Unraveling UBC 274

A morphological, kinematical and chemical analysis of a disrupting open cluster

Laia Casamiquela - GEPI

Journée Gaia DR3 -13 June 2022

1. Context

Open clusters

Gravitationally **bound groups of stars** born at the same star formation event from the same molecular cloud in the Galactic plane

Share common location, velocity, age, initial chemical composition…

Smithsonian Magazine

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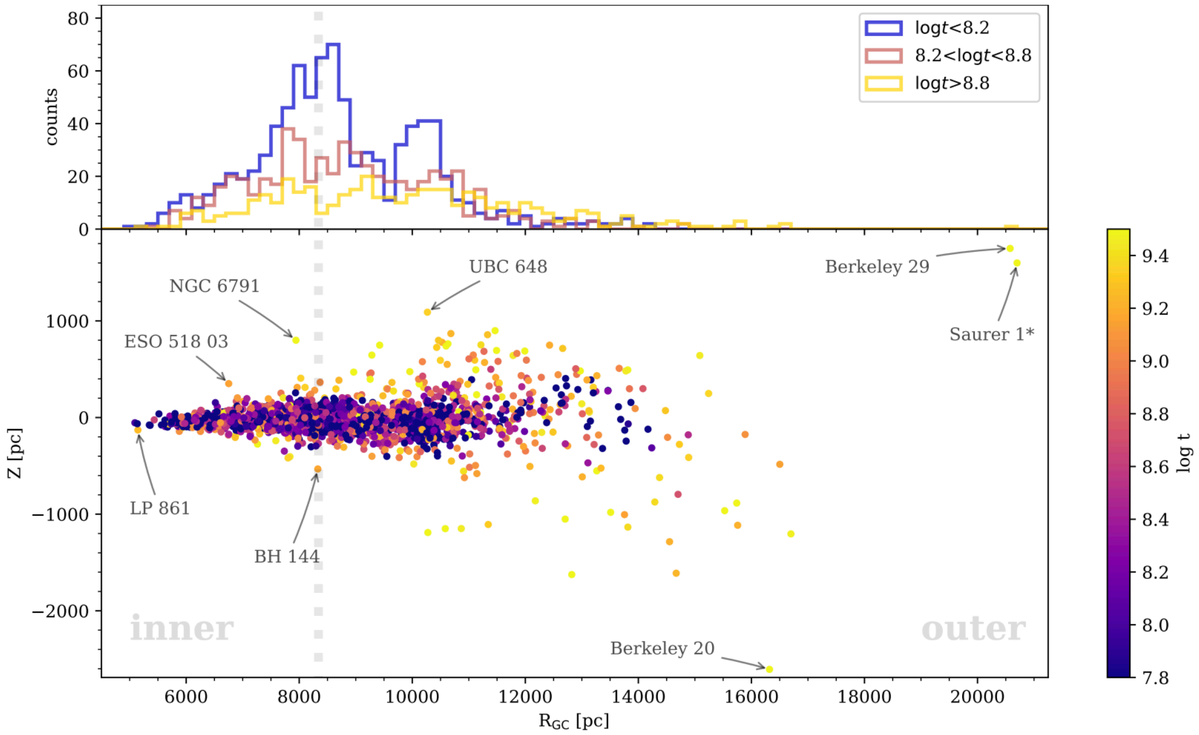
Share common location, velocity, age, initial chemical composition…

Short-lived stellar systems, which **disrupt** after ~1 Gyr due to internal and external perturbations

↓

their disruption populate the Galactic field

Old clusters with signs of disruption



Cantat-Gaudin et al (2020)

