The Open Cluster population as seen by Gaia

Caroline Soubiran

SF2A 2019

14 mai 2019

The Open Cluster population as seen by Gaia

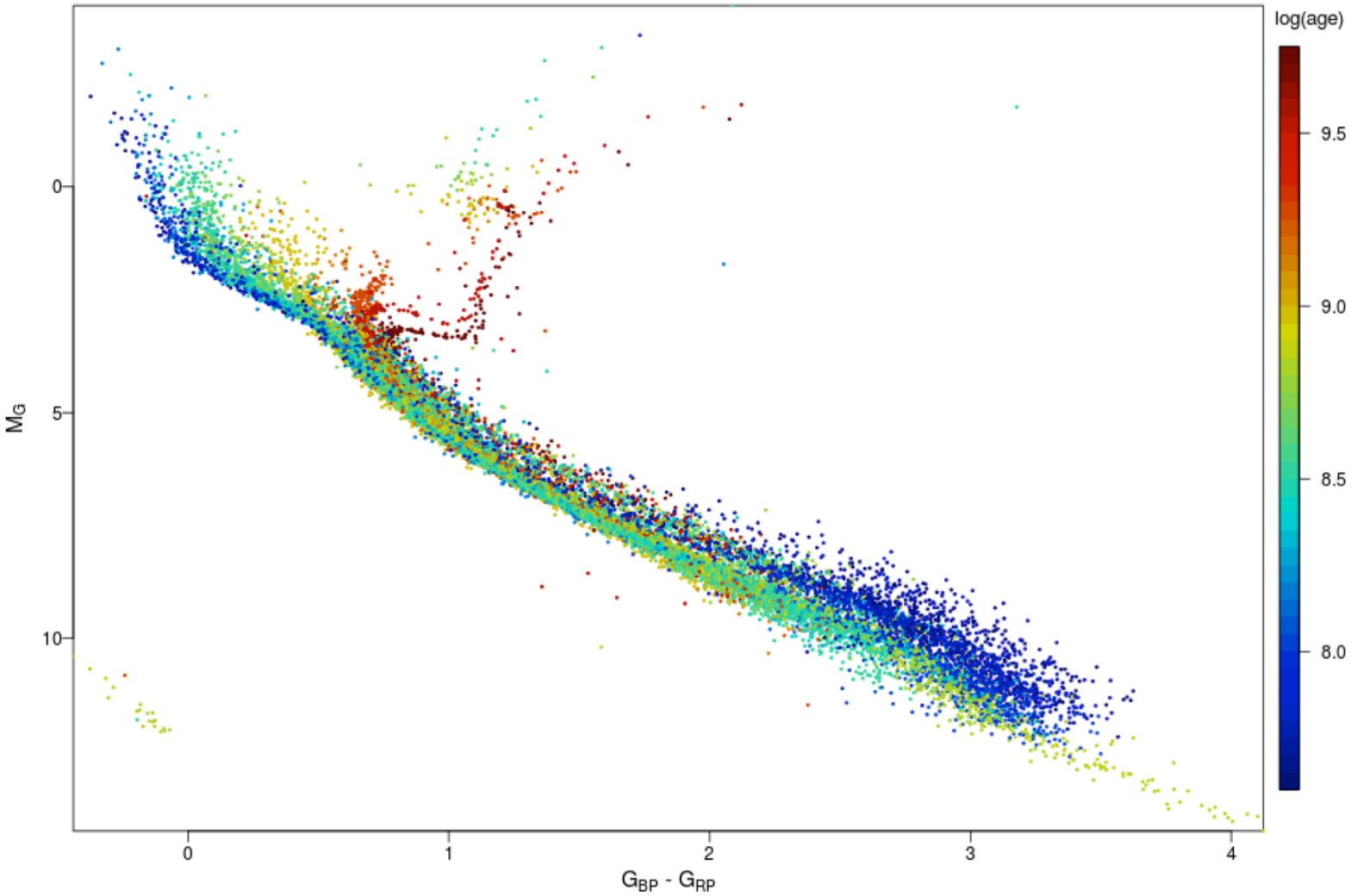
Gaia DR2

- positions
- parallaxes
- proper motions
- radial velocities
- G, Bp, Rp magnitudes

