



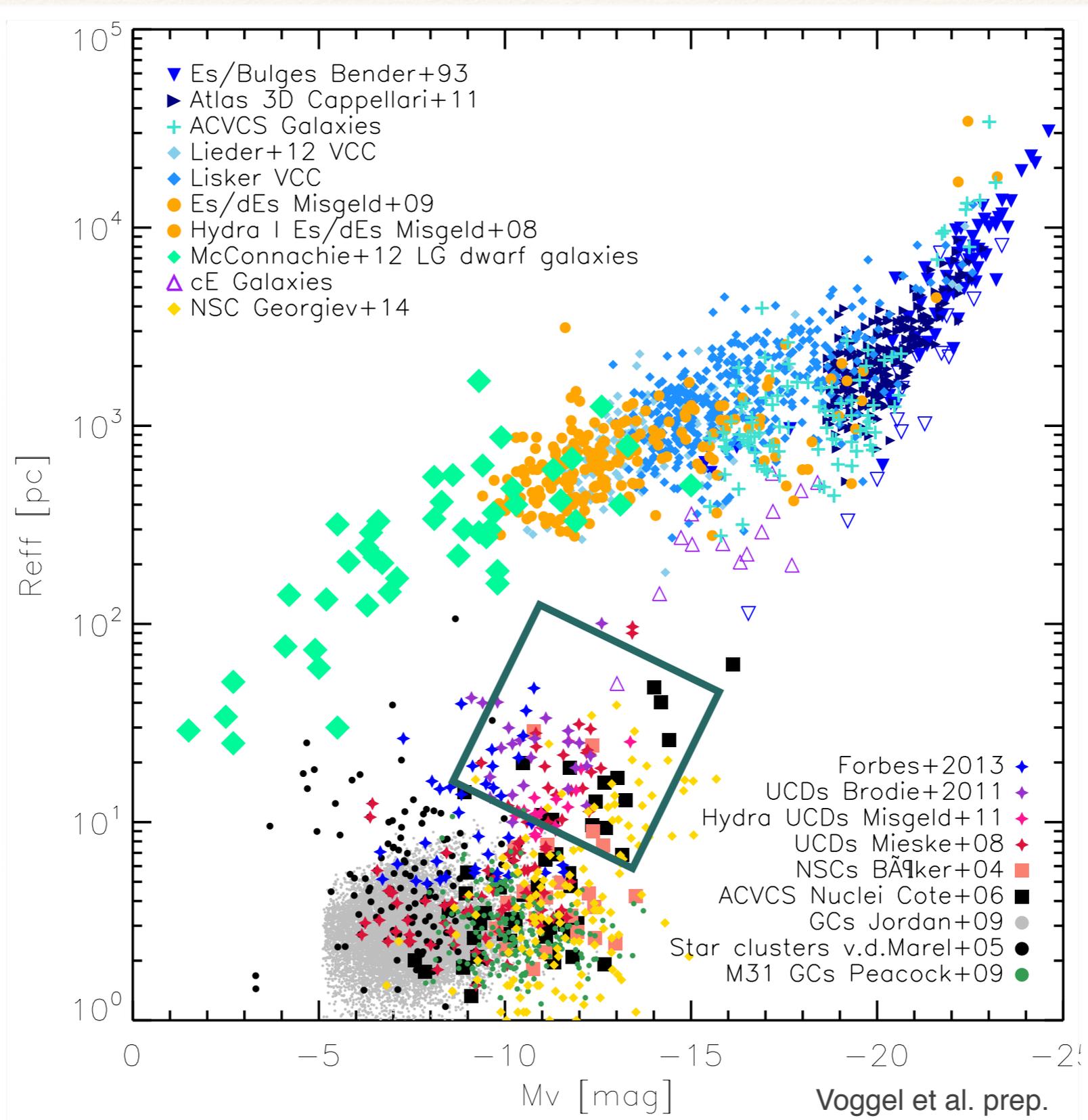
Satellites and Streams in Santiago
ESO Chile, 13-17 April, 2015

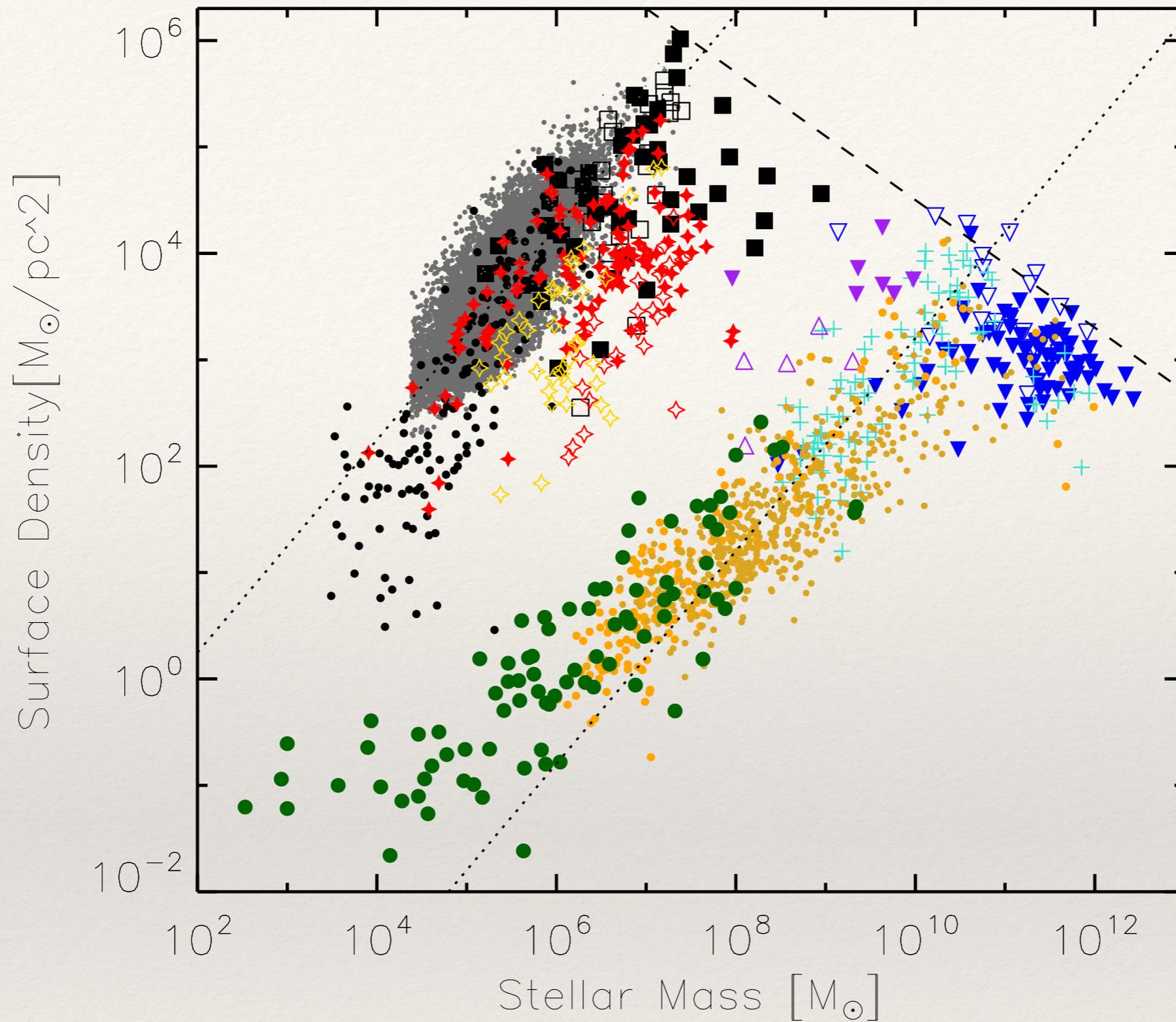
The origins of the Ultra Compact dwarfs in the Halo of NGC1399

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What are UCDs?





Surface density of stellar systems

What are the origins of UCDs?

