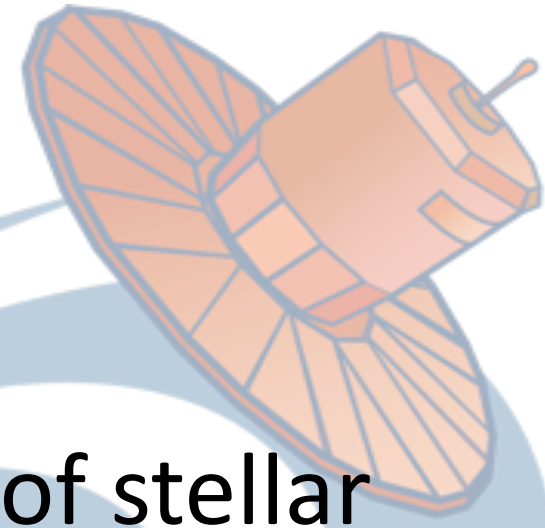

New clues on the formation of stellar clusters from the Gaia-ESO Survey

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R. Jackson, L. Spina, F. Palla and Gaia-ESO consortium

Open issues in cluster formation

- The influence of dynamics on YC properties (e.g. mass segregation)
- The initial condition to form bound clusters
- The effects of the SF environment on protoplanetary discs and young planetary systems

Goals of the Gaia-ESO Survey

- Unbiased census of the YC population
- Internal RV dispersions of YC
- RV structures and unseen multiple populations

Cha I
Nearby (160 pc), 2 Myr old, embedded cluster

Gamma Vel+NGC 2547
Intermediate age (15 and 35 Myr) gas free located in the Vela region

Porto, 12/11/2014

Cha I

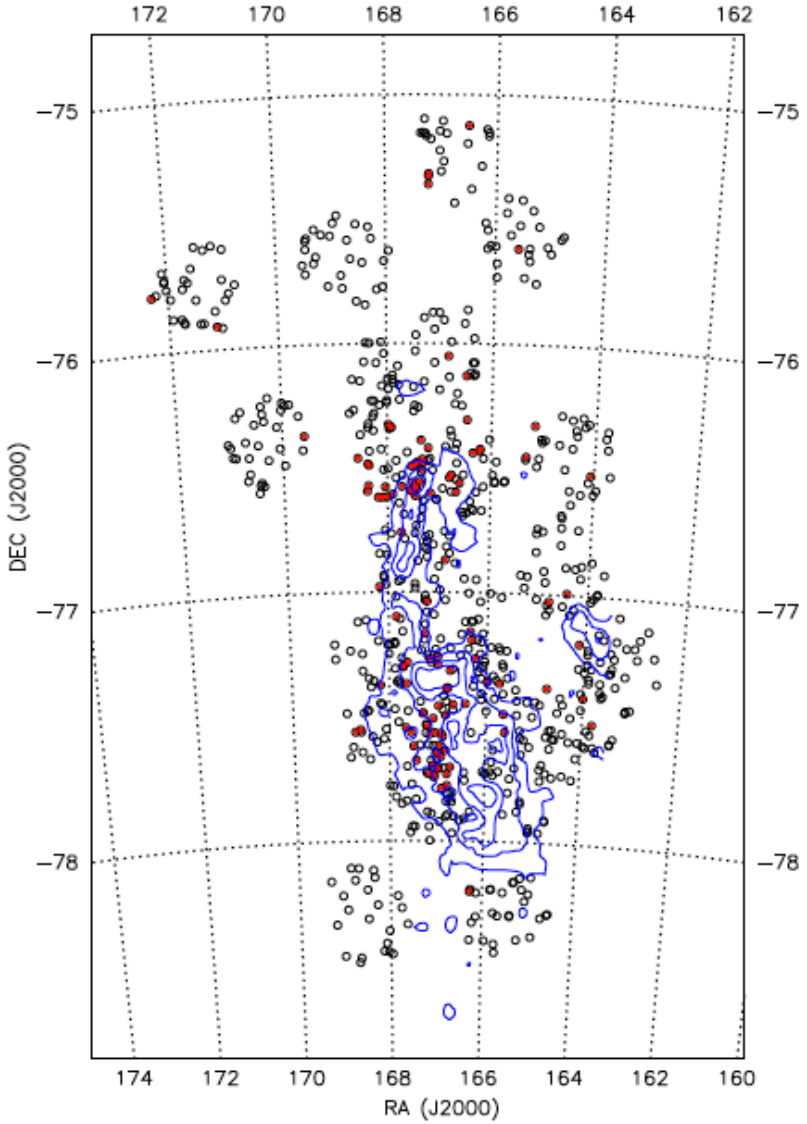
Main properties

- distance ≈ 160 pc
- age ≈ 2 Myr
- population ≈ 240 stars+BDs
- Partially embedded
- Gas mass 1000 $M_{\odot}$

(Luhman 2008)