→ **New memberships** for an unprecedented number of stars and clusters

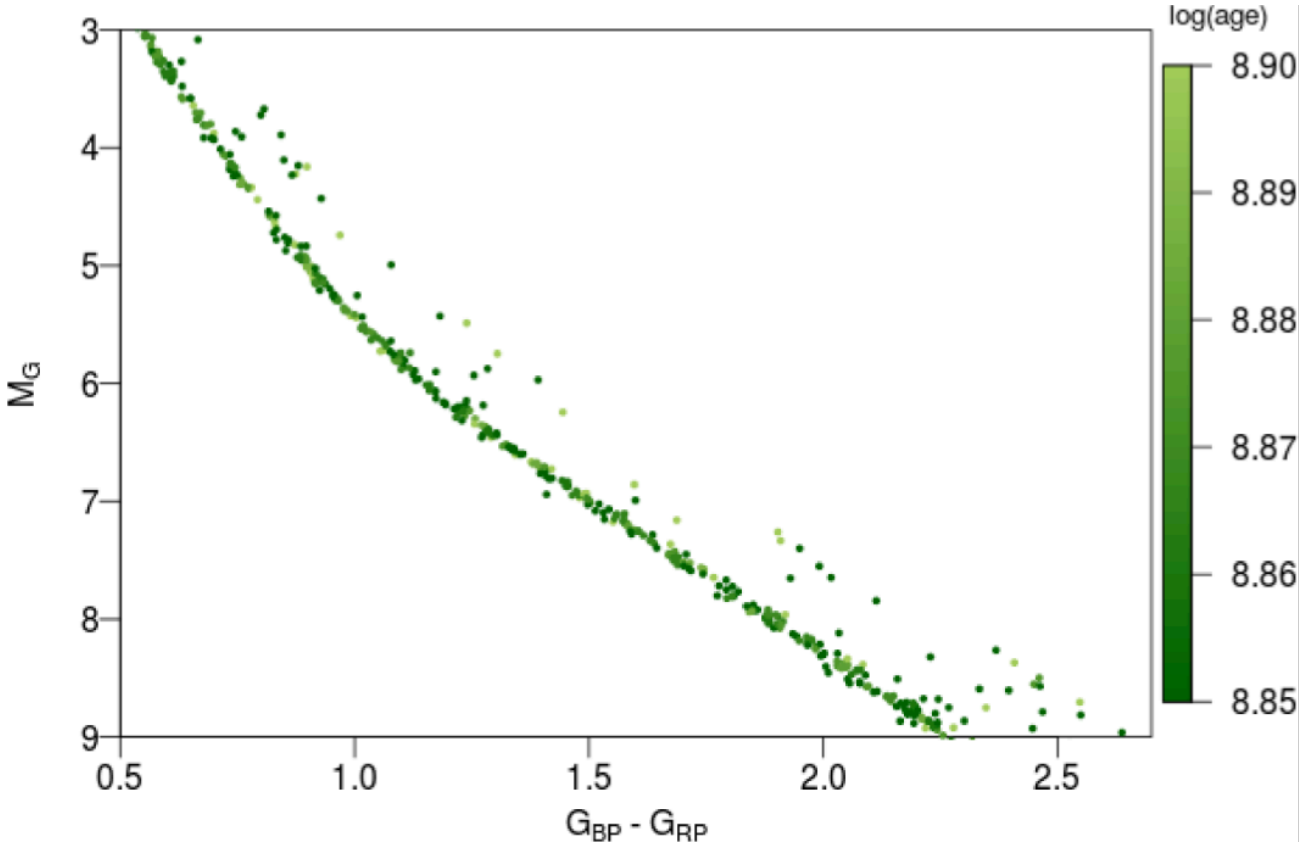
- 3D distribution in the Galaxy
- Kinematics
- Ages
- Physical properties

Composite HRD for 32 open clusters



Gaia Collaboration, Babusiaux et al. 2018A&A...616A..10G

The Hyades and Pleiades MS



Gaia Collaboration, Babusiaux et al. 2018A&A...616A..10G

A new large catalogue

A&A 618, A93 (2018)
https://doi.org/10.1051/0004-6361/201833476
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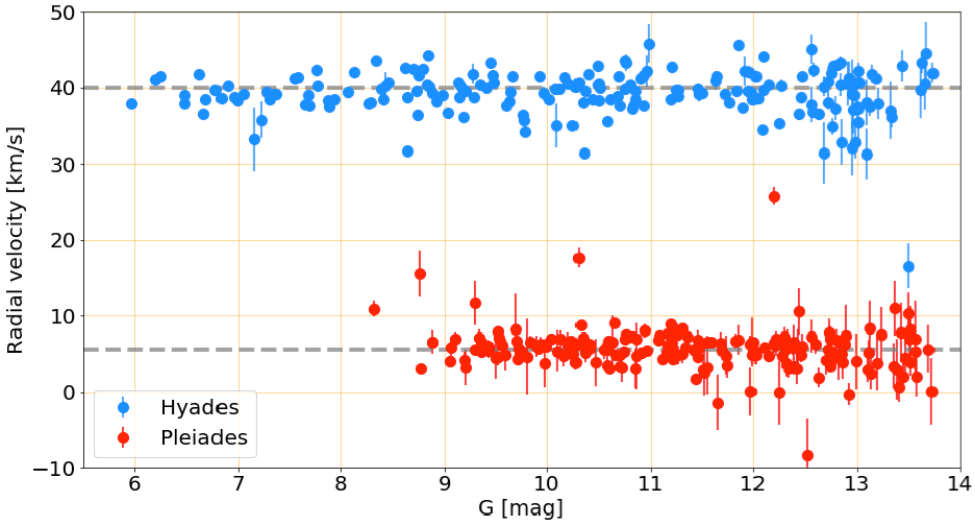
Astronomy & Astrophysics

A *Gaia* DR2 view of the open cluster population in the Milky Way★

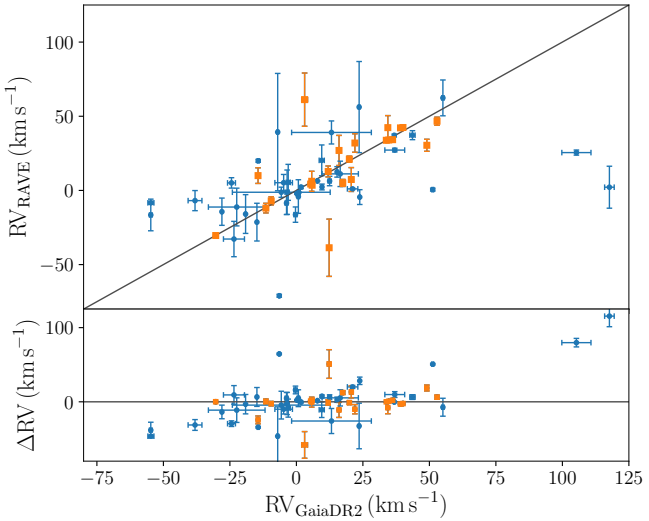
T. Cantat-Gaudin[1], C. Jordi[1], A. Vallenari[2], A. Bragaglia[3], L. Balaguer-Núñez[1], C. Soubiran[4], D. Bossini[2], A. Moitinho[5], A. Castro-Ginard[1], A. Krone-Martins[5], L. Casamiquela[4], R. Sordo[2], and R. Carrera[2]