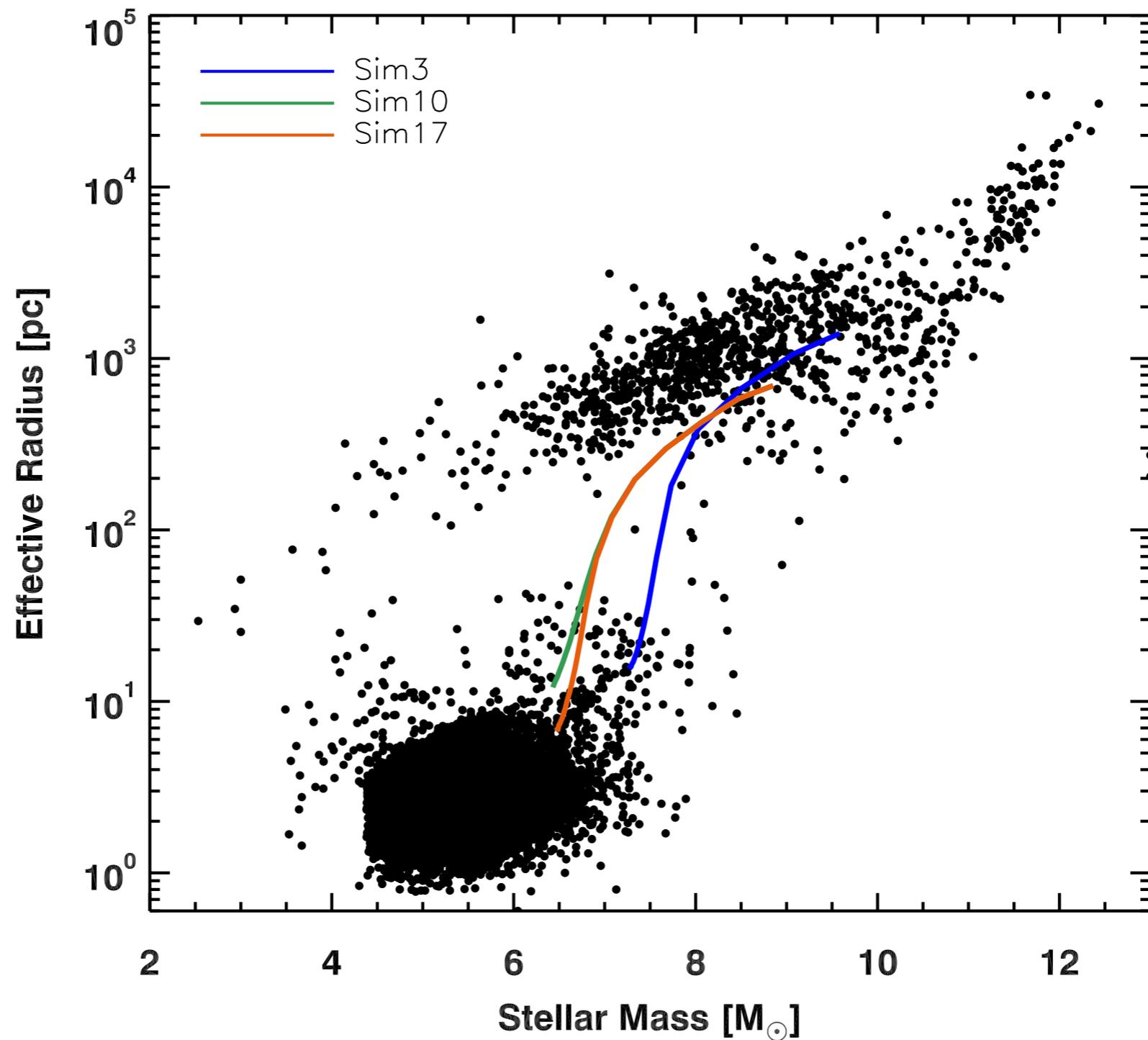
Two possible formation channels:

1. The high mass end of the GC luminosity function
2. The stripped nuclei of dwarf Elliptical galaxies

-> Goal: constrain the contribution of each formation channel to the final luminosity function of UCDs with new strategies

-> Find direct evidence for the stripping channel

The Stripping Scenario



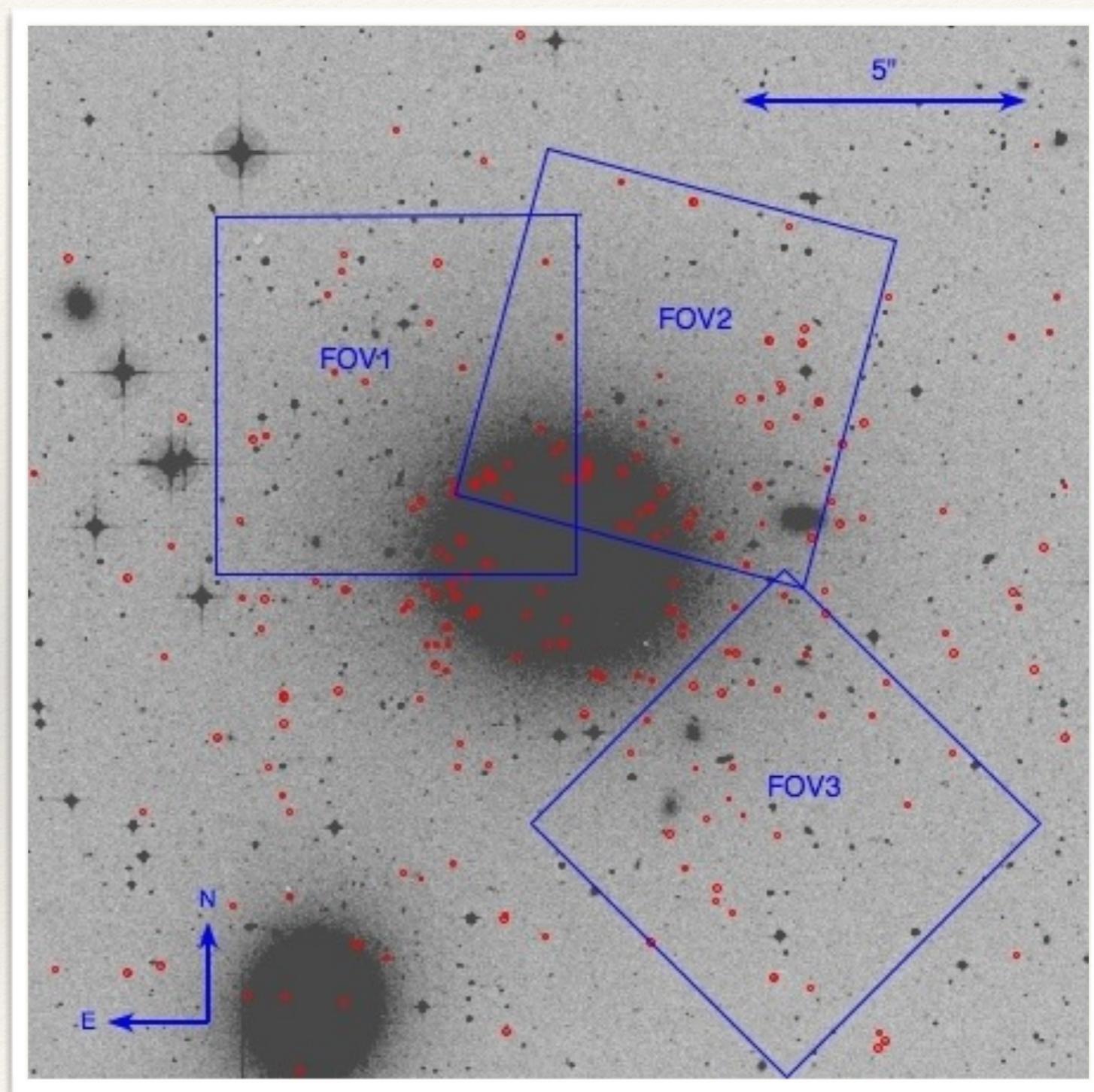
Voggel et al. in prep. (Simulation tracks based on Pfeffer&Baumgardt (2013))

Constraining Formation Channels

- ❖ Comparing the properties of large UCD sample to GCs/nuclei:
 - ❖ Spatial Distribution
 - ❖ Size-magnitude relation
 - ❖ metallicity distribution
- ❖ Single UCDs
 - ❖ color and magnitudes
 - ❖ velocity dispersion to constrain dynamical mass
 - ❖ surface brightness profiles / tidal features
 - ❖ resolving the stellar populations