GES Observations

- 25 fields
- 661 GIRAFFE+48 UVES targets (108 known members)
- Selection based on infrared photometry



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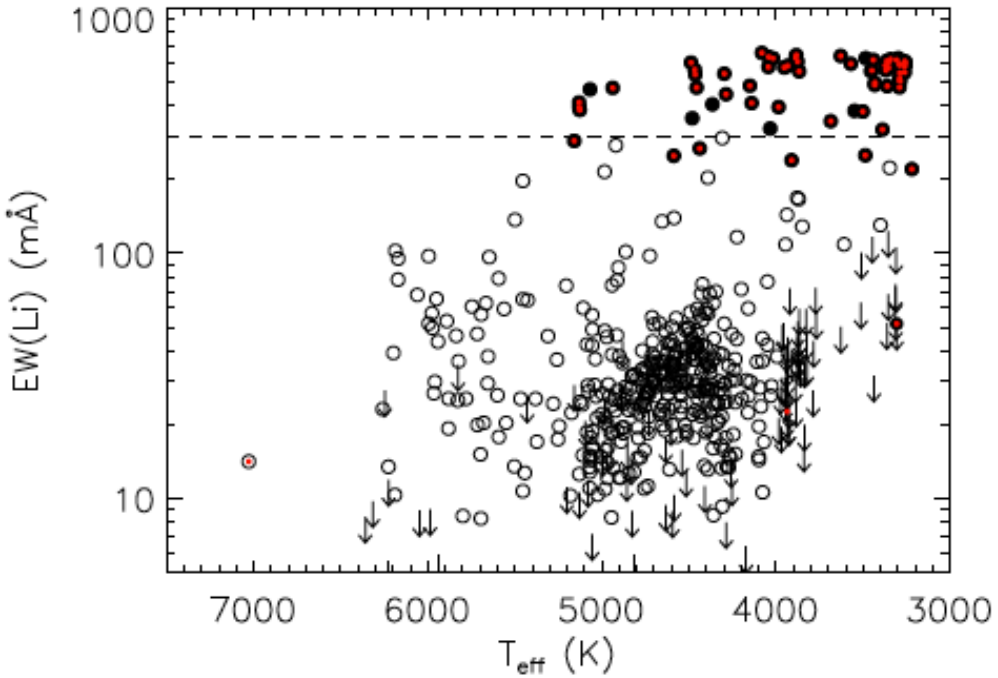
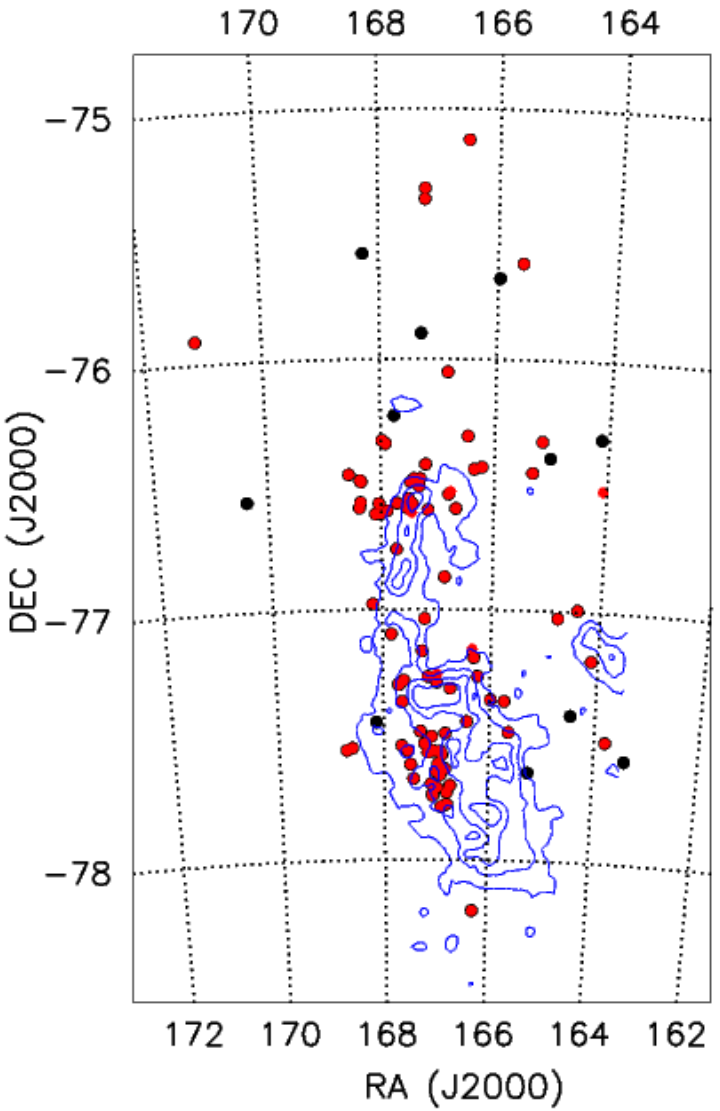
Cha I: membership