- systematic search of members around ~3000 open clusters from literature
- membership probabilities for ~400000 stars
- most probable distances for 1229 open clusters

Unprecedented RV survey

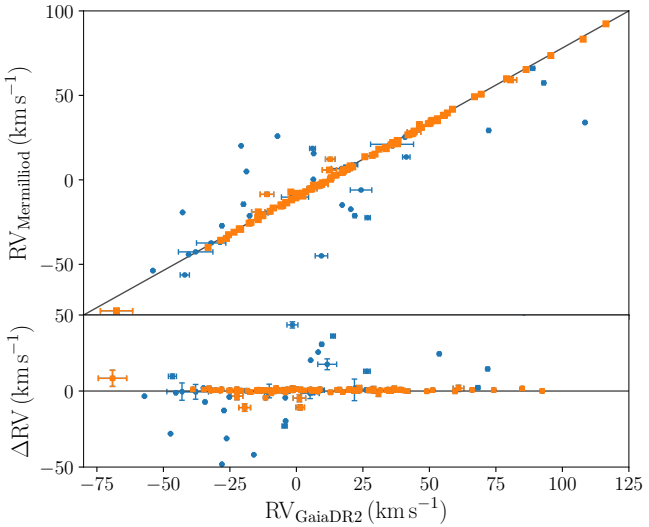


Katz et al. 2019A&A...622A.205K



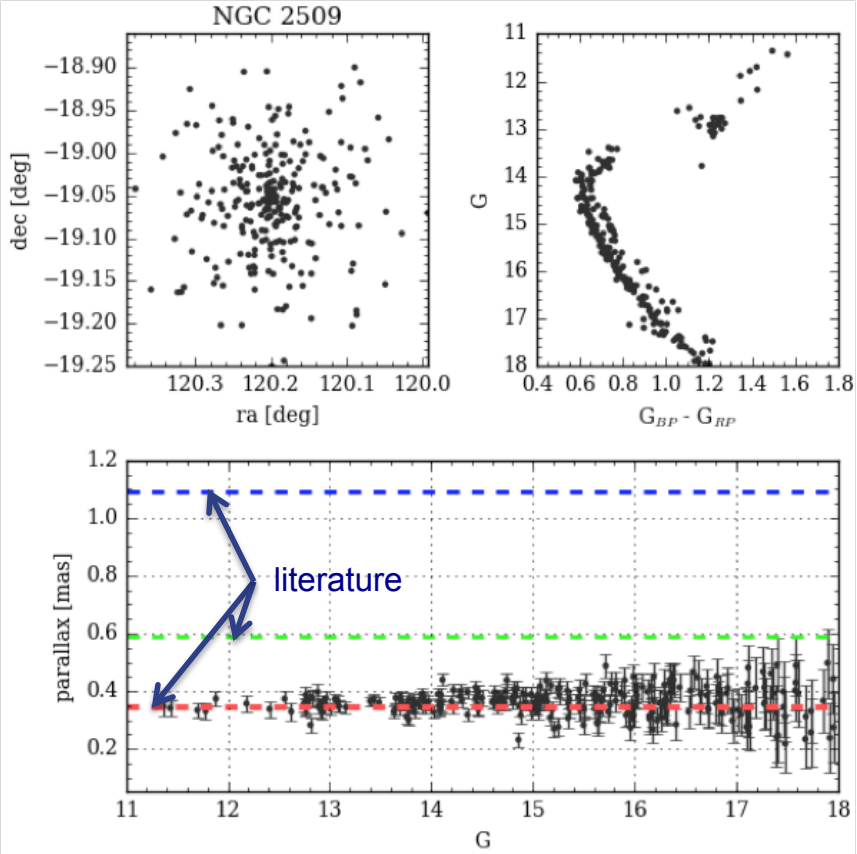
Validation

- RV dispersion
- comparison to literature

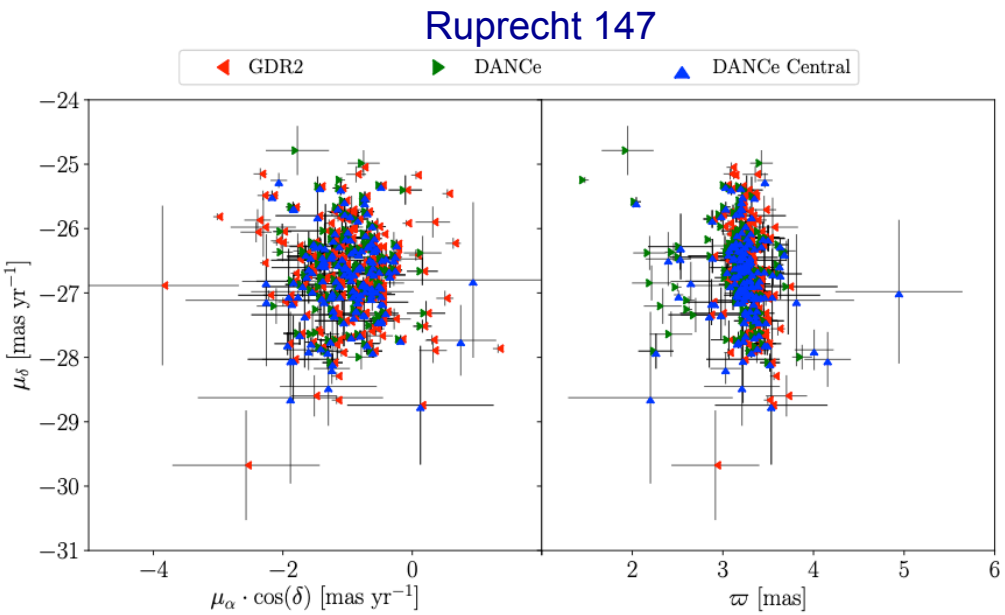


