# Physical characterization of recently discovered globular clusters in the Sagittarius dwarf spheroidal galaxy I. Metallicities, ages and luminosities

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## Context

Globular clusters (GCs) are important tools to reconstruct the accretion history of a galaxy.

In particular, there are newly discovered GCs in the Sagittarius (Sgr) dwarf galaxy (Minniti et al. 2021a,b), that can be used as probes of the accretion event onto the Milky Way (MW).

The Sgr GCs can be compared with those of the LMC, MW (2010 compilation of Harris 1996 catalogue) and Andromeda (M31) in order to study the formation of these galaxies.

## Results: Estimation of physical parameters

We build the optical and near-IR color-magnitude diagrams (CMDs, representative examples shown in Fig.1) for 21 new Sgr GCs using the VISTA Variables in the *Via Láctea Extended Survey (VVVX)* near-IR database combined with the *Gaia Early Data Release3 (EDR3)* optical database. The main physical parameters:

- **Metallicity**: 17 metal-rich GCs with **[Fe/H]=-0.3 to -0.9**; and 4 metal-poor GCs with **[Fe/H]=-1.1 to -2.0**;
- **Age**: metal-poor GCs are the older component (**~13-14 Gyr**); metal-rich GCs span a wider range of ages from younger (**~7-8 Gy**r) to older (**~10-14 Gyr**);
- **Total luminosity**: all new Sgr GCs are **low-luminosity objects**, at least ~1.3 mag less luminous than the MW GCLF peak ($M_V = (-7.4 \pm 0.2)$ mag — Harris 1991, Ashman & Zepf 1998).
- **Mass**: low-mass GCs with $M \approx 10^3 - 10^4 M_\odot$