- Members selection based on Li line at 6708 Ang and Hα10% width

- 11 (out of 119) new members located in the the outer region





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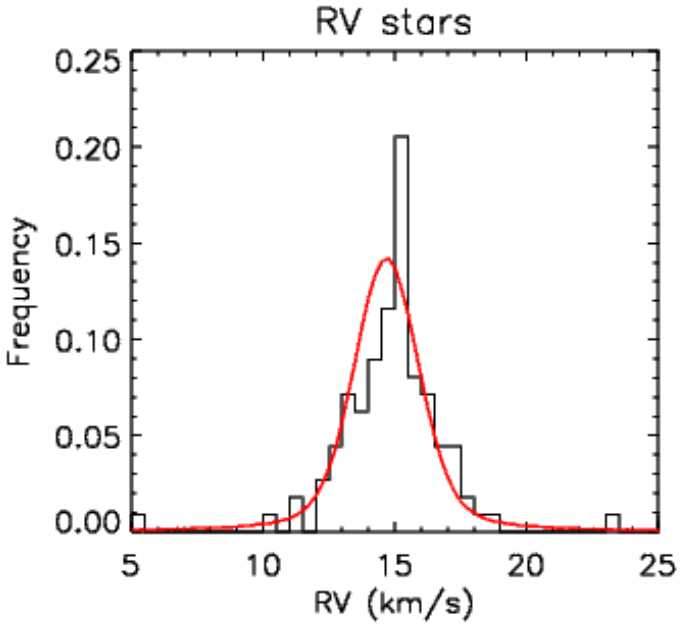
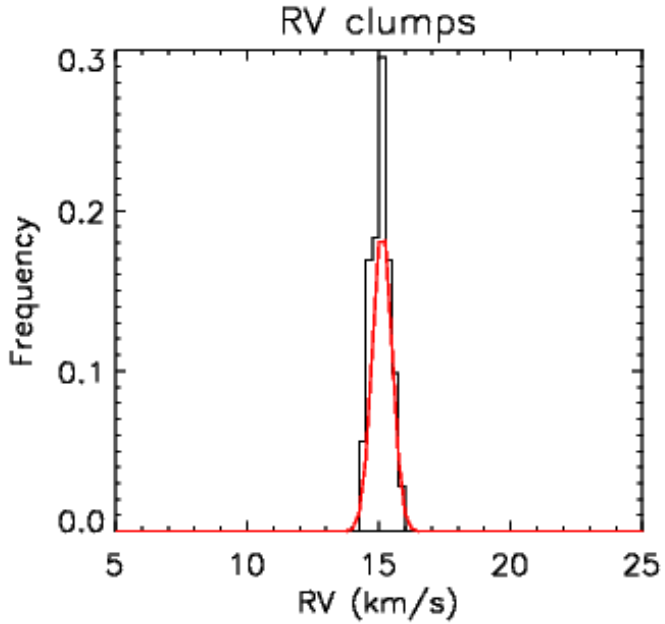
Cha I: dynamics





Intrinsic RV dispersion of the stars observed by GES σ_v=1.1 ± 0.1 km s^{-1} (taking into accounts errors and binarity)

RV dispersion of C^{18}O clumps (from Haikala et al. 2005)