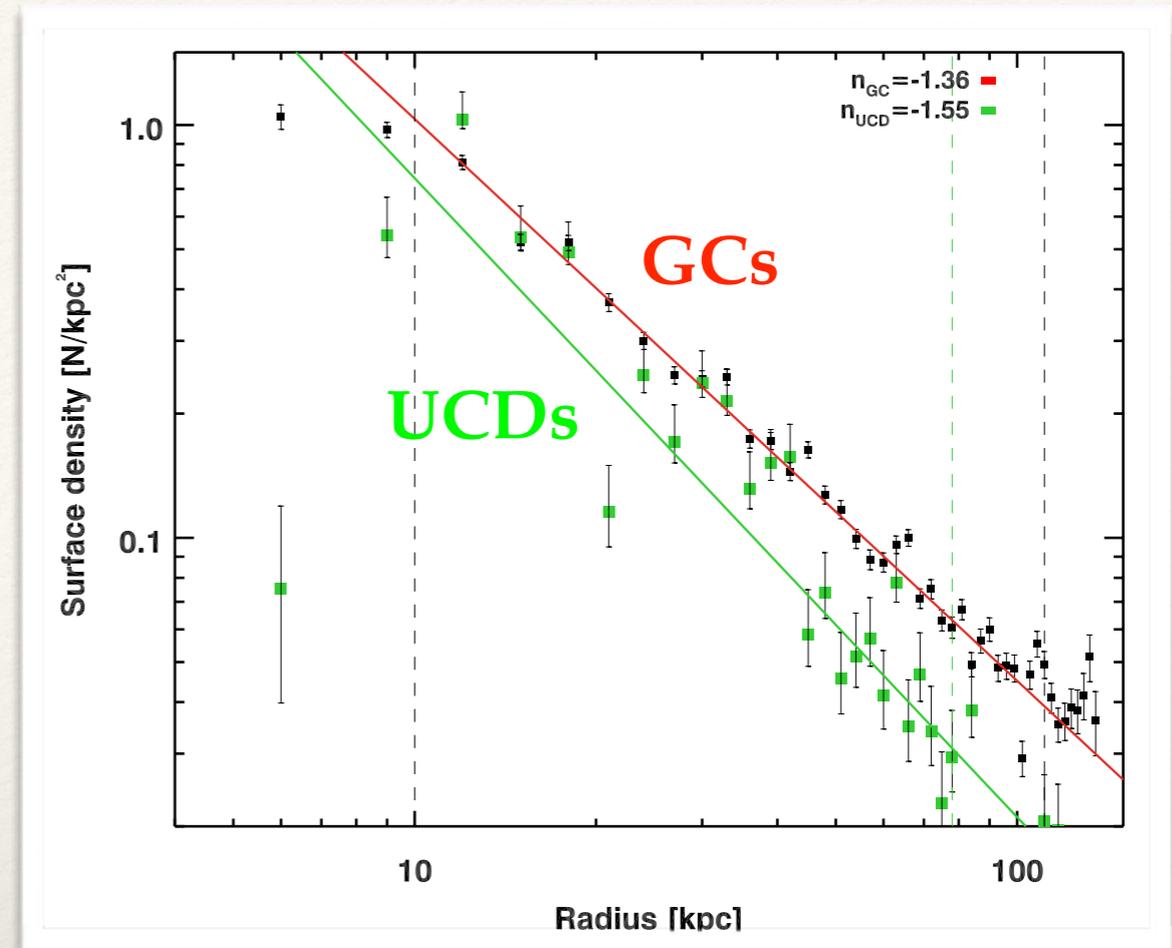
Spatial Distribution of UCDs and GCs

- ❖ Spatial distribution of UCDs (red) around NGC1399, the central Fornax galaxy
- ❖ All UCDs are confirmed members of the Fornax cluster
- ❖ Wide field sample of GCs and UCDs (Dirsch et al. 2003)
- ❖ Three smaller FORS2 fields with photometry on 109 UCDs in good 0.6'' seeing conditions



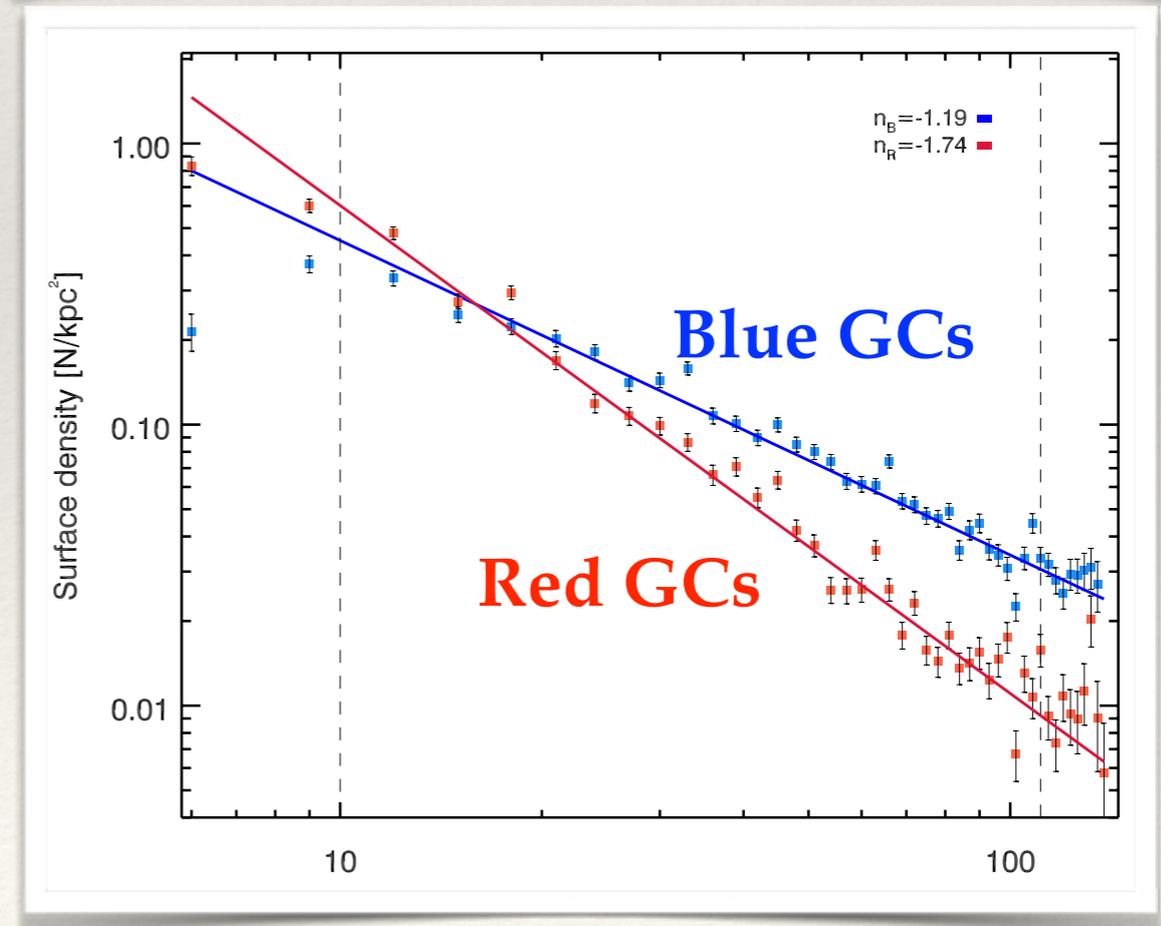
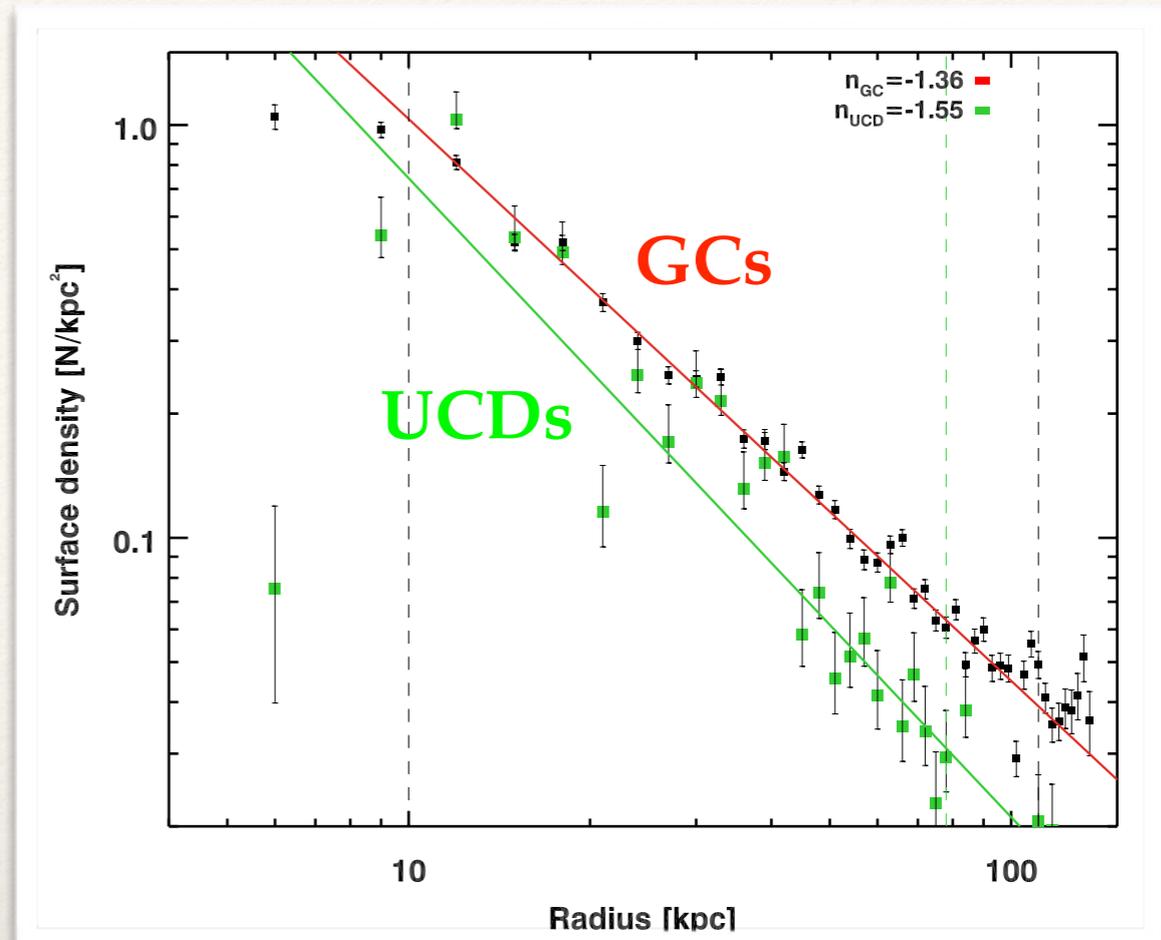
Spatial distribution of GCs around NGC1399

- ❖ Projected surface density profiles around NGC1399
- ❖ Top panel: GC sample (red line) and UCD sample (green)
- ❖ Solid lines: Fitted power law to the surface density