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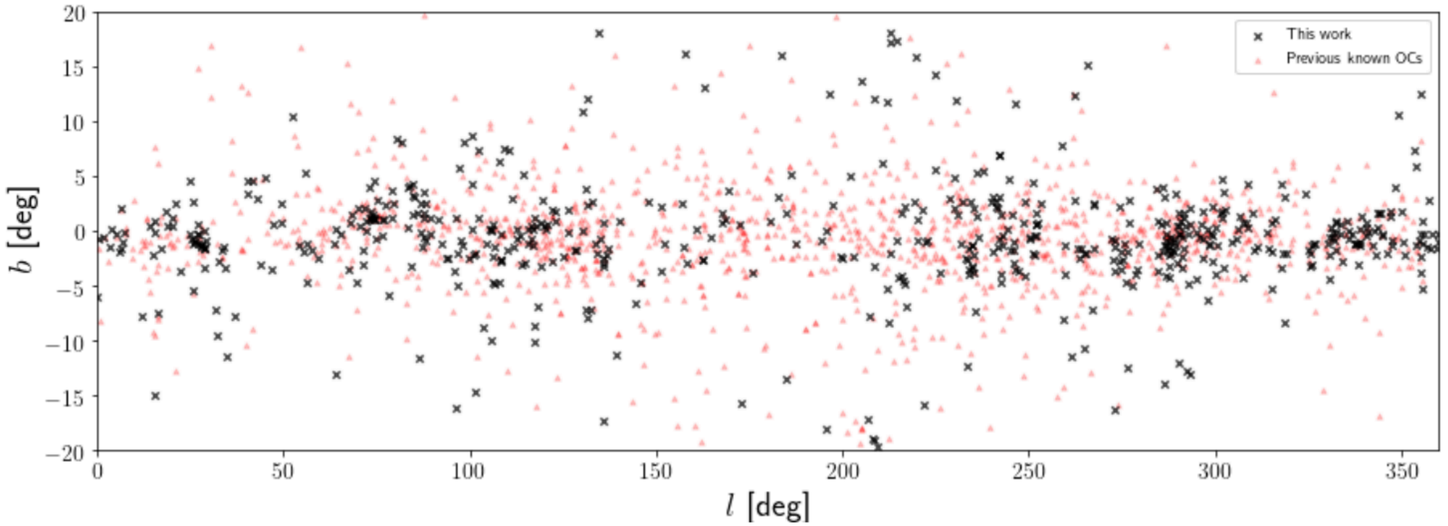
Open clusters in *Gaia*

Systematic detection of new candidates doubling the census of known objects pre-Gaia
[e.g. Castro-Ginard et al. 2018,2019,2020; Liu&Pang 2019]



Castro-Ginard et al. (2020): New open clusters in *Gaia* DR2

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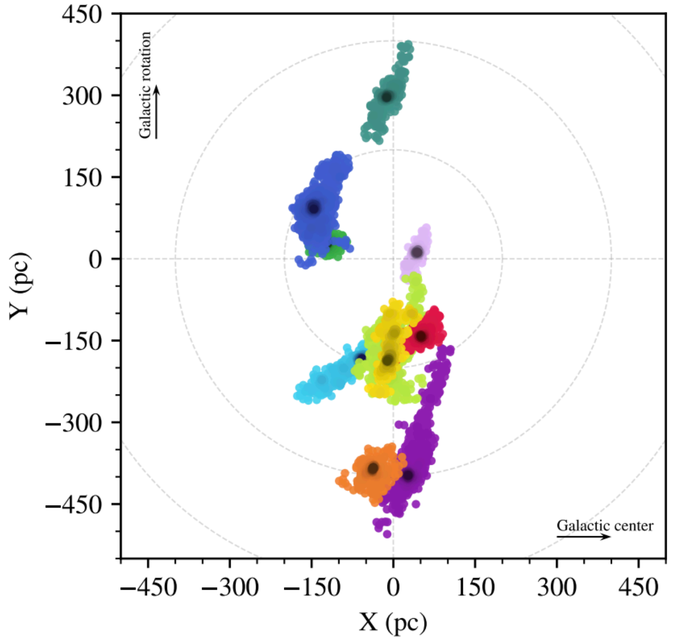
Systematic detection of new candidates doubling the census of known objects pre-Gaia [e.g. Castro-Ginard et al. 2018,2019,2020; Liu&Pang 2019]