σ_c=0.38± 0.1 km s^{-1}

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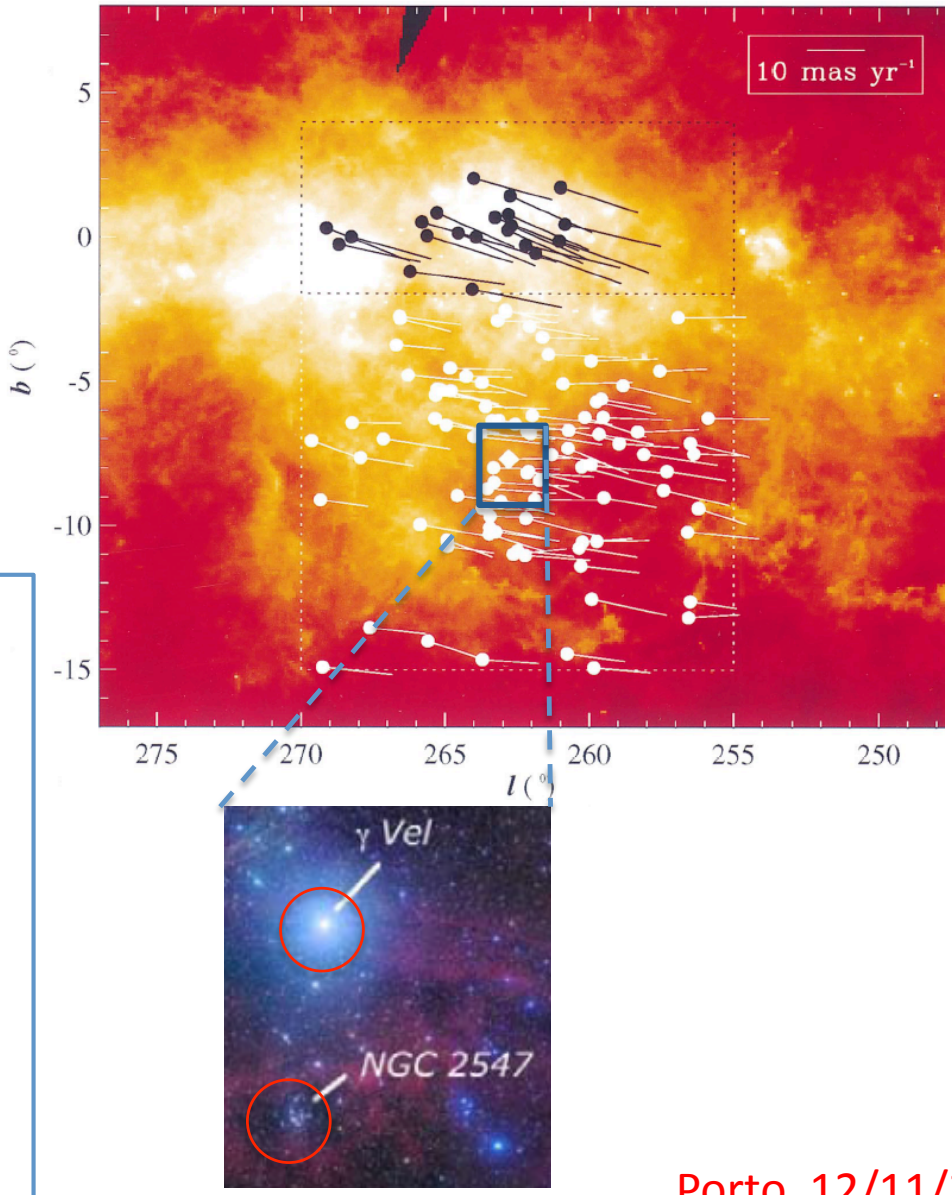
The Vela OB2 association

- Distance ≈ 350-400 pc
- Hipparcos Members = 93 (γ^2 Velorum, 81 B-type, 5 A type, 3 G type, 3 K type from de-Zeeuw et al. 1999)
- Area on the sky: 180 deg^2
- Most massive star: Wolf-Rayet WC8+O9 I binary (age ~ 5 Myr, total mass 39 $M_\odot$, de Marco & Schmutz 1999, Eldrige 2009)