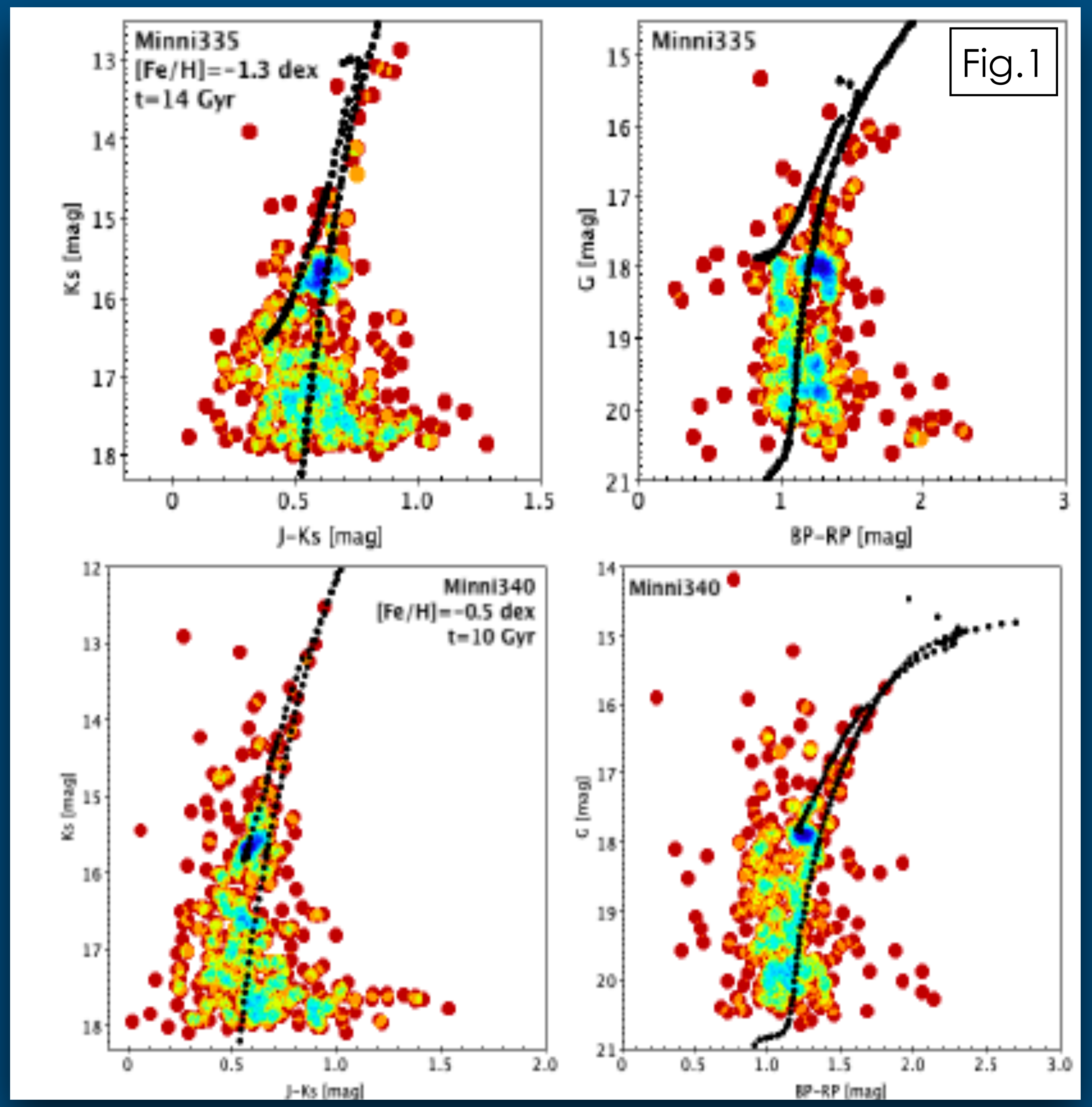


Fig.1

# Discussion: Metallicity distributions (MDs) and Luminosity Functions (LFs)

### MDs are bimodal (Fig.2)

**Sgr galaxy**

$[Fe/H]_{MP} = -1.75 \pm 0.35$ dex
$[Fe/H]_{MR} = -0.56 \pm 0.18$ dex

**LMC galaxy**

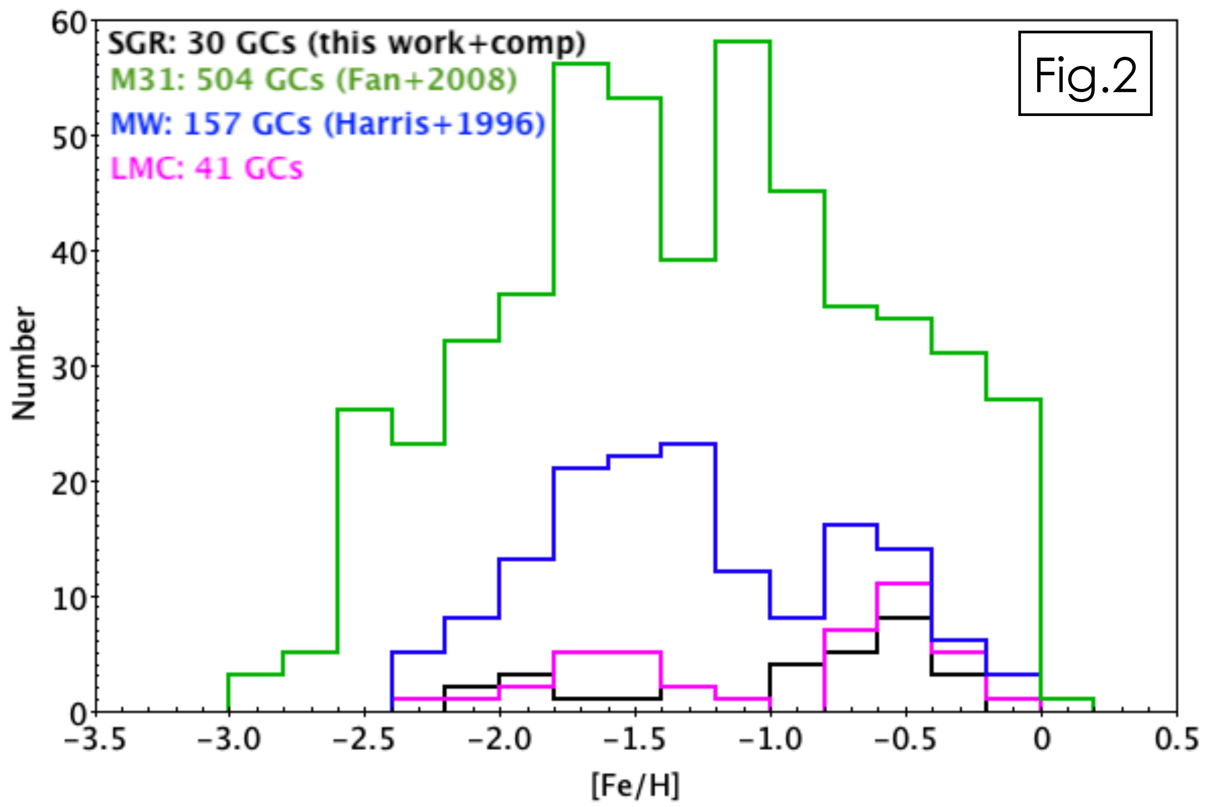
$[Fe/H]_{MP} = -1.66 \pm 0.30$ dex
$[Fe/H]_{MR} = -0.47 \pm 0.15$ dex

**MW galaxy**

$[Fe/H]_{MP} = -1.55 \pm 0.35$ dex
$[Fe/H]_{MR} = -0.54 \pm 0.22$ dex

**M31 galaxy**

$[Fe/H]_{MP} = -1.71 \pm 0.46$ dex
$[Fe/H]_{MR} = -0.76 \pm 0.39$ dex




### LFs appear to be non-Gaussian, probably as a result of the different formation and dynamical evolution histories (Fig.3)