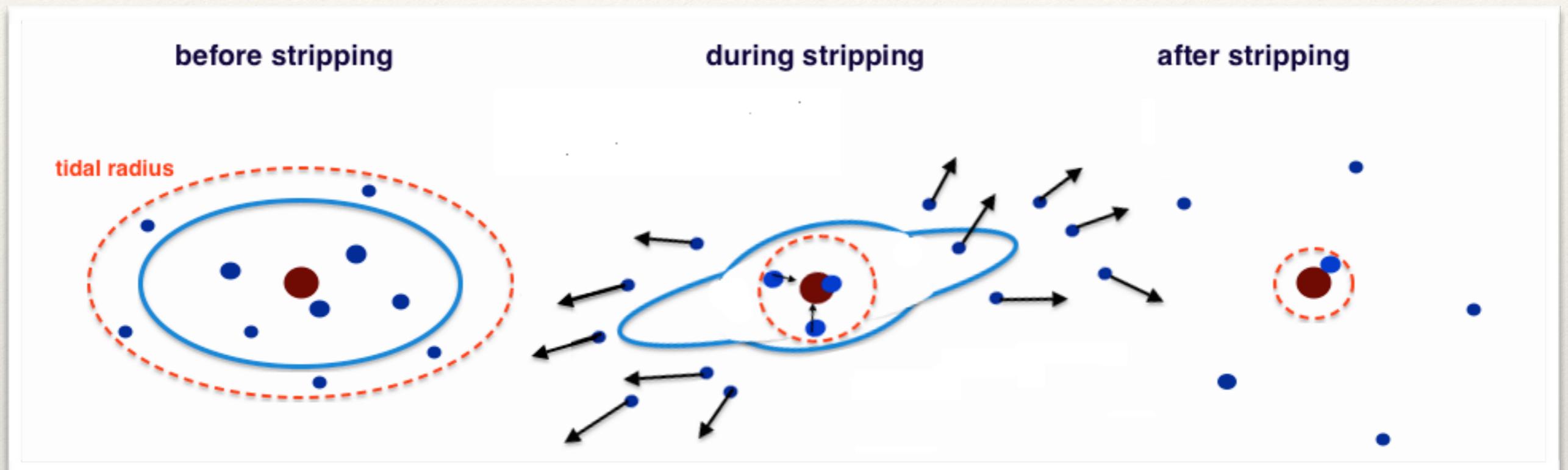


Spatial distribution of GCs around NGC1399

- ❖ Projected surface density profiles around NGC1399
- ❖ Top panel: GC sample (red line) and UCD sample (green)
- ❖ Solid lines: Fitted power law to the surface density
- ❖ Bottom panel: for the blue and red GC population separately
- ❖ Red population steeper and more centrally concentrated than the blue component



What happens to the GCs of a dE during stripping?



dwarf Elliptical



UCD

GC system of dEs: Lotz et al. (2001, 2004)

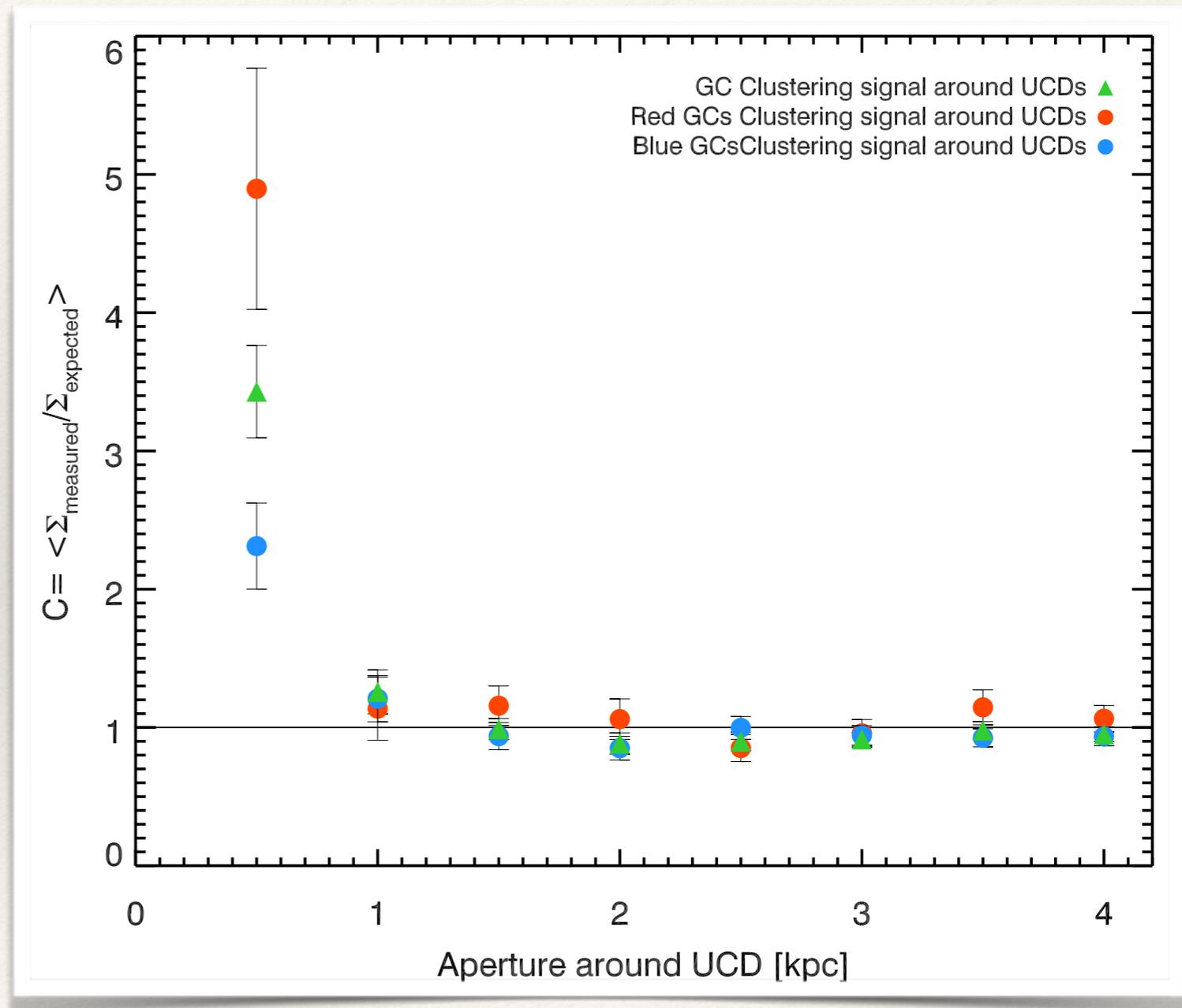
Dynamical Friction: Arca-Sedda & Capuzzo-Dolcetta (2014), Capuzzo-Dolcetta, (1993)

Spatial Clustering of GCs around UCDs

❖ Is the surface density of GCs around UCDs systematically higher than what is expected from the main distribution of the GCs in the halo?

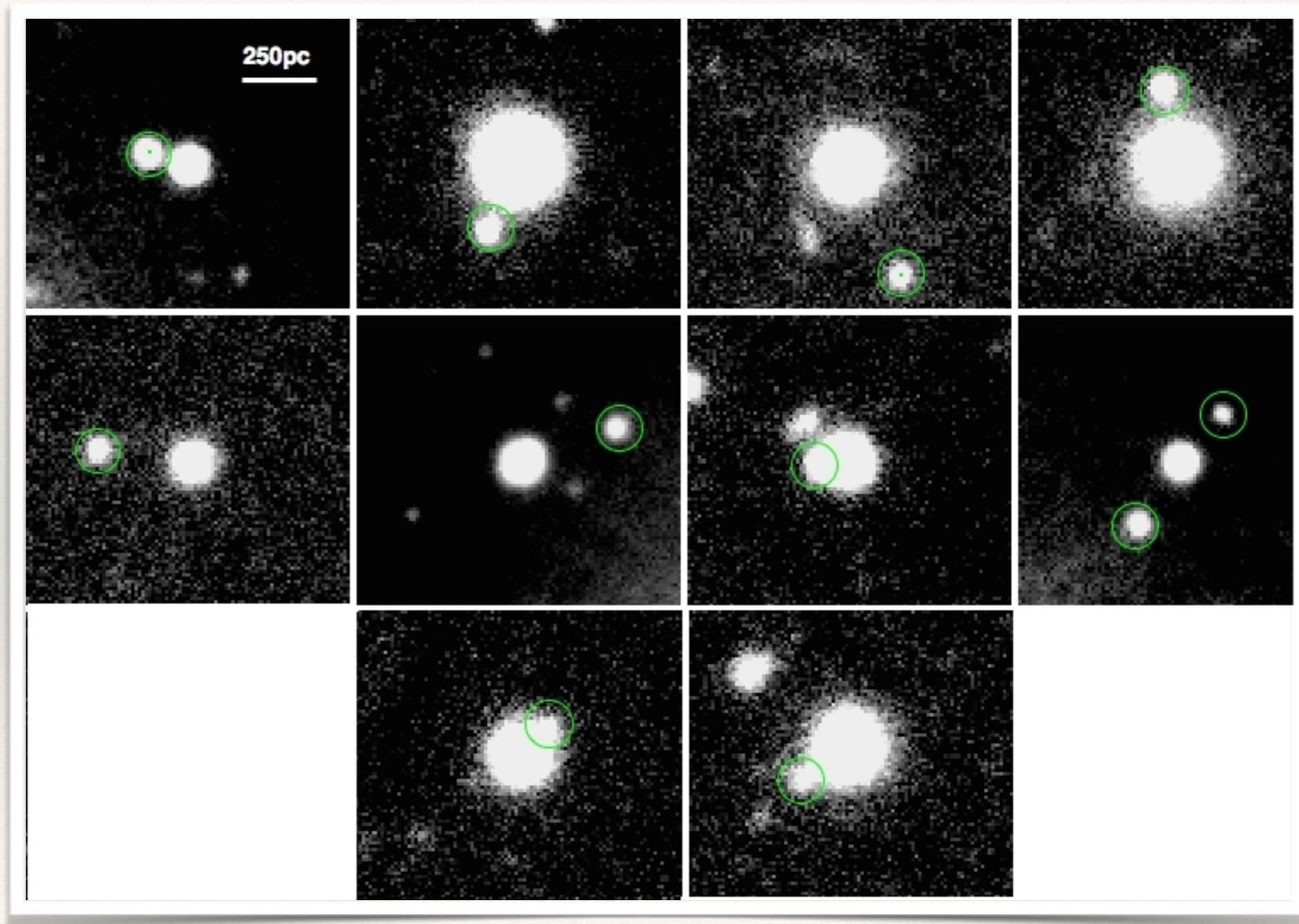
-> We find a systematic *average* overdensity within 500pc for all GCs and the colour separated samples