GES Observations

Gamma Velorum
Age 5-10 Myr
located around γ^2 Velorum
field 1 deg^2

NGC 2547
Age 35 Myr
Located 2 degrees south of γ^2 Velorum
Field 1 deg^2

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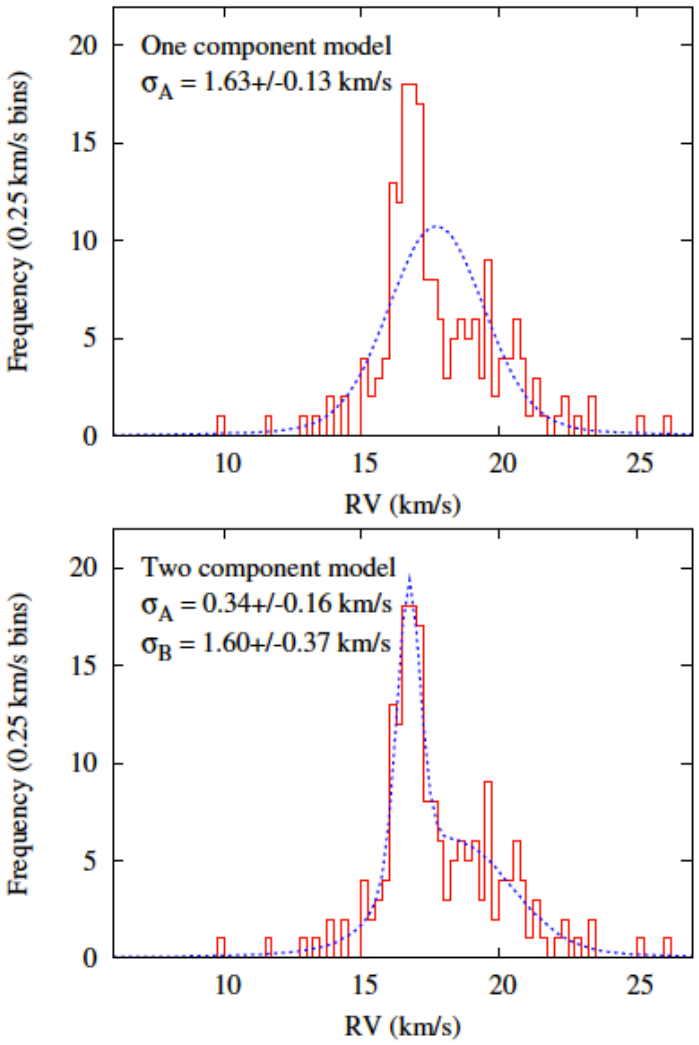
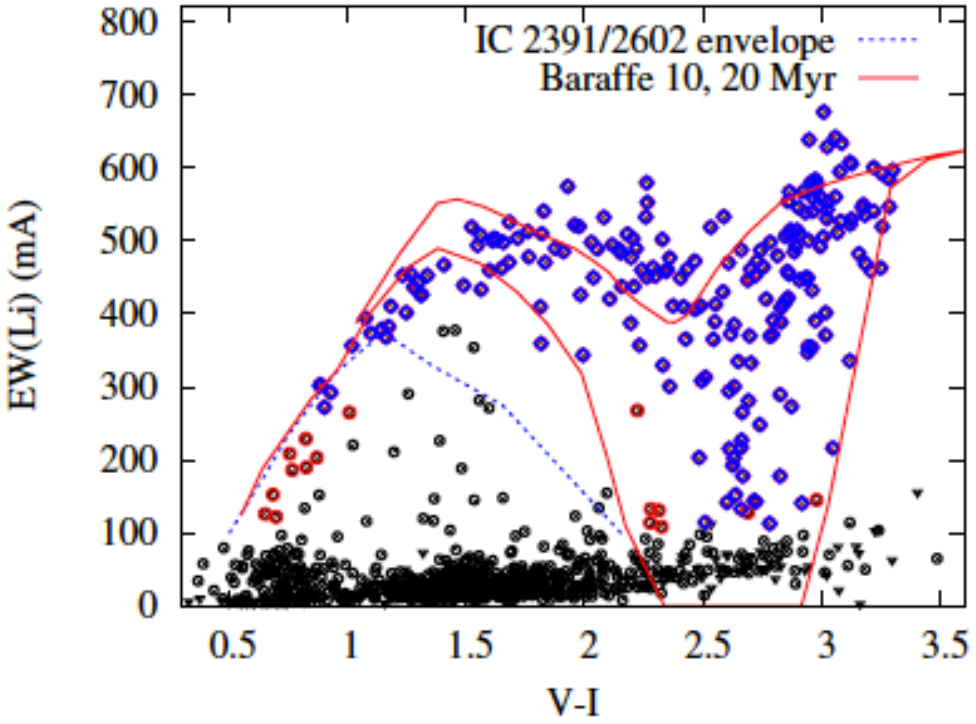
Gamma Velorum: membership & dynamics



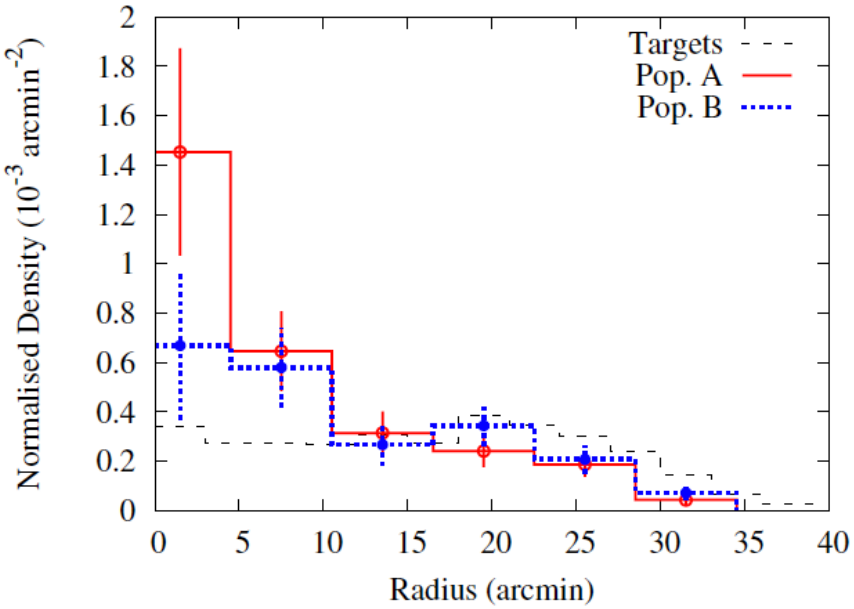
RV distribution of members shows the presence of two kinematically distinct populations

