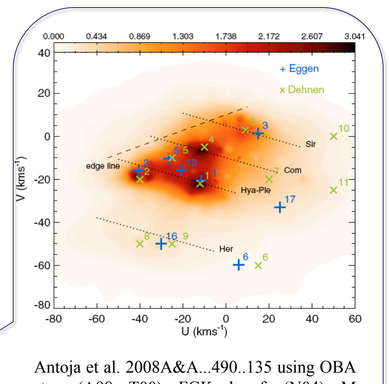


UV plane obtained by Skuljan et al., 1999MNRAS.308..731 for stars in the Solar neighbourhood, using HIP astrometry for over 4000 `survey' stars with parallaxes greater than 10 mas and radial velocities found in HIP.

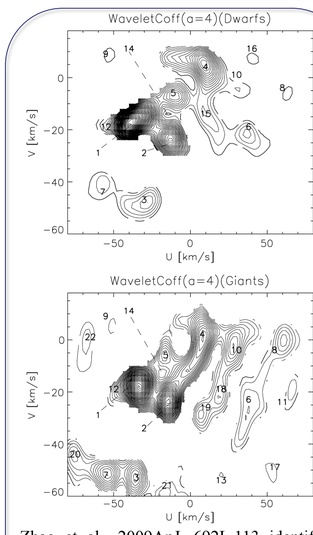
Table 3. Heliocentric velocities of the main moving groups according to (1) Dehnen (1998) and (2) Eggen (1971, 1996, and references therein).

Moving group	(1) U (km s^{-1})	(1) V (km s^{-1})	(2) U (km s^{-1})	(2) V (km s^{-1})
1 Pleiades (Stream 0)	−12	−22	−11.6	−20.7
2 Hyades (Stream I)	−40	−20	−40.4	−16.0
3 Sirius (Stream II)	9	3	14.9	1.4
4 Coma Berenices	−10	−5		
5 NGC 1901	−25	−10	−26.4	−10.4
6 HR1614	15	−60	5.8	−59.6
7	20	−20		
8	−40	−50		
9	−25	−50		
10	50	0		
11	50	−25		
12 IC 2391			−20.8	−15.9
13	−70	−10		
14	−70	−50		
15 61 Cygni			−80	−53
16 ζ Herculis			−30	−50
17 Wolf 630			25	−33

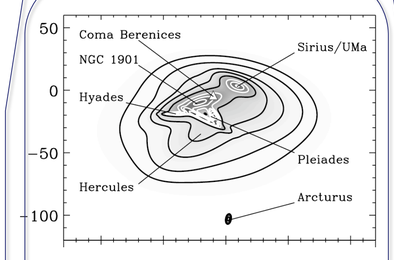
A detailed study of the possible relation between the different substructures found from all these authors and the well known moving groups and associations is under study.



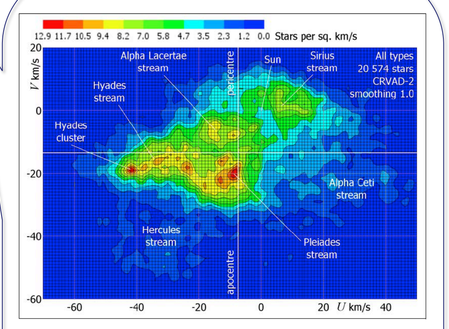
Antoja et al. 2008A&A...490..135 using OBA stars (A98, T00), FGK dwarfs (N04), M dwarfs (B05) and K and M giants (F05) confirm the Sirius, Coma Berenices, Hyades-Pleiades and Hercules branches and identified several substructures. They also analysed the distributions in the U–V-age-[Fe/H] space.



Zhao et al., 2009ApJ...692L.113 identified 22 moving group candidates in the solar neighborhood from a sample which includes around 14,000 dwarfs and 6000 giants.



Bovy et al., 2009ApJ...700.1794 present a three-dimensional reconstruction of the velocity distribution of nearby stars and find that there is little evidence for structure in the distribution function beyond the moving groups established prior to the Hipparcos mission. They cannot trust structures on scales smaller than ≈2 km/s.

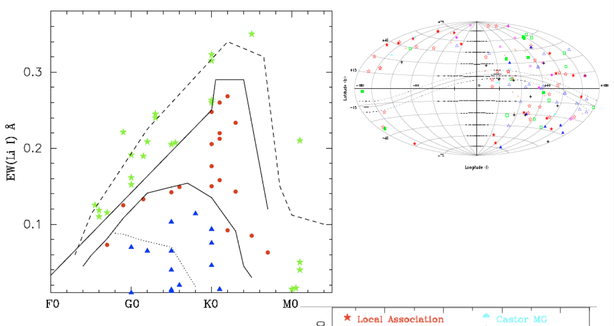


Francis & Anderson 2009NewA...14..615 and 2009arXiv0901.3503 obtain the the distribution in the UV plane of 20574 local stars in the New Hipparcos Reduction with known radial velocities. They also analysed the dependence on color and age identifying six mayor stellar streams.

Ongoing and future high resolution spectroscopic surveys of possible late-type stars members of the different stellar kinematic groups:

Survey late-type stars in MGs

Collaborators (UCM): Montes D., López-Santiago J., Gálvez-Ortiz M.C., Crespo-Chacón I., Martínez-Arnáiz R.M., Fernández-Figueroa M.J., De Castro E., Cornide M.