-> Red GCs are correlated stronger with UCDs than blue ones



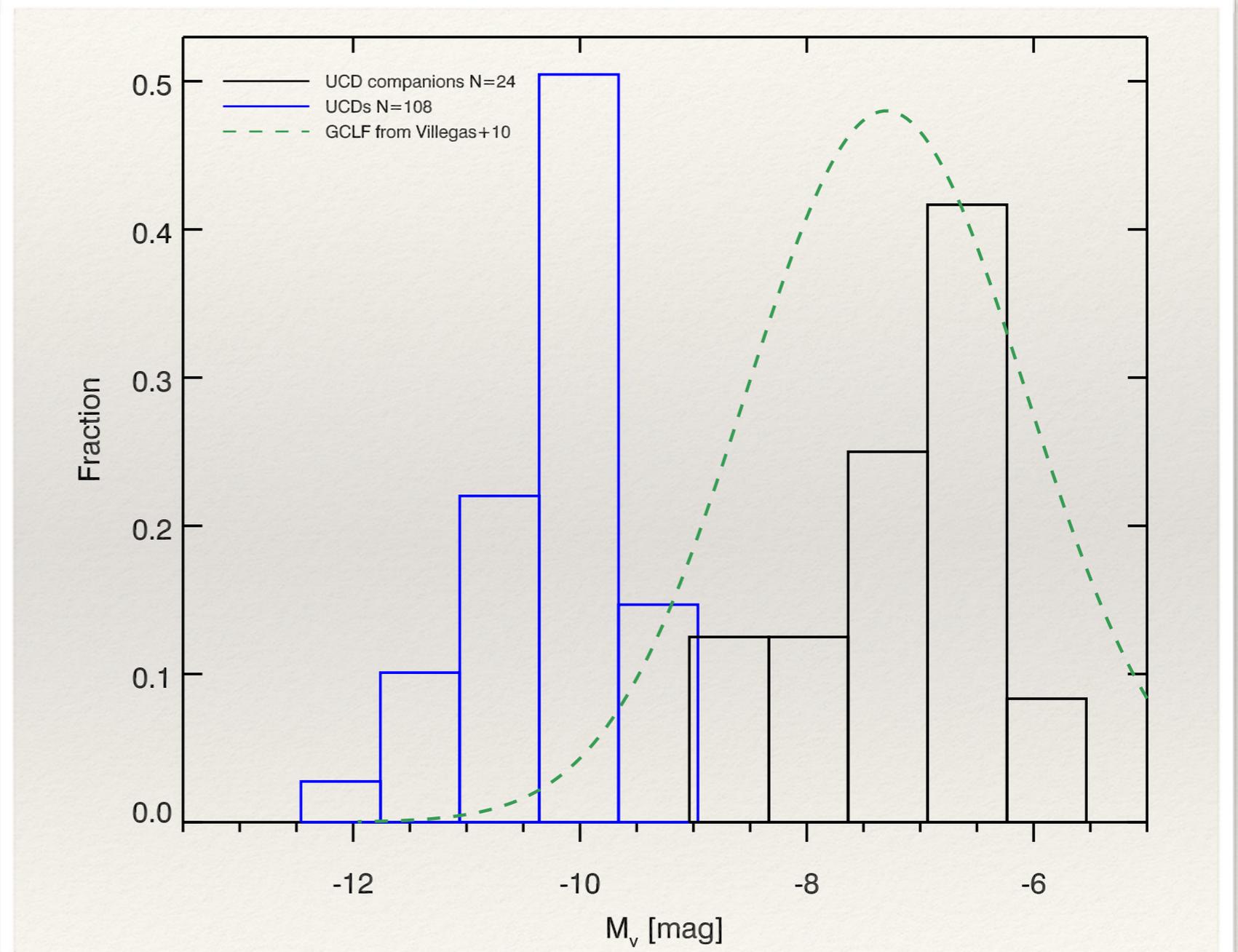
Do UCDs have GC companions?

- ❖ Close up images of UCD companion sources within $r < 200 \text{ pc}$
- ❖ Some blend with the light profile of UCD
- ❖ Dwarf galaxy with pericenter $R = 20 \text{ kpc}$ is $\sim 250 \text{ pc}$ for a 10^7 UCD