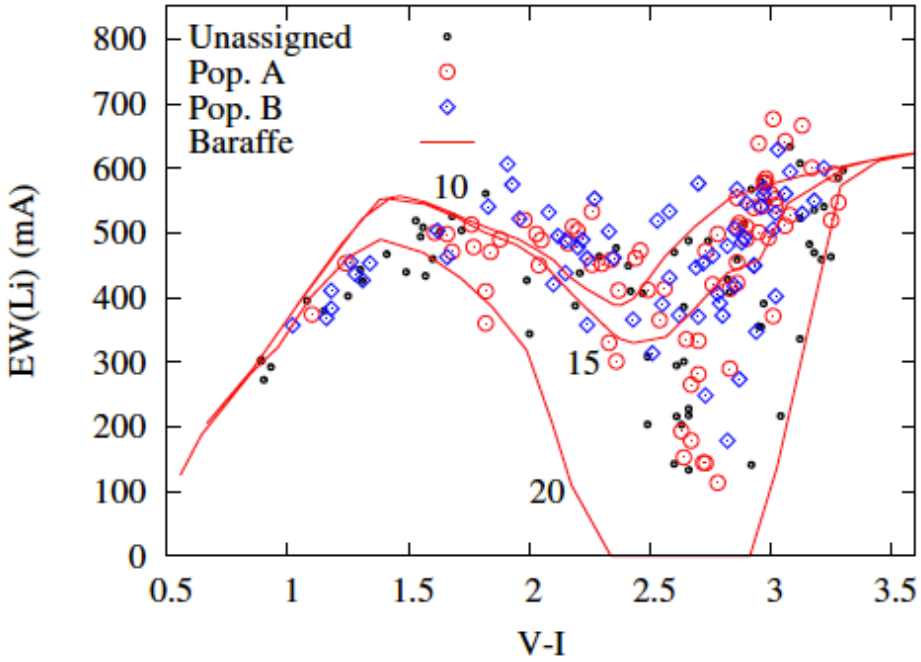
Membership selection based on Li and CMD



(Jeffries et al. 2014)

Gamma Velorum: star formation scenario





Population A

Age 10-20 Myr

Dynamically bound

Spatially concentrated aroung γ^2 Velorum

Population B

Age 10-20 Myr (but 1-2 Myr younger than Pop A)

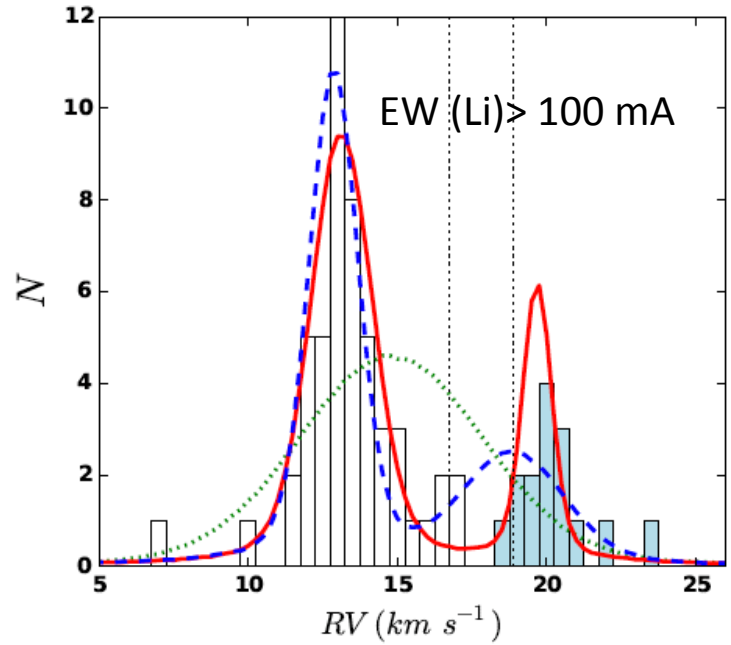
Clearly unbound

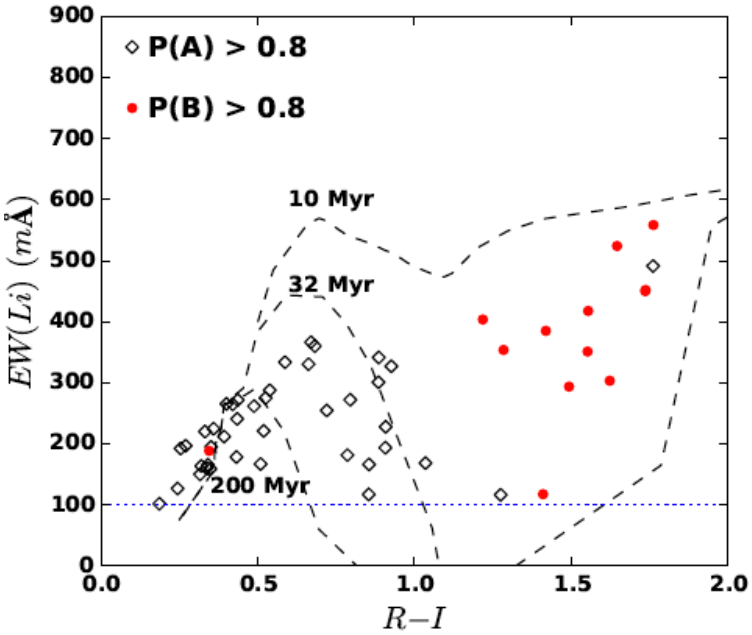
Not evidence of spatial concentration

Population B is probably part of the Vela OB2 association, while population A is the remnant of a cluster around γ^2 Velorum

(Jeffries et al. 2014)

Multiple population in NGC 2547





1. NGC 2547 is composed of two kinematically distinct populations;
2. The RV distribution of the secondary population is consistent with Gamma Velorum B;
3. Population B is much younger than population A

(Sacco et al. 2014, in prep.)