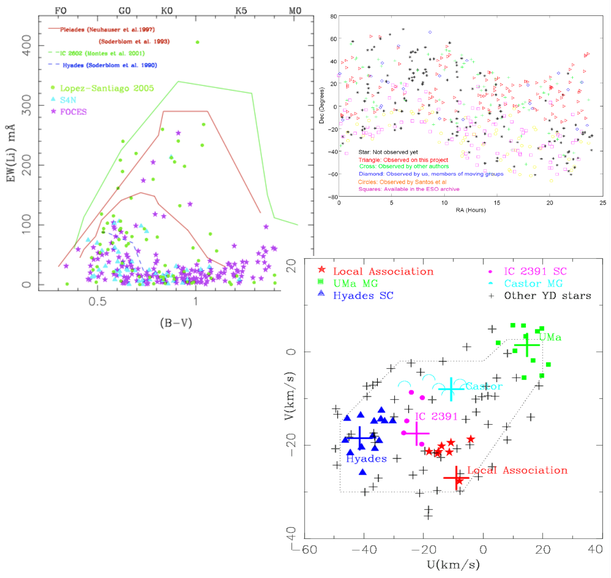


High resolution echelle spectroscopic survey of late-type stars, identified by Montes et al. 2001 MNRAS, 328, 45 as possible members of young MG. See Montes et al.
2001 A&A, 37, 976;
López-Santiago et al.
2005, PhD Thesis UCM;
2006 ApJ, 643, 1160;
2009 A&A, 499, 129;
2010 A&A, 514, A97.

This survey analyse in more detail the membership of these stars to the different young MG: kinematic membership (U, V, W), age-dating methods for late-type stars such as the chromospheric activity level and the lithium absorption line.

FGK in the solar neighbourhood

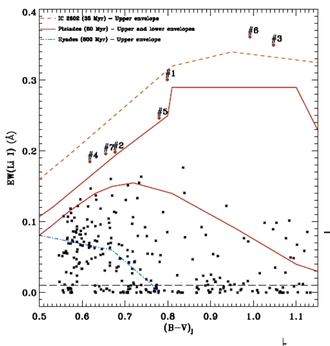
Collaborators (UCM, UAM, CAB): Montes D., Martínez-Arnáiz R.M., Maldonado J., Eiroa C., Montesinos M.

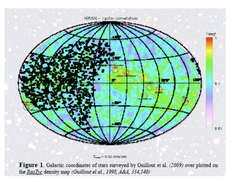


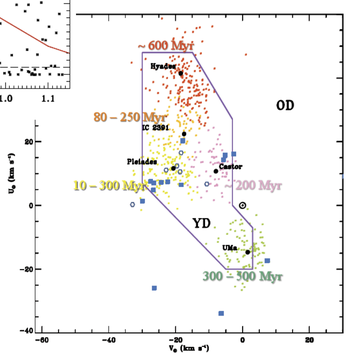
The survey of FGK stars in the solar neighborhood (d< 25 pc) which include the DUNES sample, an approved Herschel OTKP with the aim of detecting cool faint dusty disks provide also information about membership of these stars to young and old MG (Martínez-Arnáiz et al. 2008; 2010, A&A, astro-ph:1002.4391; Montes et al. 2009; Maldonado et al. 2008; 2010, A&A, in press)

RasTyc Survey

Collaborators (Strasbourg, Catania, UCM): Guillout P., Klutsch A., Frasca A., Freire Ferrero R., Marilli E., Montes D.

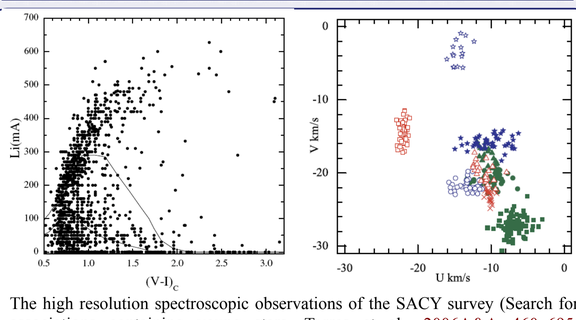






The spectroscopic survey of the youngest field stars in the solar neighbourhood selected from the RasTyc sample (cross-correlation of the ROSAT All-Sky Survey (RASS) with the TYCHO catalogue, Guillout et al. 2009, A&A, 504, 829) indentified new late-type stars MG members and new MGs. See also Klutsch et al. 2010, IAU, SpS07-p:56) and. Guillout et al. 2010, IAU, SpS07-p:79.

SACY Survey



The high resolution spectroscopic observations of the SACY survey (Search for associations containing young stars, Torres et al., 2006A&A...460..695; Viana Almeida et al., 2009A&A...501..965), dedicated to ROSAT all-sky X-ray sources in the Southern Hemisphere, confirm some previously known associations and identified some new ones (Torres et al., 2008hsf2.book..757).

Future Surveys

- Chemical Tagging:
The detailed analysis of the chemical signatures (chemical tagging) is another powerful method that provide clear constrains to the membership to these MGs. Using our previous high resolution spectroscopic observations and additional ones we are applying the chemical tagging to some MGs like the Hyades supercluster and Ursa Major MG (see Tabernero, Montes, González Hernández et al., 2012, 2014).

- Surveys centred on pre-Gaia or follow-up Gaia targets:
Additional high resolution spectroscopic observations will be needed in order to apply age-dating methods for late-type stars and be able to understand the nature of these kinematic structures. All this in the framework of Gaia complementary ground based observations related with the REG (Red para la Explotación Científica de Gaia), the Gaia GREAT working groups and GES the Gaia-ESO survey (Gilmore et al. 2012, Smiljanic et al. 2014, http://www.gaia-eso.eu).

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