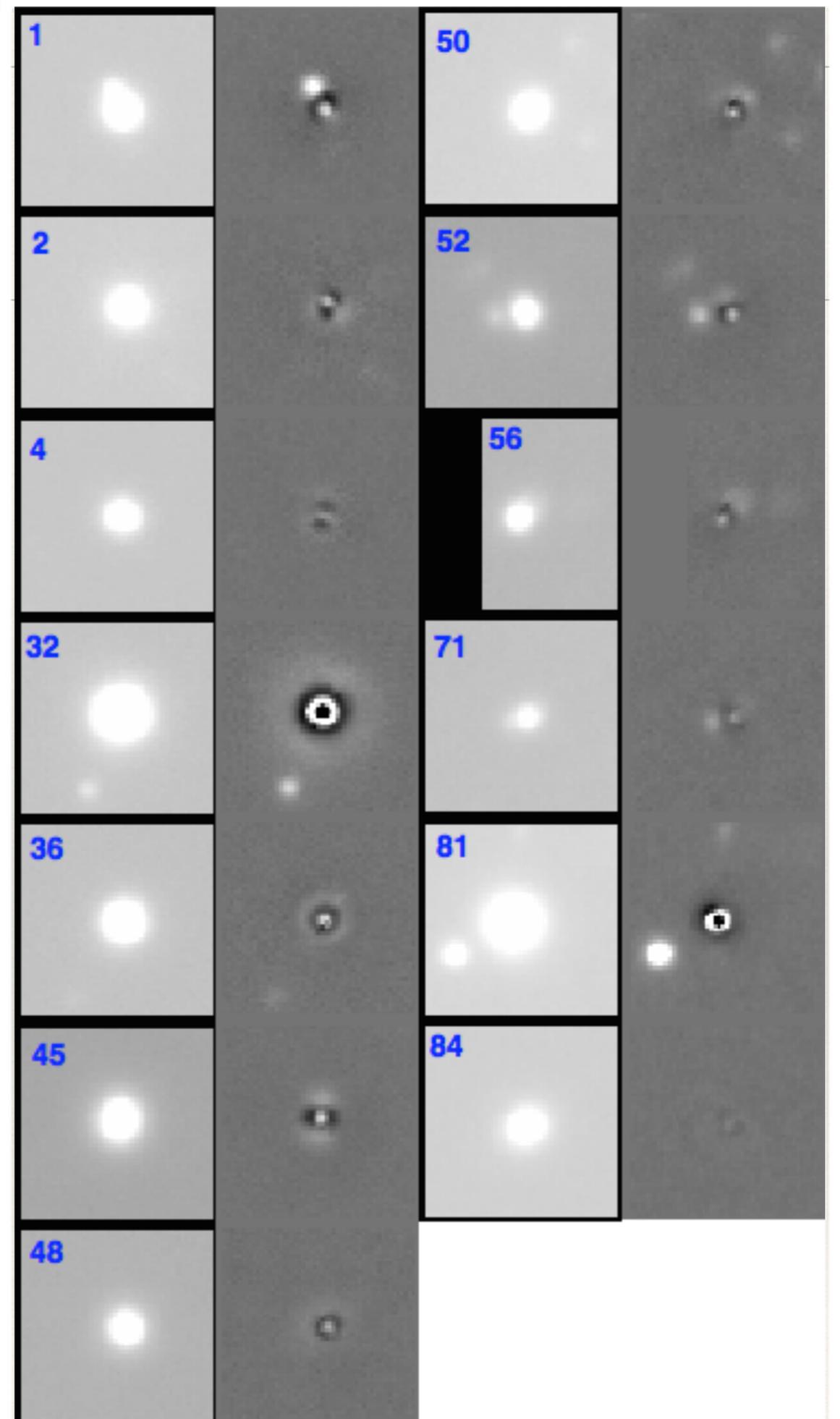
Luminosity Function of UCDs and GCs

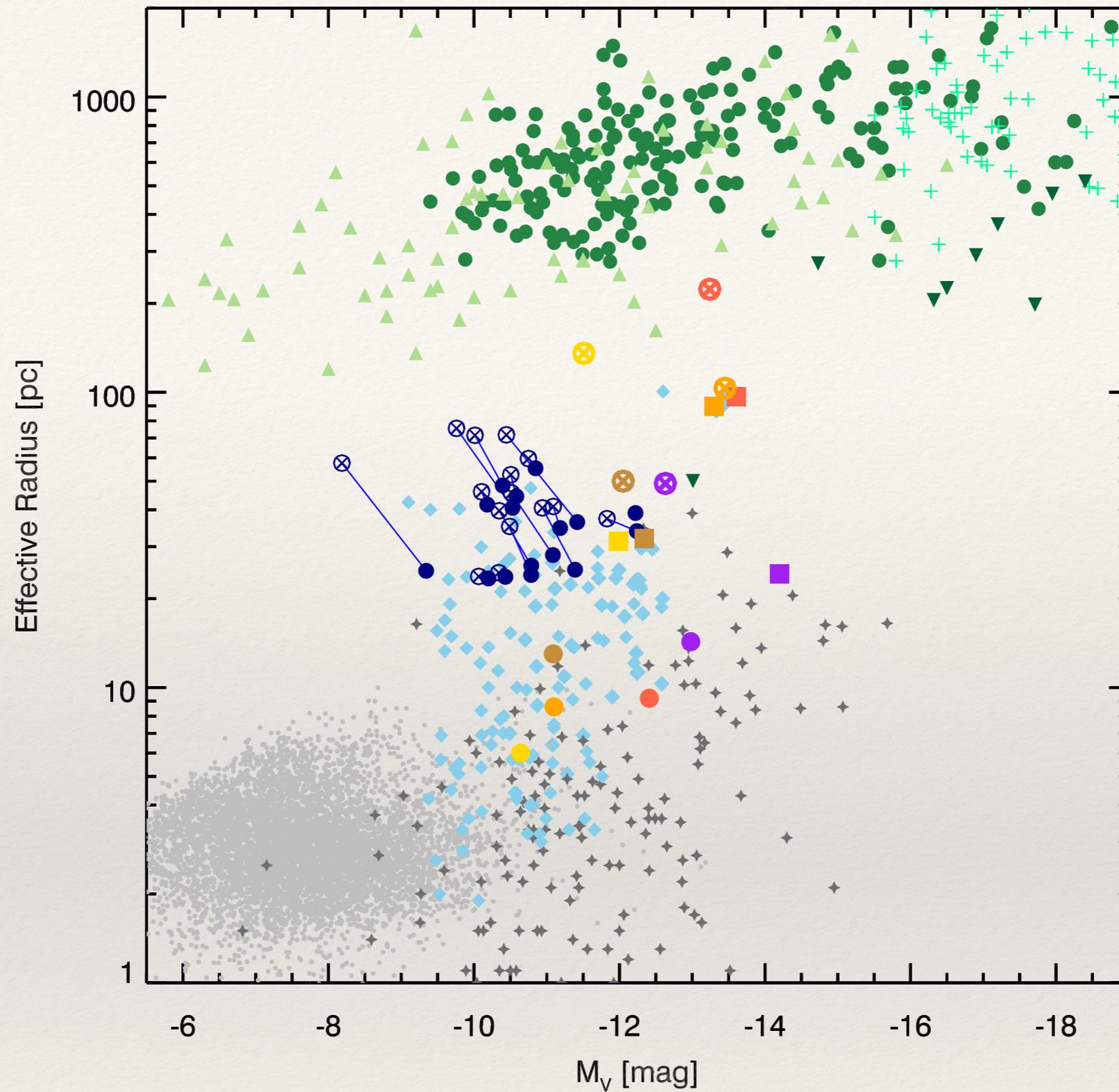
- ❖ Luminosity Function of UCDs in the FORS fields (blue)
- ❖ GCLF of NGC1399 from Villegas et al. 2010 in dashed green
- ❖ For the 24 objects that showed very nearby point sources ($r < 200\text{pc}$) we measured their magnitude after subtracting the UCD model
- ❖ Histogram of companion sources to the UCDs in black



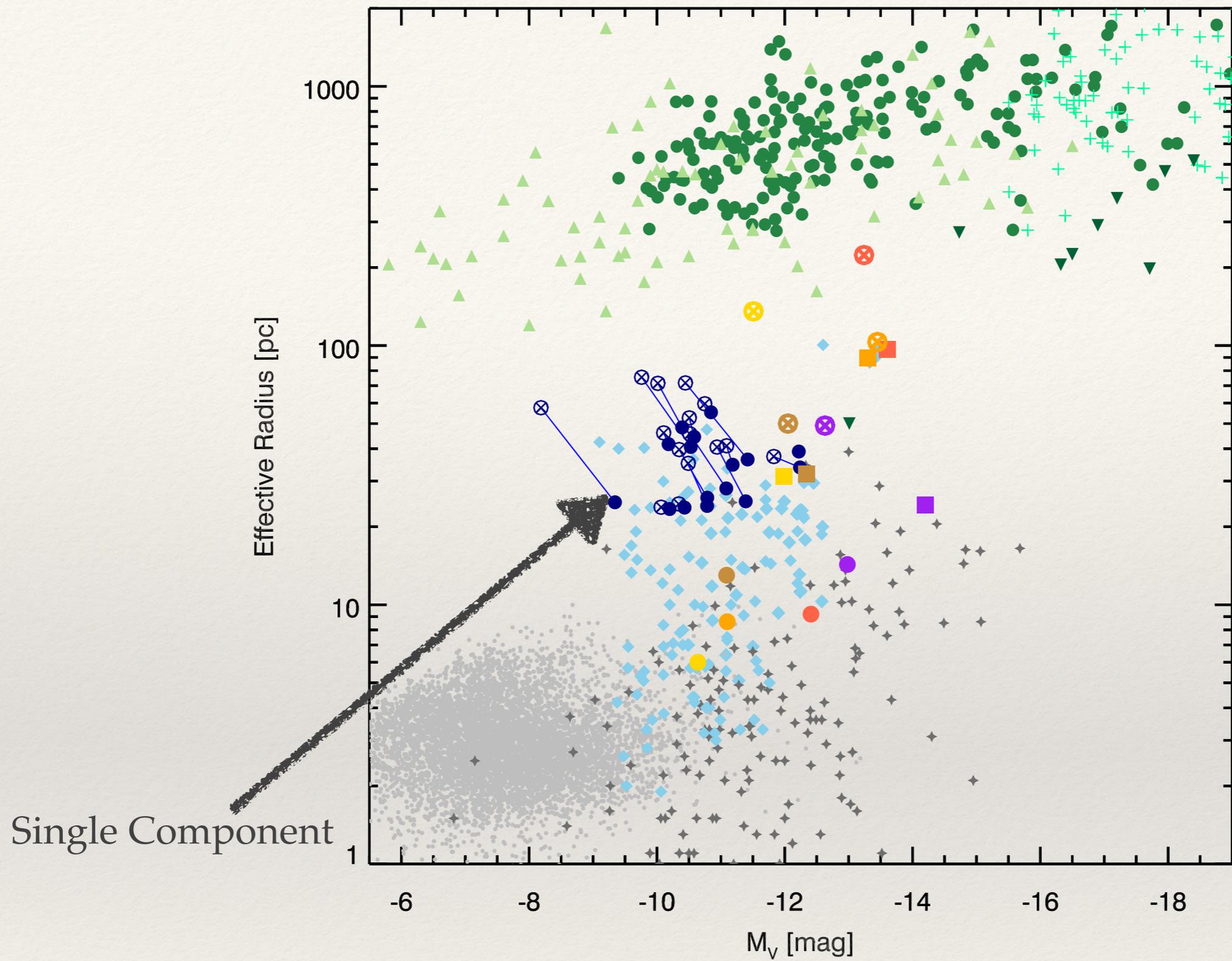
Surface Brightness Profiles of UCDs

- ❖ Studied detailed structural composition of 108 UCDs in the halo of NGC 1399 by fitting several profiles with GALFIT
- ❖ 16 UCDs (14.8%) are extended above the resolution limit of $\sim 23\text{pc}$ when fitted in a single Sersic fit
- ❖ Fitted a core+envelope model with fixed 10pc King core and a Sersic envelope