Soubiran et al. 2019A&A...623C...2S

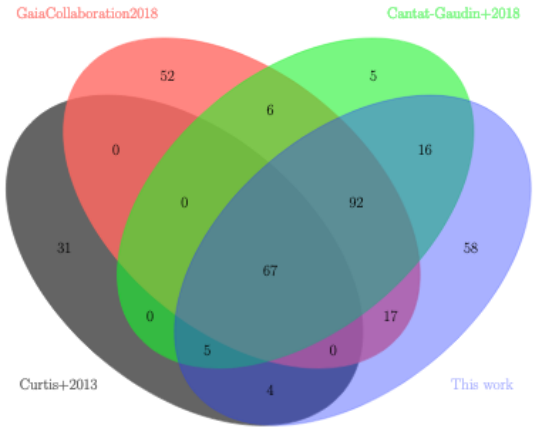
New methods for membership



Cantat-Gaudin et al. 2018A&A...618A..93C

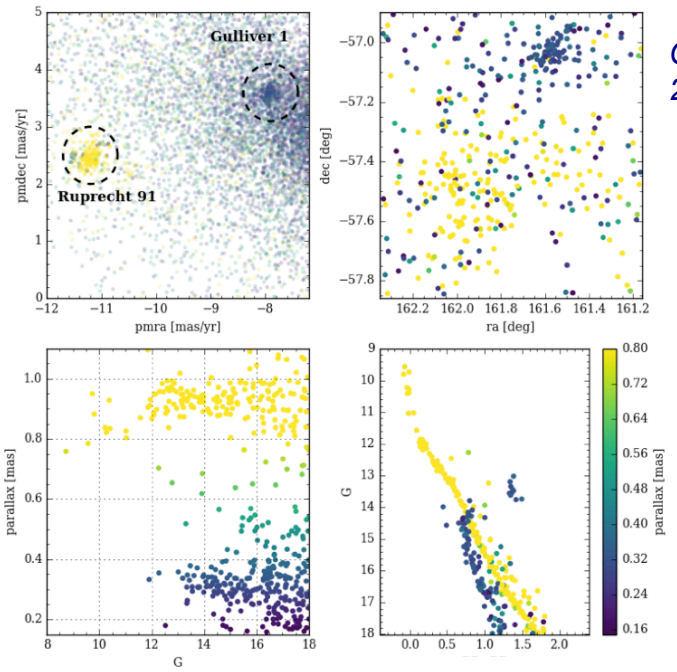


Olivares et al. 2019arXiv190205753O

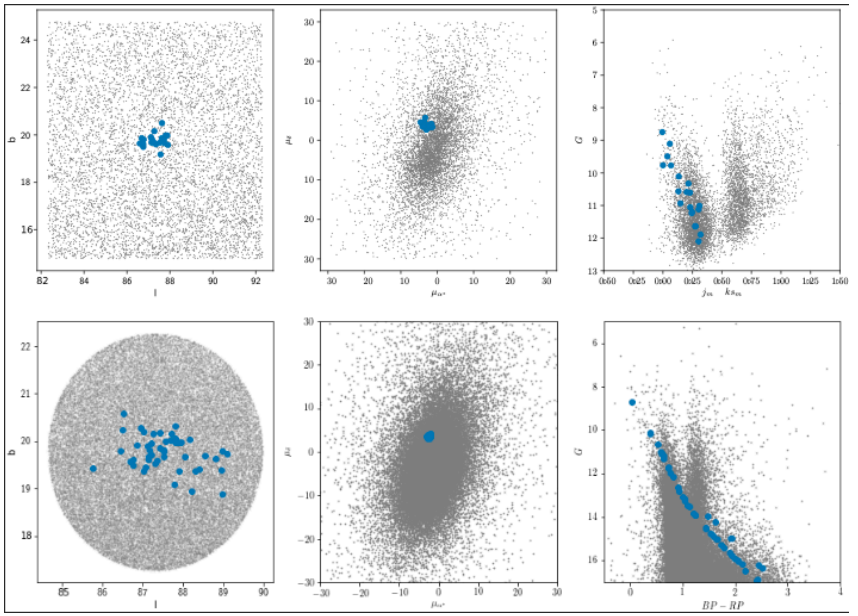


Results depend on the consideration of
- astrometry + photometry + RV + other data
- errors + correlations
- method