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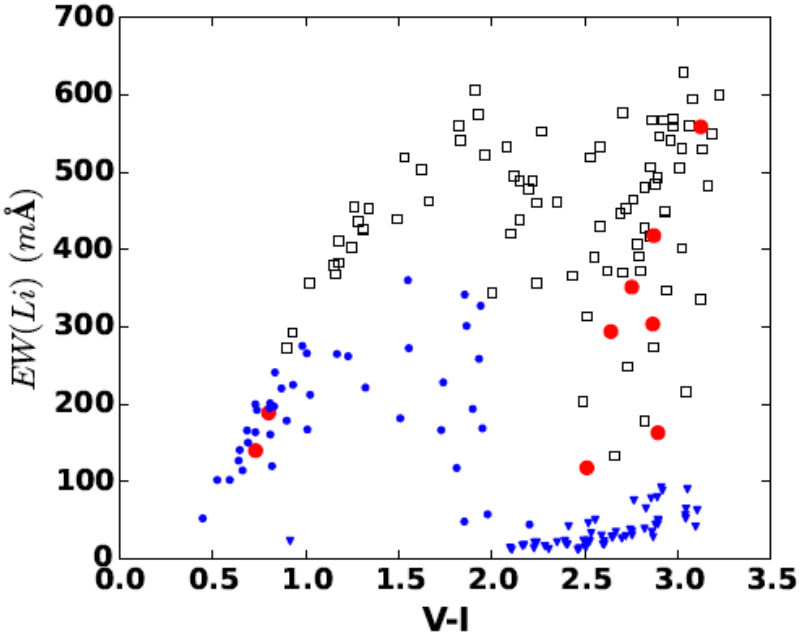
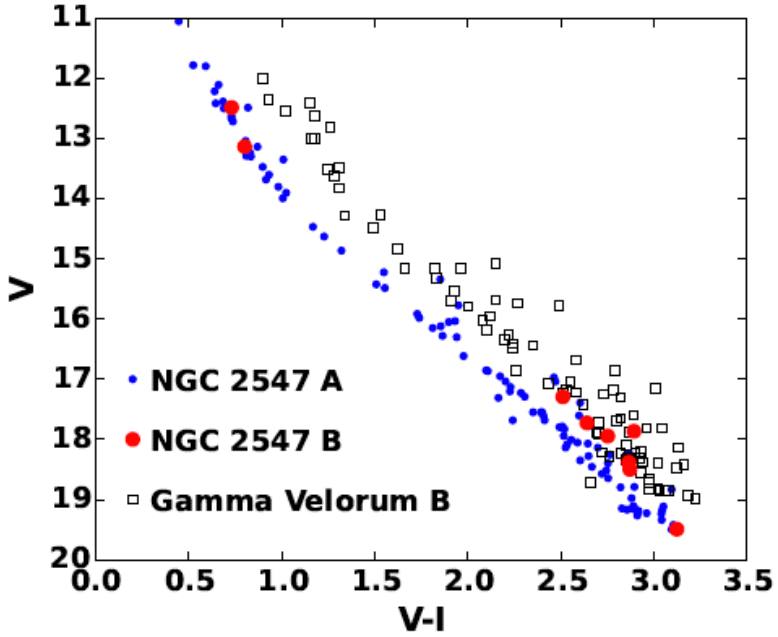
Gamma Velorum and NGC 2547 population B





Age and distance of NGC 2547 B (other than RV) are consistent with Gamma Velorum B