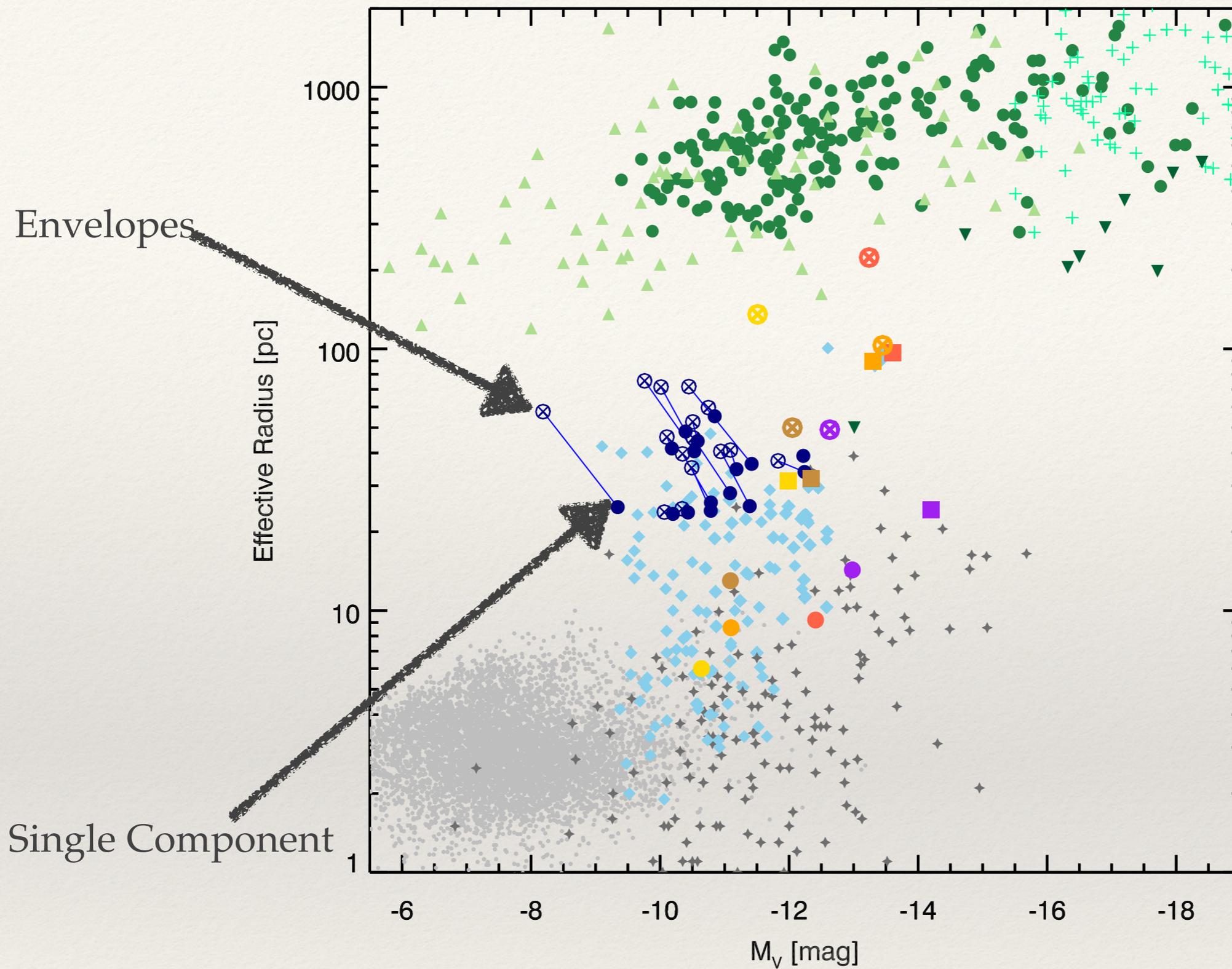




Filling the Magnitude Size Plane



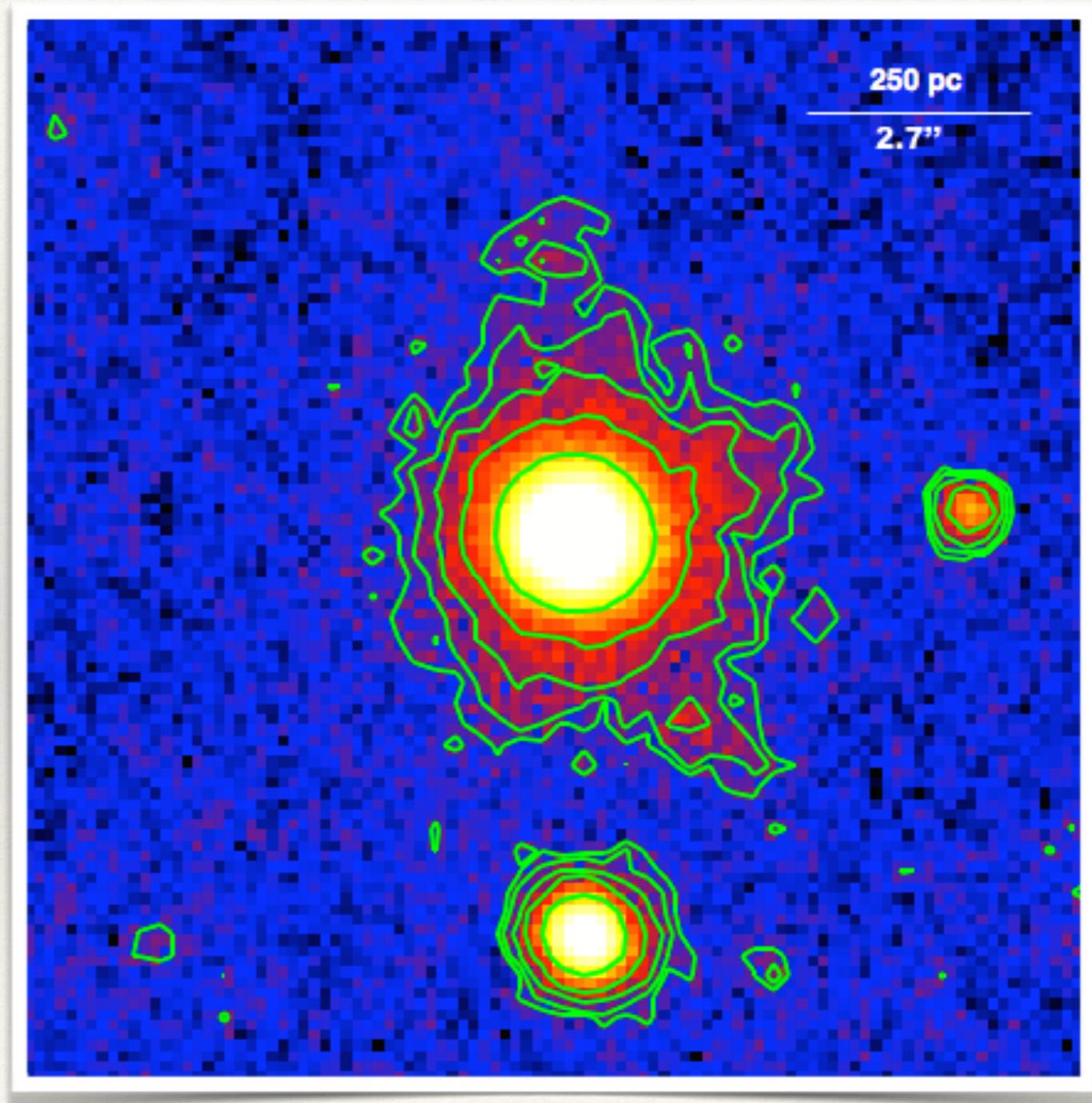
Filling the Magnitude Size Plane



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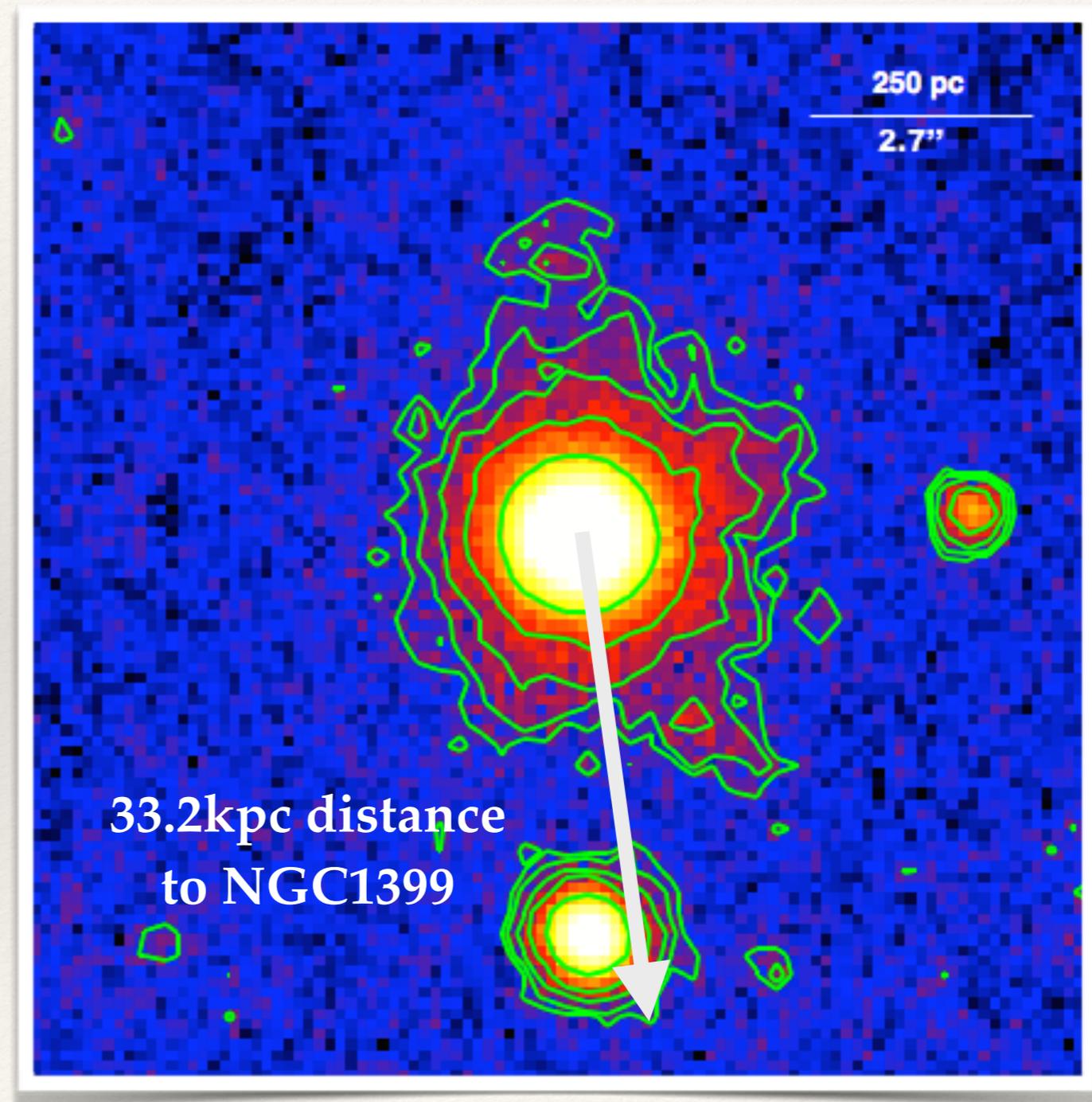
Tidal tails around UCDs

- ❖ Two large tidal tails detected with ~ 350 pc radial extension found around UCD in Fornax
 - ❖ high relative radial velocity $v=1074$ km/s relative to NGC1399 with $v=1425$ km/s
 - ❖ Tidal radius ~ 280 pc at the distance to NGC1399
- > Direct observation of the transformation of a dE galaxy into a UCD?