Revisited memberships and physical properties of the open cluster population [e.g. Cantat-Gaudin et al 2020; Meingast et al. 2019; Tarricq, Soubiran, Casamiquela et al. 2022]

Detection of **elongated shapes** mostly in the Solar neighbourhood objects



Meingast et al. (2019): Elongated structures in nearby clusters

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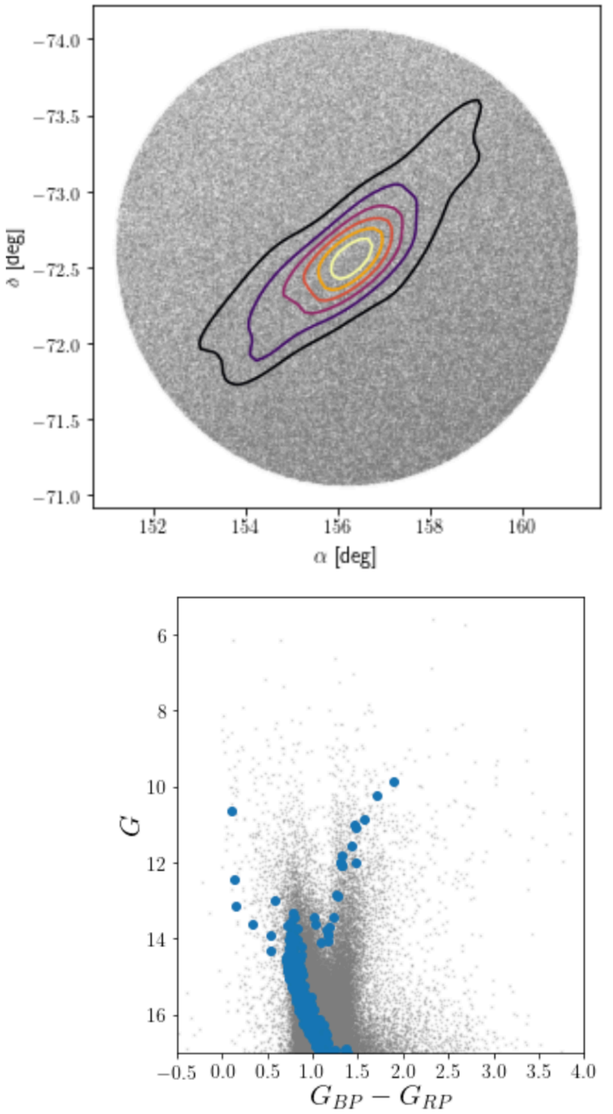
One of the **furthest away** (d=1.78 kpc) and **oldest** cluster (2.5 Gyr) with significant elongation is **UBC 274**



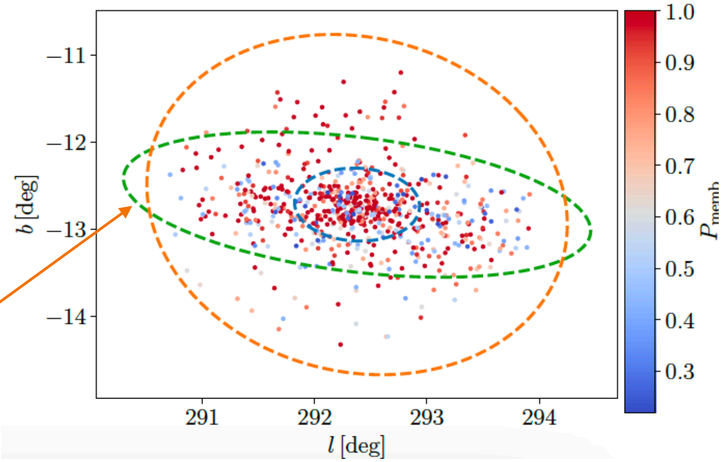
Castro-Ginard et al. (2020): Sky distribution and HR diagram of UBC 274