Gamma Velorum B is extended over 10-15 deg^2

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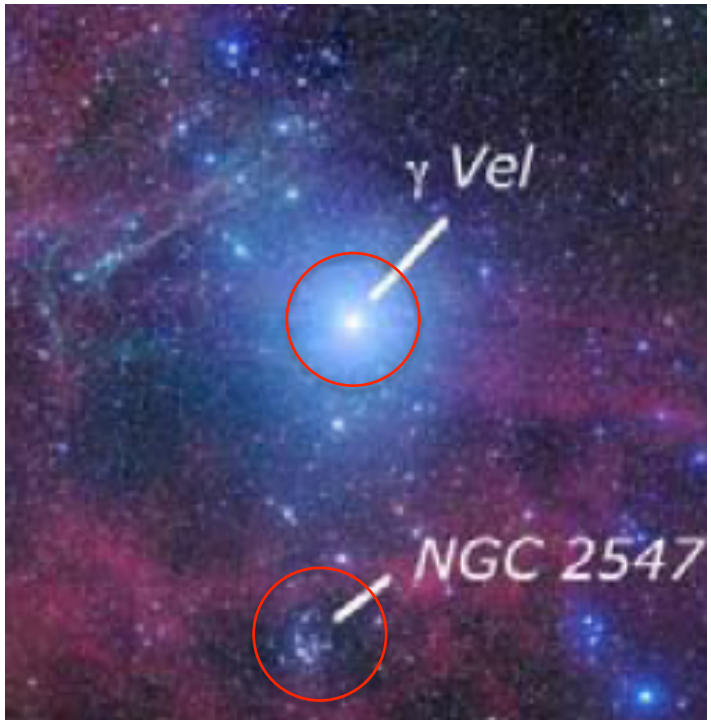
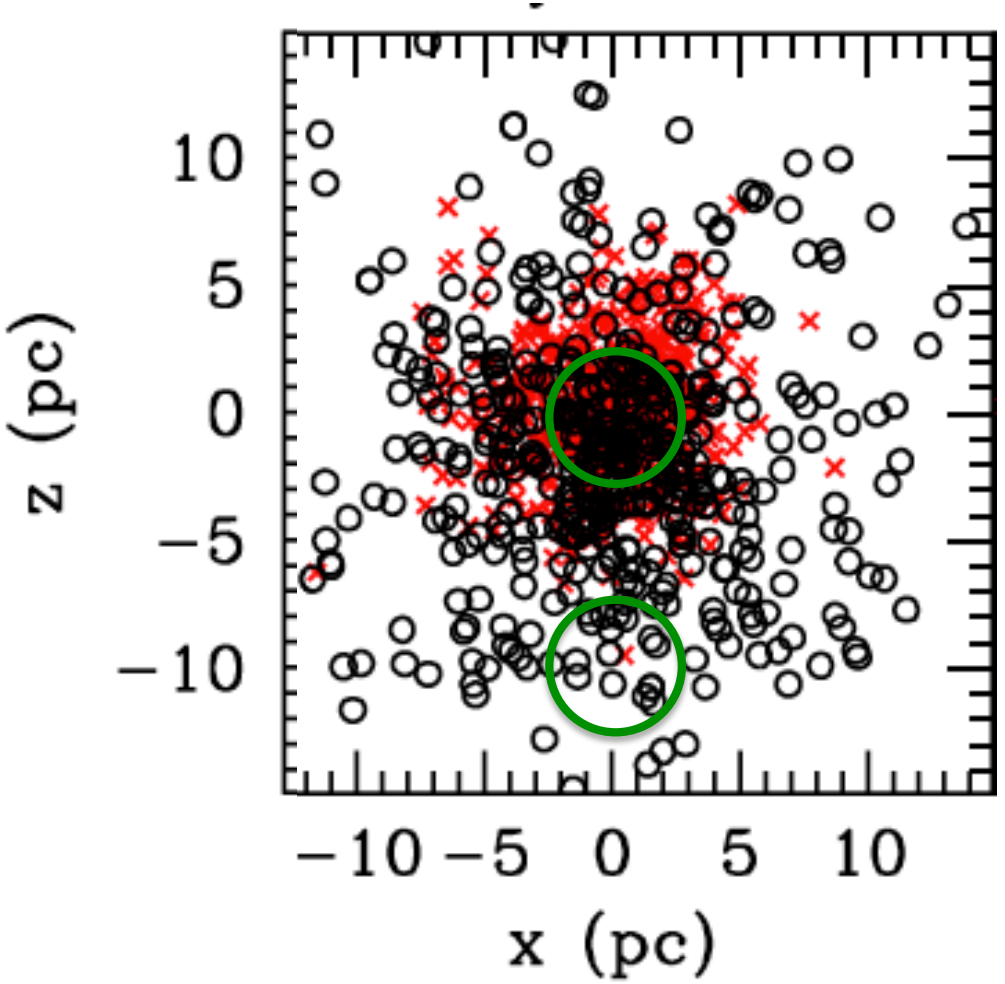
Vela OB2: Star formation scenario





(Courtesy of M. Mapelli et al. 2014)

Conclusions

Thanks to the strategy used for the target selection and the precision of the RVs, the Gaia-ESO Survey is a powerful dataset for studies of cluster dynamics. We outlined some of the results obtained for the young embedded cluster Cha I and the clusters Gamma Velorum and NGC 2547 in the Vela region:

- We discovered new members in the low density outer region of Cha I

- We measured the intrinsic radial velocity dispersion in Cha I

- We discovered in the Vela region a very complex system composed of two clusters, one bound and one supervirial and extended over several pc^2

Porto, 12/11/2014