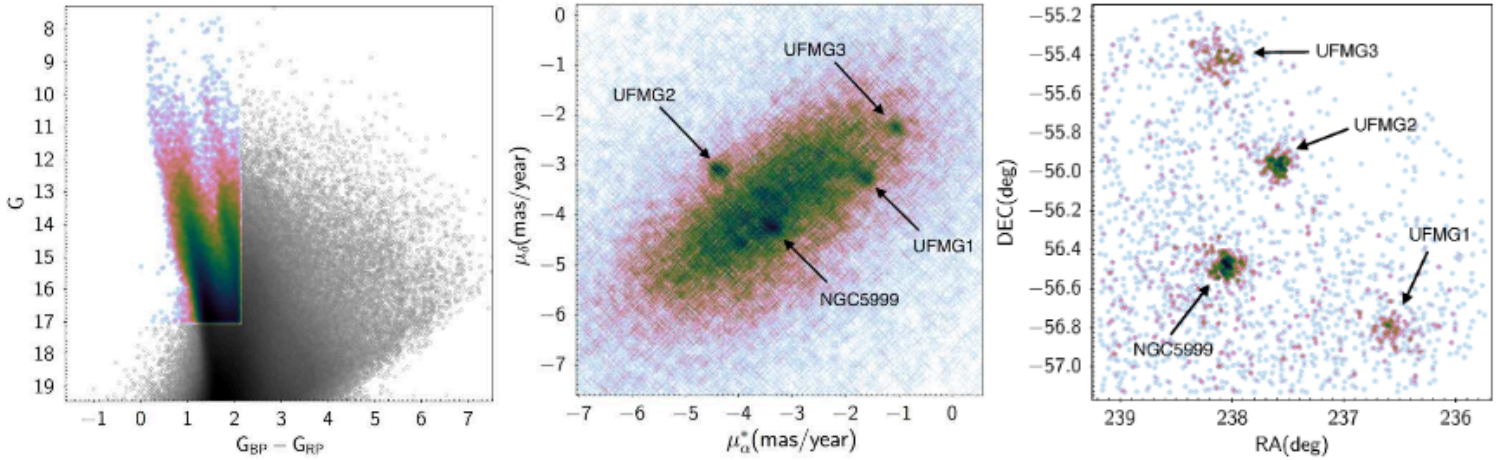
New open clusters



Cantat-Gaudin et al.
2018A&A...618A..93C



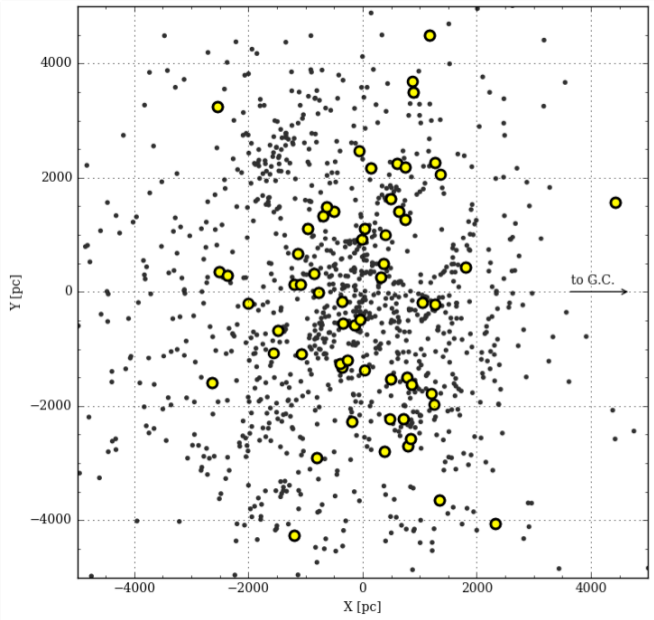
Castro-Ginard et al.
2018A&A...618A..59C