2. Morphology & kinematics of UBC 274

***Gaia* eDR3** data to extend the previous membership of the cluster up to **G=19** and with a radius of **50 pc** around the center

- Fit of a **Gaussian Mixture Model** with 3 components to sky distribution

Tilted component ~10 deg: tidal tail with **high eccentricity** (0.9)



Casamiquela et al. (2022)

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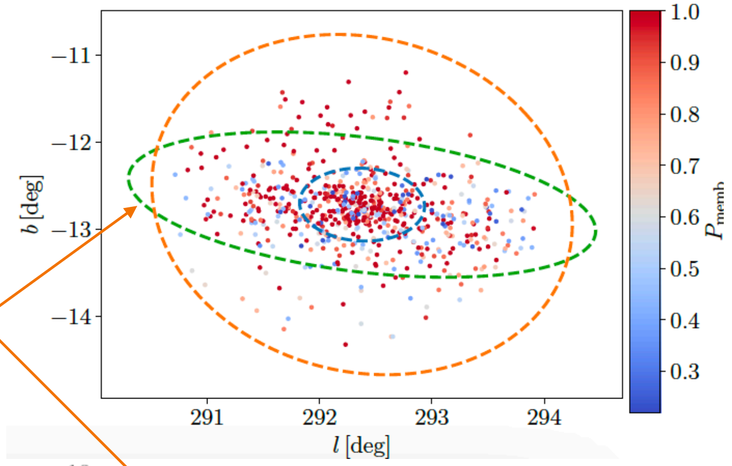
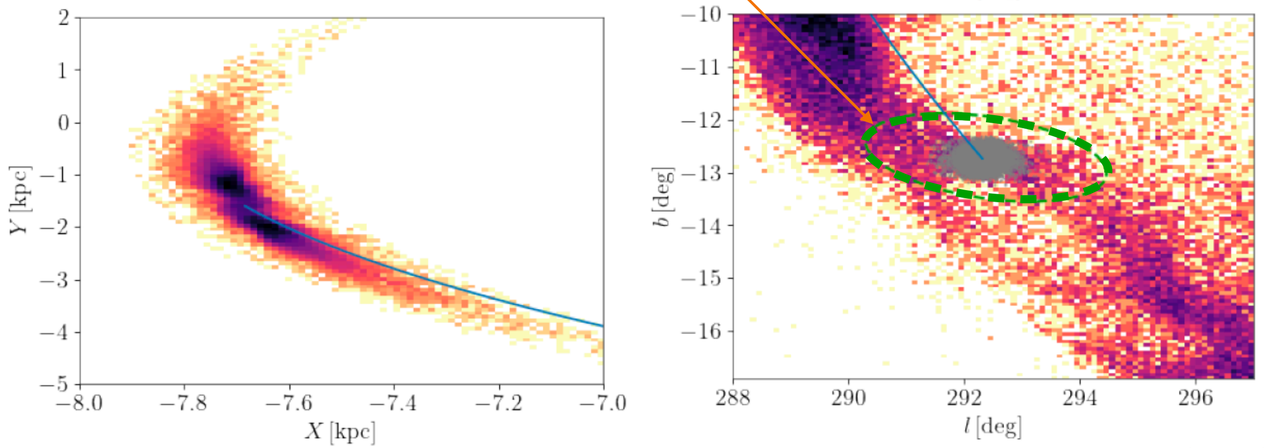


- Test-particle **simulation** of a disrupting cluster:



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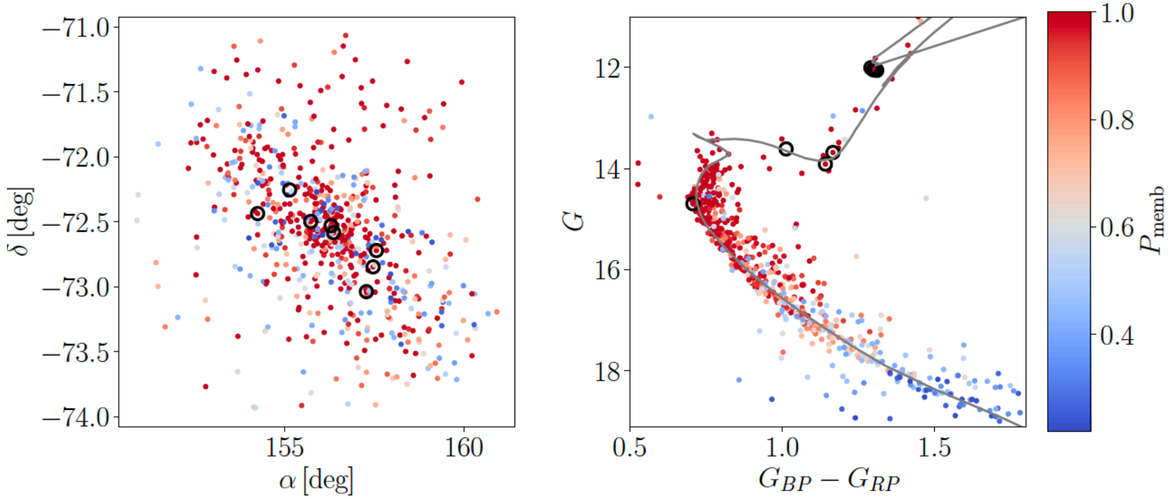
3. Spectroscopic follow-up

8 stars **MIKE spectrograph** @ 6.5m Clay Magellan Telescope (Las Campanas) R ~ 80,000 S/N ~ 100



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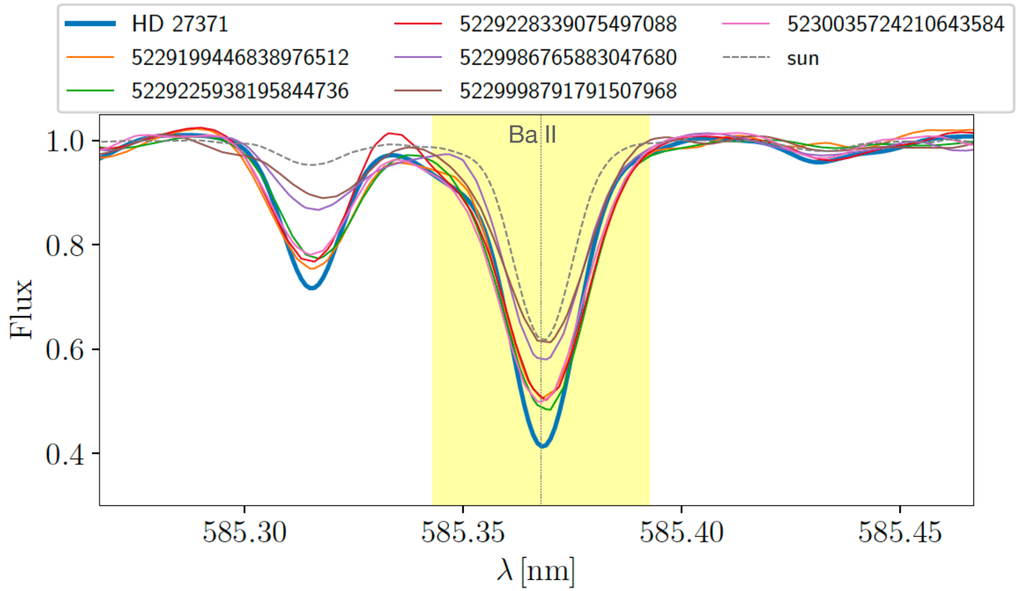