**Sgr galaxy**

$M_V^{Sgr} = -5.46 \pm 1.46$ mag

**LMC galaxy**

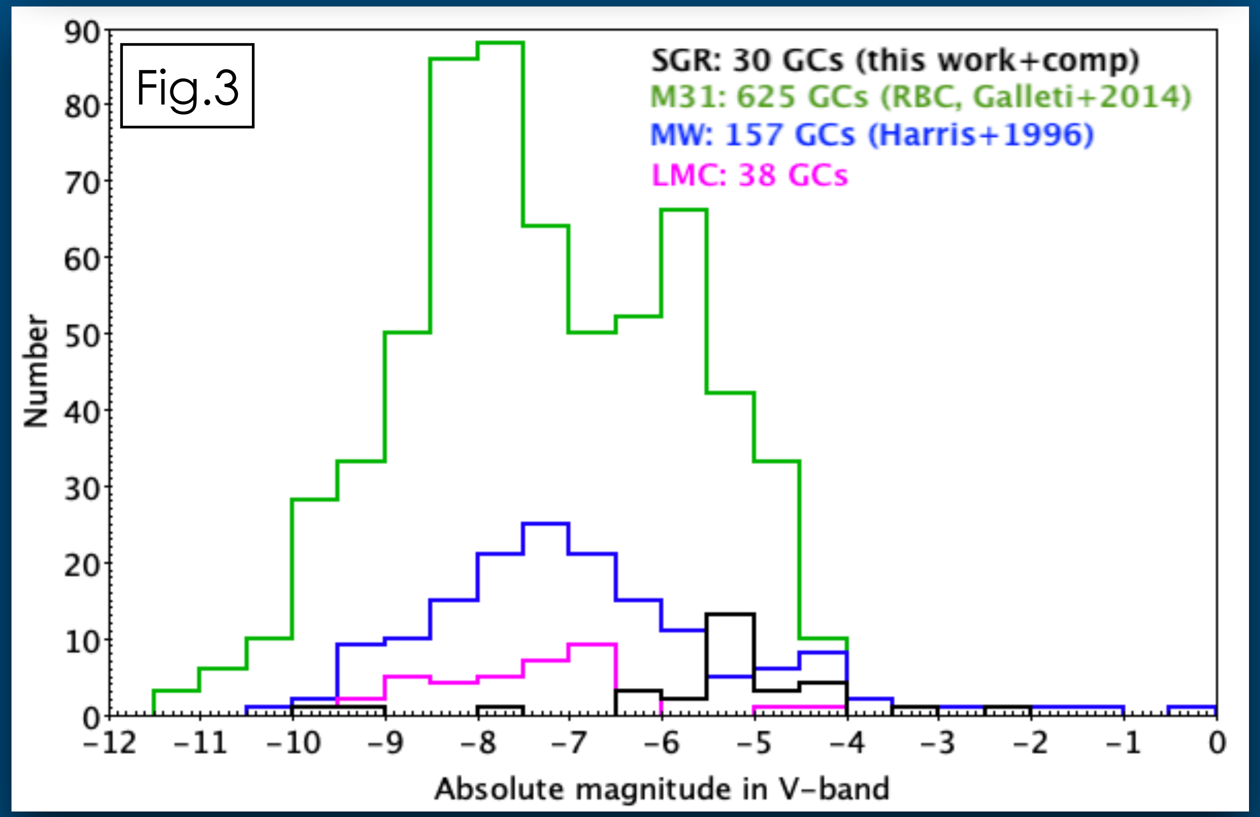
$M_V^{LMC} = -7.43 \pm 1.17$ mag

**MW galaxy**

$M_V^{MW} = -7.46 \pm 1.04$ mag
$M_V^{MW} = -4.01 \pm 1.28$ mag

**M31 galaxy**

$M_V^{M31} = -7.95 \pm 1.12$ mag
$M_V^{M31} = -5.71 \pm 0.71$ mag




VVV X Survey

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**References:**

[1] Garro et al. 2021, A&A, in press (arXiv:2107.09987)
[2] Hasselquist et al. 2021, ApJ, accepted (arXiv:2109.05130)
[3] Minniti et al. 2021a, A&A, 647, L4
[4] Minniti et al. 2021b, A&A, 650, L1
[5] Kruijssen et al. 2011, MNRAS, 414, 1339


# Conclusions

- The Sgr progenitor could have been a gas-rich galaxy, and this gas was retained and subsequently converted into GCs during the infall into the MW halo (Hasselquist et al. 2021).
- Many GCs survived dynamical processes (i.e. tidal shocks and two-body relaxation process), probably because they were formed before the main star formation burst and pulled toward the halo where these process are less efficient, according to Kruijssen et al. (2011).
- Some of the many other unconfirmed candidate clusters, detected by Minniti et al. (2021a,b) could be dissolved GCs associated to the Sgr dwarf.
- Since the Sgr GCLF peaks at lower luminosities ($M_V \approx -5.5$ mag), we conclude that the dynamical processes that destroy GCs are more efficient in larger galaxies than in smaller ones, or that many faint GCs are missing from the present compilations.