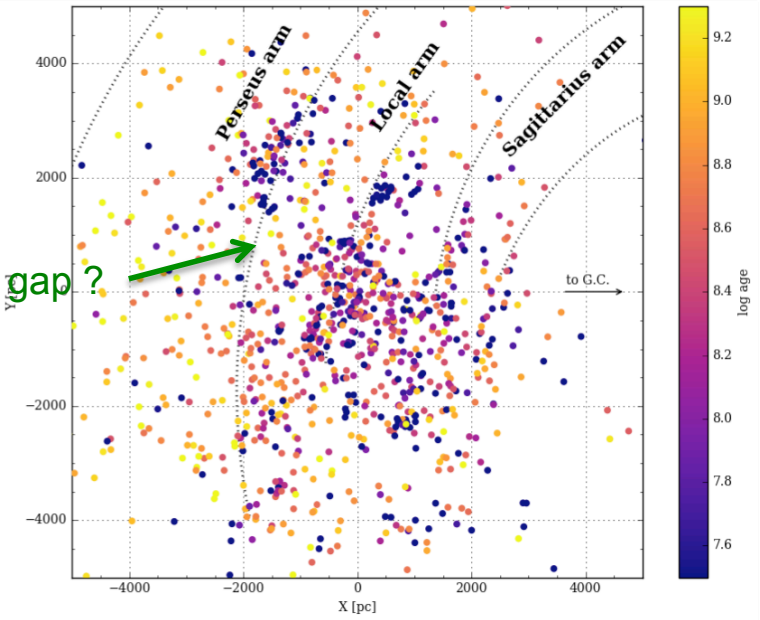


Ferreira et al.
2019MNRAS.483.5508F

Galactic distribution of open clusters

new clusters

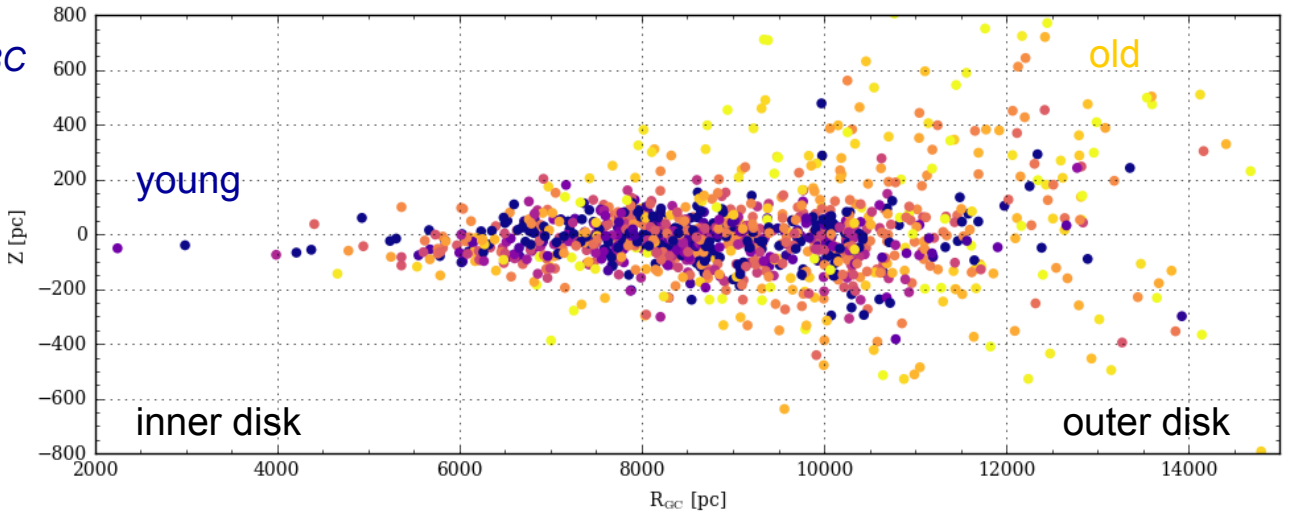




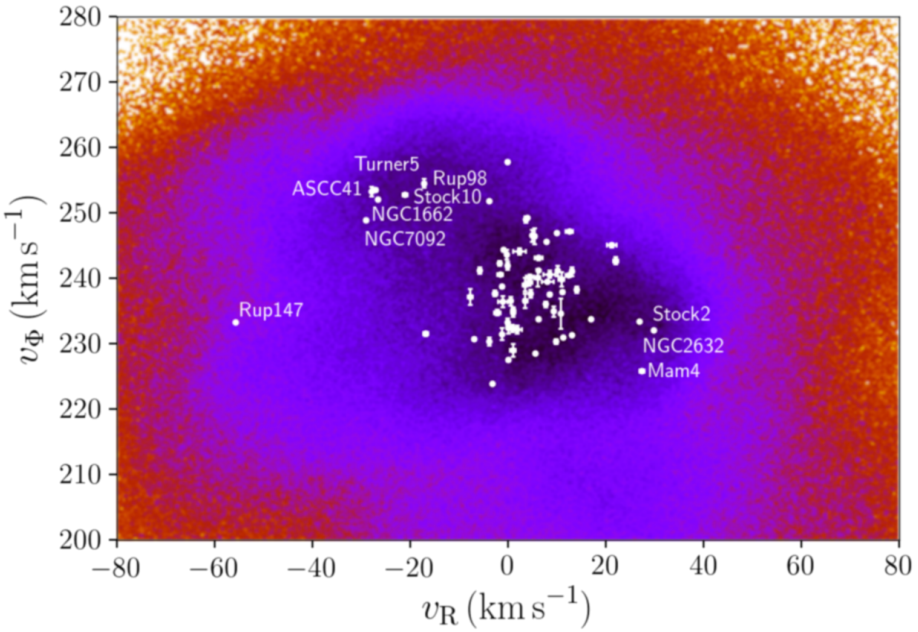
young cllusters trace the arms

Cantat-Gaudin et al. 2018A&A...618A..93C

no high-altitude clusters with R_{GC} < 7 kpc