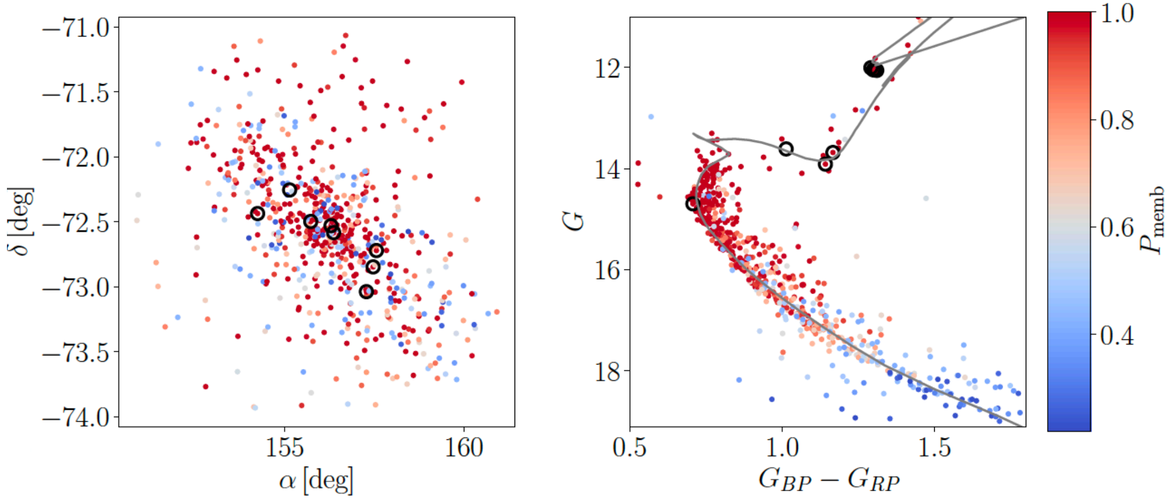

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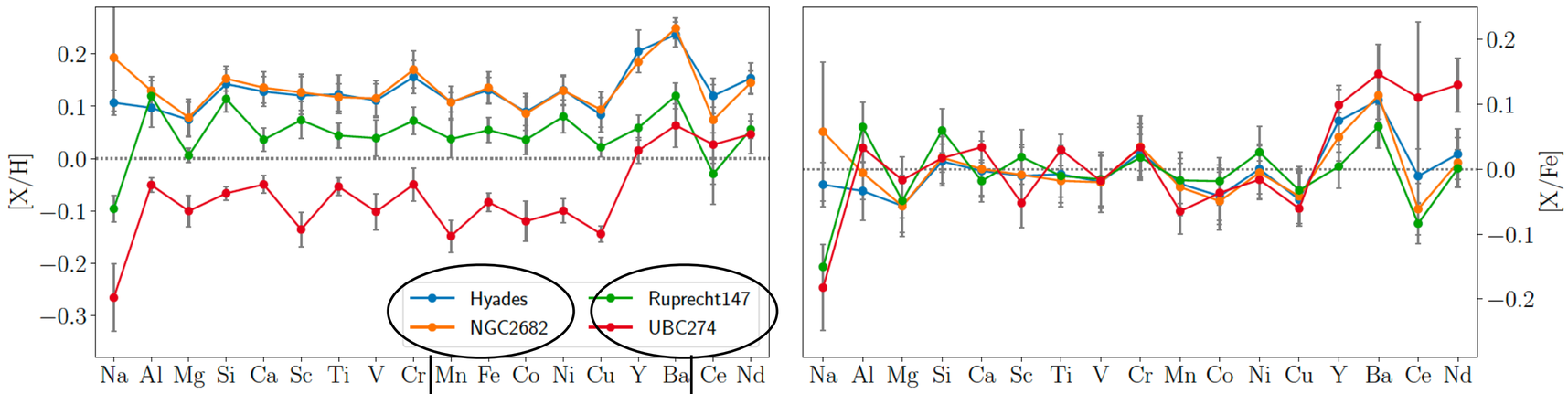
Chemical pattern [X/Fe] similar to other clusters with similar age



