

# A new classification of ex-situ and in-situ Galactic globular clusters based on a method trained on Milky Way analogues in TNG50 cosmological simulations

Boldrini, Di Matteo, Laporte et al.+25, submitted to A&A

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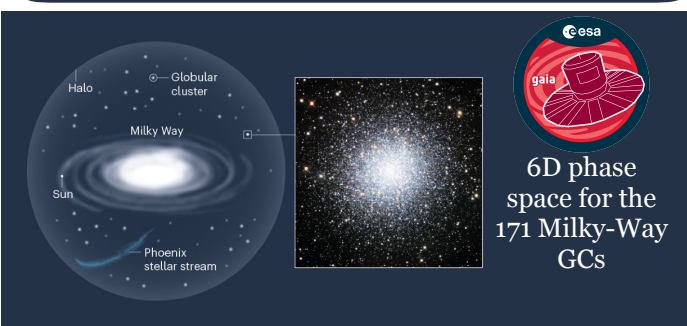
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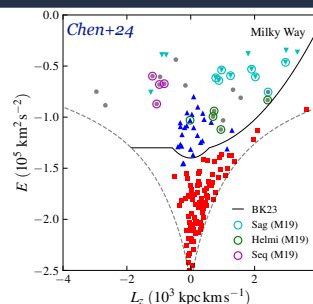
Credits: Gaia collaboration

## What is the origin of the MW globular clusters?



Gaia Collaboration+18,+21, Vasiliev & Baumgardt+21

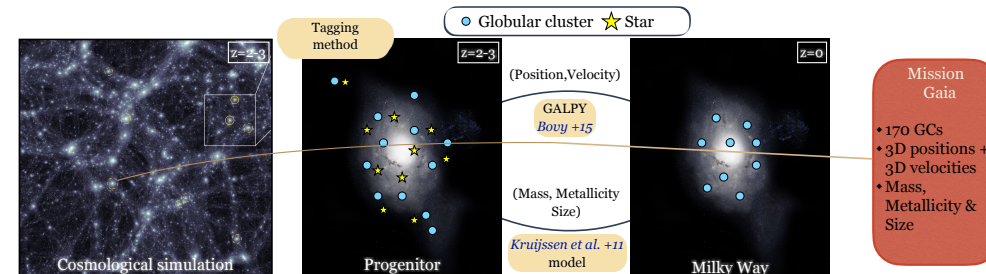
## State-of-the-art



Massari+19  
Callingham+22  
Belkurov+24  
Chen+24

Previous studies found a clear separation between the two GC populations

## Our new approach



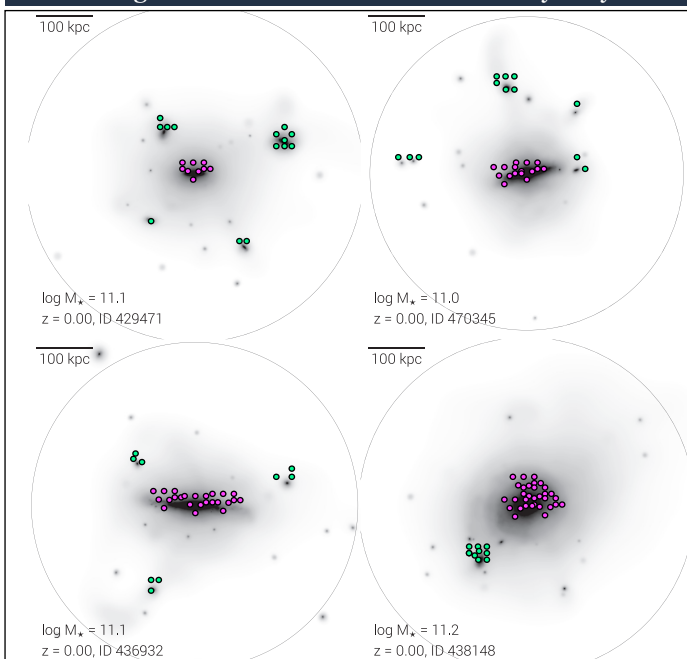
A novel method combining existing cosmological simulations (TNG50) and orbital integration to study the hierarchical assembly of GC populations in the MW, which models the growth and evolution of GC populations across various galactic environments as well as the dynamical friction and mass-loss experienced by these objects

## EX-SITU

## IN-SITU

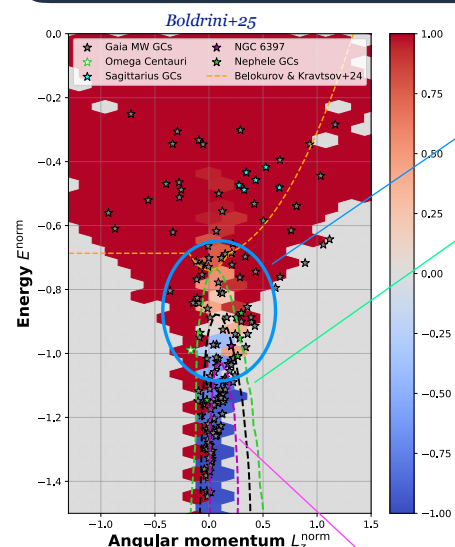
Formed in satellite galaxies

Formed within the Milky Way



MW GCs have diverse origins: while some are thought to have formed in-situ within the progenitor of the MW, others were accreted through the mergers of satellite galaxies

## Key results

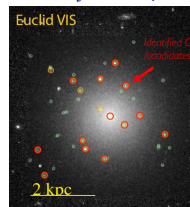


Mixing zone

New ex-situ frontier

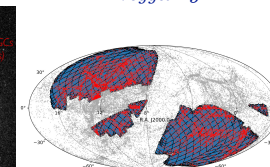
Mixture of the two GC populations → Challenges previous separation methods

Saifollahi+24

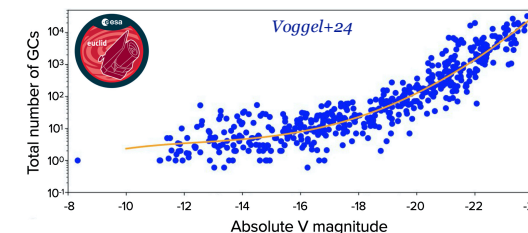


Half a million extragalactic GCs within 100 Mpc in 10 000 nearby galaxies with Euclid

Voggel+25



## Futur works with Euclid



Extended our method to include all galaxies with stellar masses between  $10^9$  and  $10^{12} M_{\odot}$  in TNG50, beyond the Pillepich+24 sample, to predict the number and spatial distribution of GCs as a function of redshift and host galaxy mass