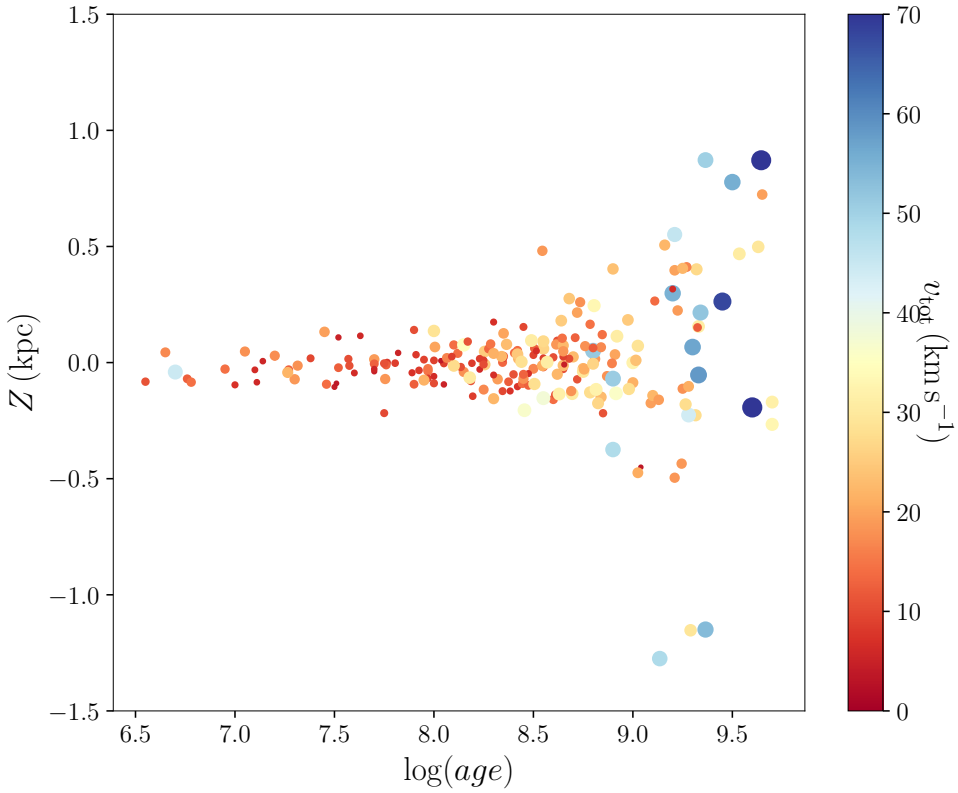
Kinematics of open clusters



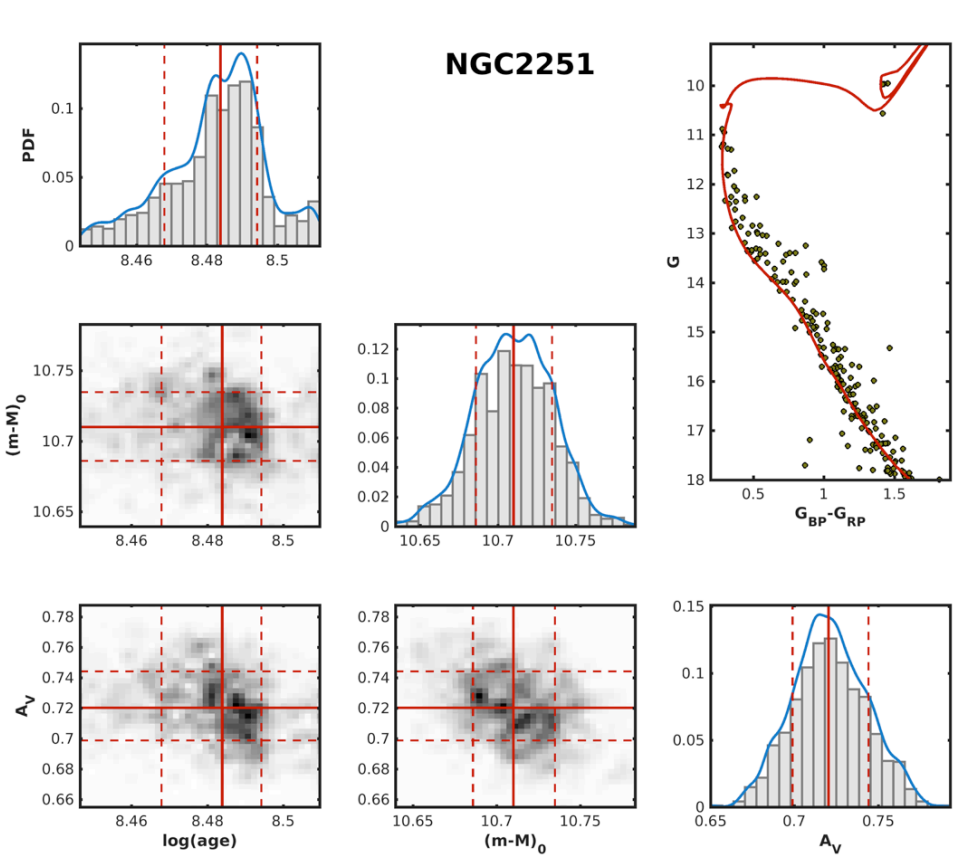
Soubiran et al. 2018A&A...619A.155S

OCs follow the kinematics of disc stars
dispersion of vertical velocity :

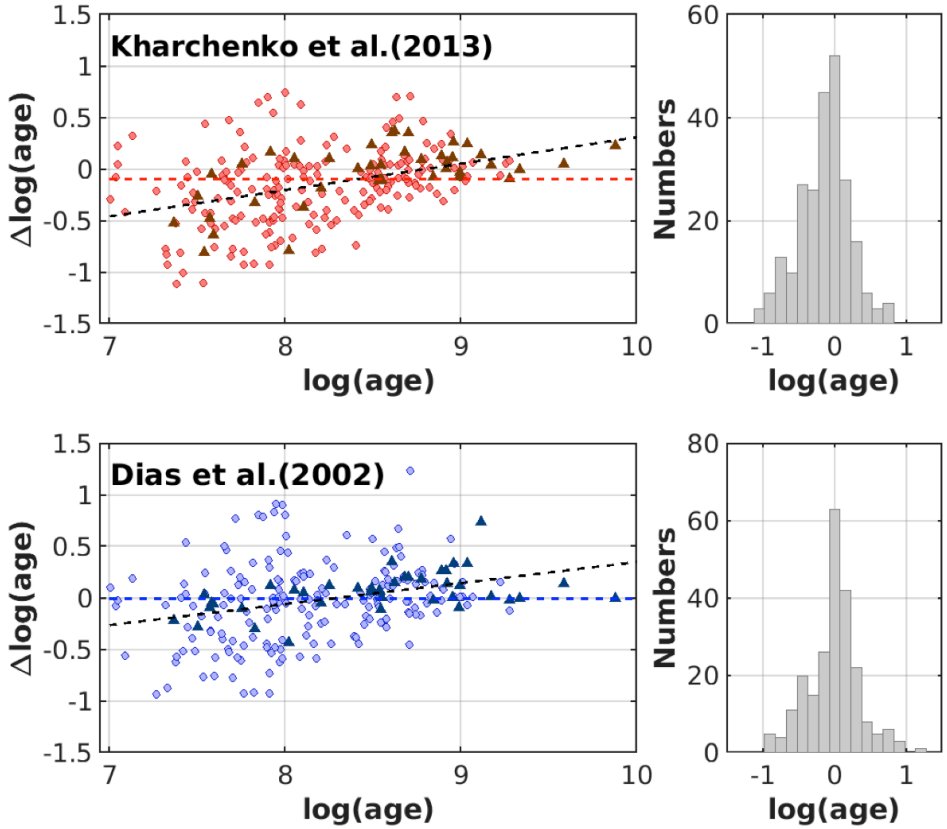
- 5 km/s for young clusters
- 14 km/s for older clusters