Same **age 0.7 Gyr**
Same spatial locations in the Galaxy (**solar neighbourhood**)

Same **age 2.5 Gyr**
Different spatial locations in the Galaxy

Casamiquela et al. (2022)

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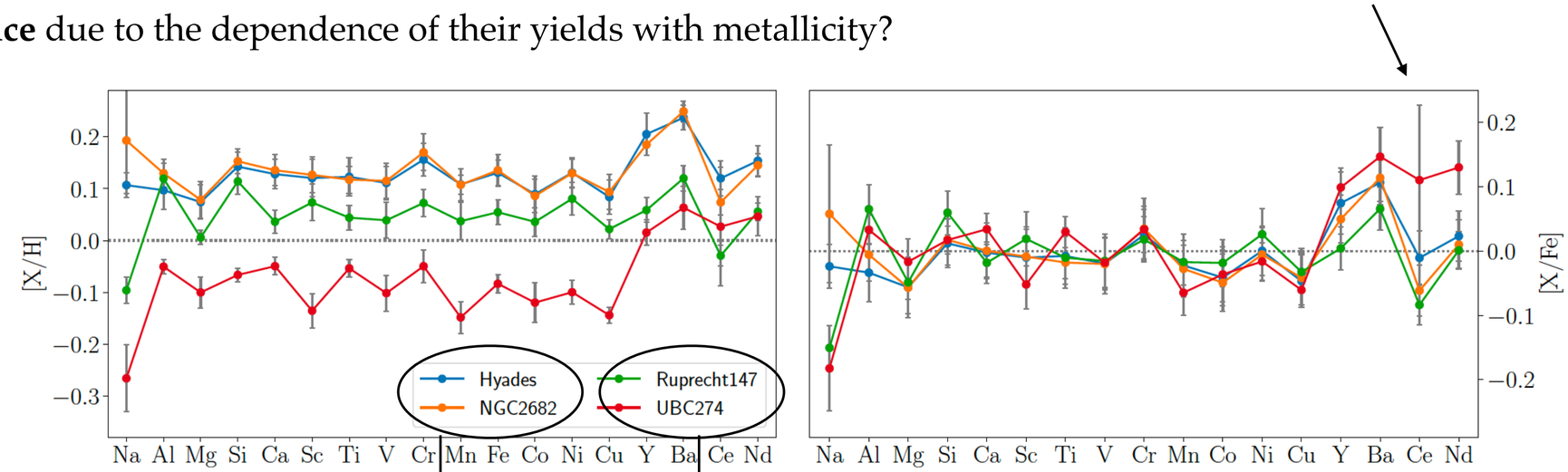
Enhancement of neutron capture elements [n/Fe] ~ 0.1

Neutron-capture elements difference due to the dependence of their yields with metallicity?



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Unraveling UBC 274: a morphological, kinematical and chemical analysis of a disrupting open cluster⋆

L. Casamiquela[1,2], J. Olivares[3,4], Y. Tarricq[2], S. Ferrone[1], C. Soubiran[2], P. Jofré[5], P. di Matteo[1], F. Espinoza-Rojas[6], A. Castro-Ginard[7], D. de Brito Silva[5], and J. Chanamé[6]

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[7] Leiden Observatory, Leiden University, Niels Bohrweg 2, 2333 CA Leiden, Netherlands

4. Conclusions

The **recent discovery** of a significant number of open clusters with **spatially elongated morphology** presents an opportunity to study the disruption mechanisms of co-natal stars, and how they populate the Galactic field

The **increasing quality of *Gaia* data releases** allows a better-constrained membership determination of these clusters and up to fainter magnitudes

Spectroscopic follow-up provide precise chemical abundances and provide an insight into the chemical homogeneity and the link to enrichment history of the Galactic disk