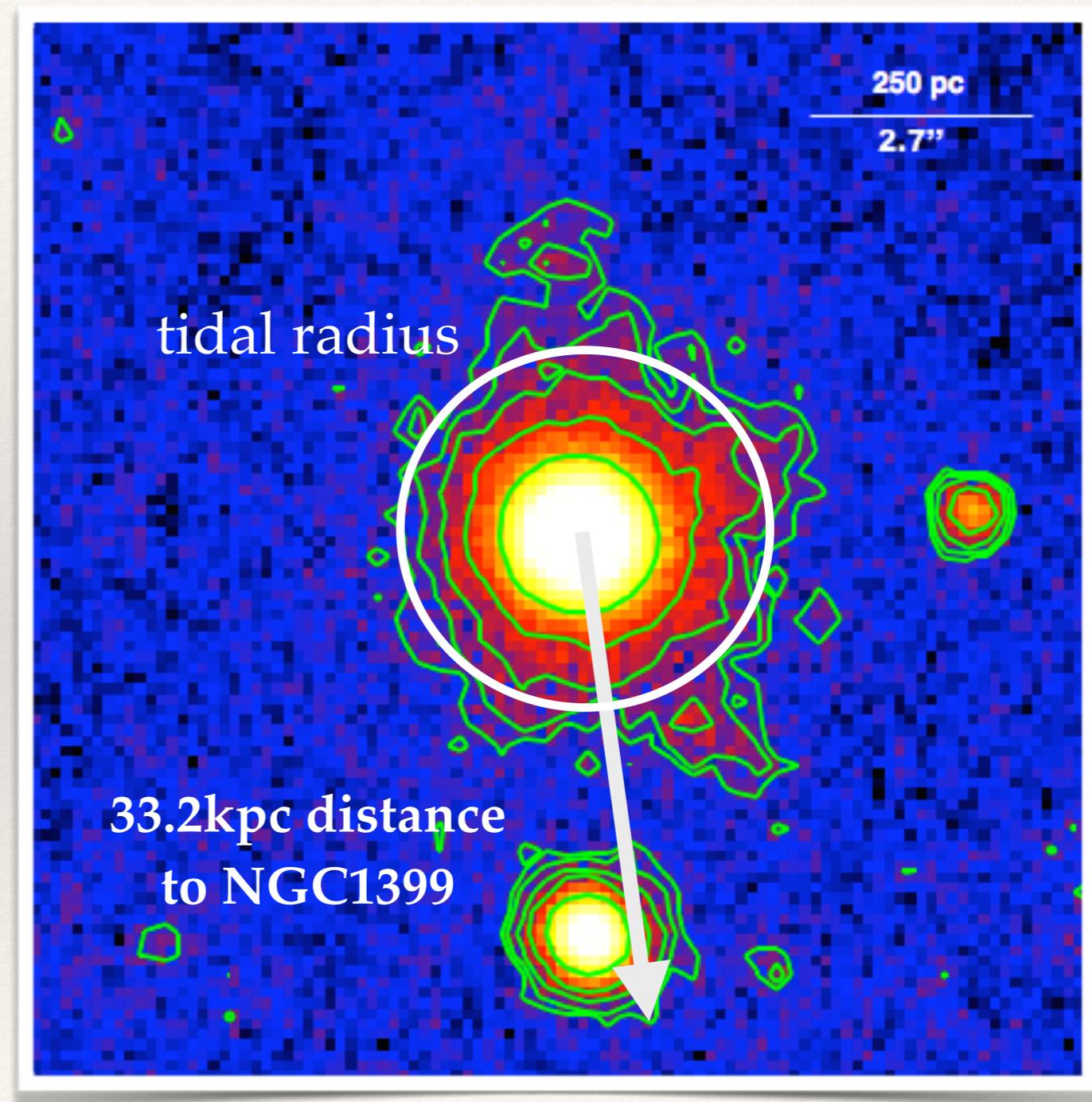
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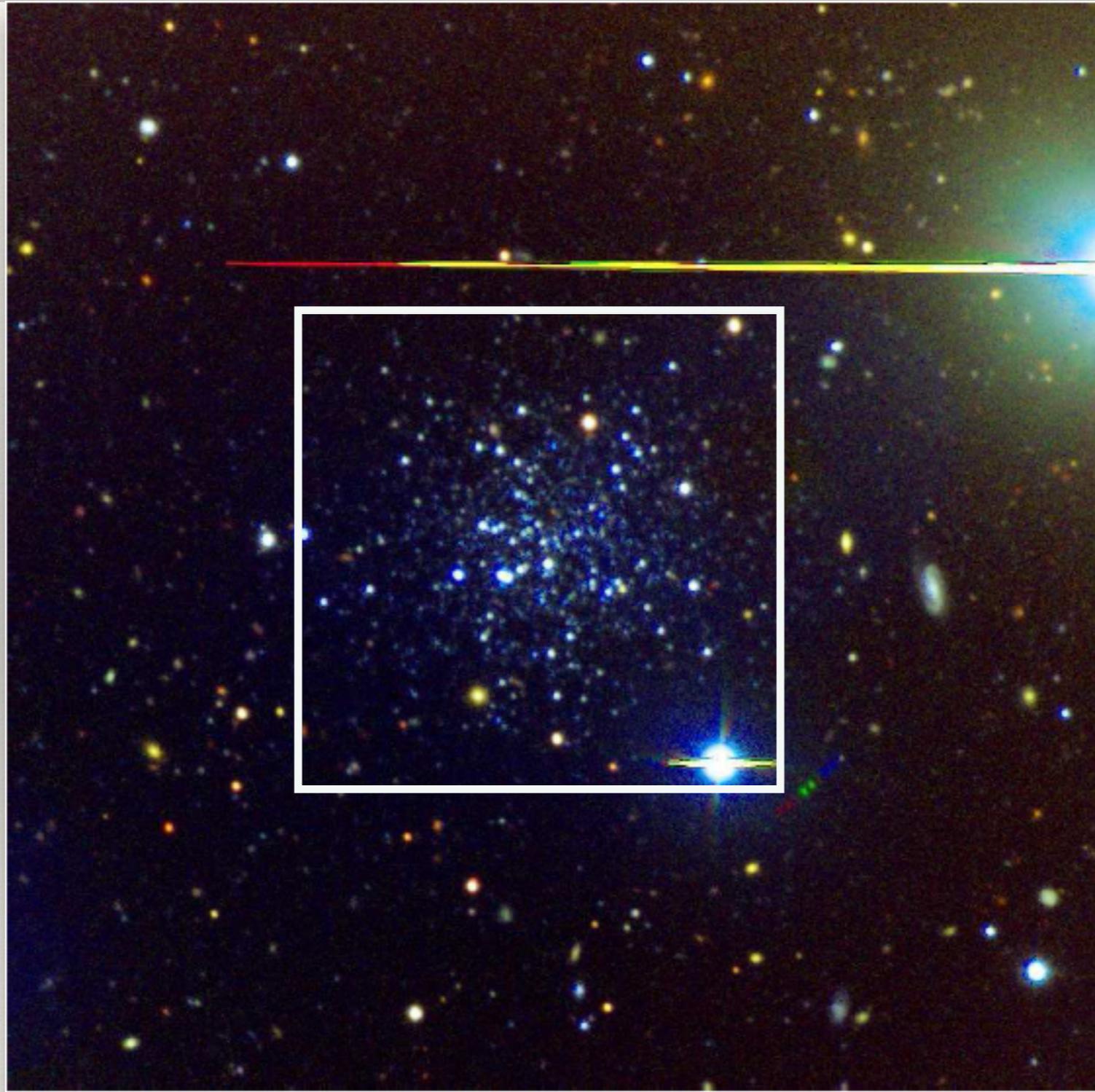
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Summary

- ❖ GCs are significantly more common at 500pc around UCDs compared with what is expected from the global distribution -> **UCDs and GCs are spatially correlated**
- ❖ Large UCDs well fitted with Sersic profiles. When decomposing into two components the **envelope lies in between galaxy and star cluster branch in size magnitude space.**
- ❖ **First direct evidence for tidal features around UCDs**

Stay tuned for ... Crater!



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