Ages of open clusters



Bossini et al. 2019A&A...623A.108B



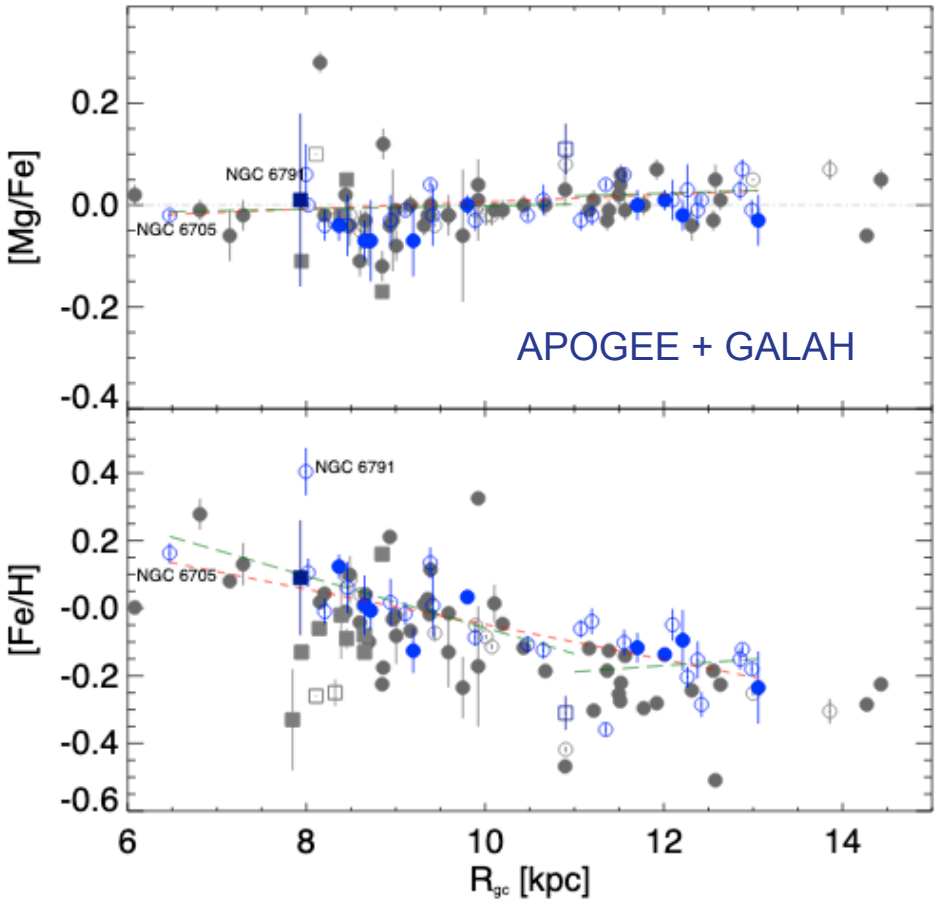
isochrone fitting with bayesian approach

269 OCs : the largest homogeneous sample

Complementary photometry needed to deconvolve age, extinction and metallicity

Metallicities of open clusters

Combination with ground-based spectroscopic surveys



Carrera et al. 2019A&A...623A..80C

or with high resolution spectroscopy
→ talk by L. Casamiquela

More to come with Gaia ESO, WEAVE which have dedicated observations on OCs
→ galactic abundance gradients
→ intrinsic abundance variations
→ chemical tagging

Extended structures around old OCs

Hyades
Röser et al. 2019A&A...621L...2R
Meingast & Alves 2019A&A...621L...3M
Lodieu et al. 2019A&A...623A..35L

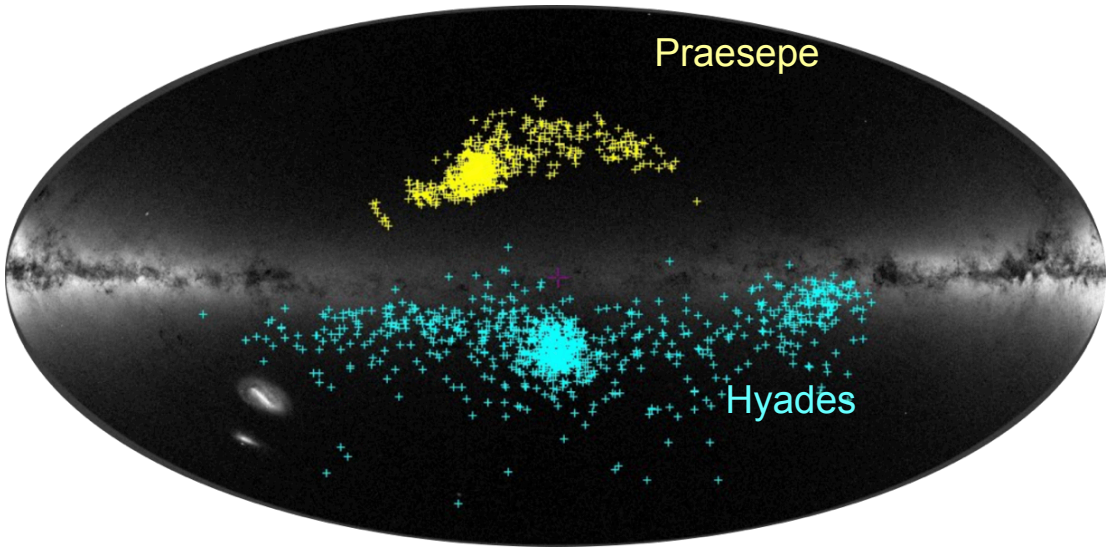
Coma Berenices
Tang et al. arXiv:1902.01404
Fürnkranz et al. 2019A&A...624L..11F

Ruprecht 147
Yeh et al. 2019AJ....157..115Y
Olivares et al. 2019arXiv190205753O

M67
Carrera et al. 2019arXiv190502020C

Praesepe
Röser & Schillbach arXiv:1903.08610

Members up to 200pc from the center → learning about the dissolution process



Conclusion

Many other things not shown, in particular about young open clusters

New memberships with Gaia DR2 are revolutionizing the field : many on-going activities about OCs

More to come with combination of ground based observations

Gaia DR3 will improve the memberships of distant clusters