Satellites of satellites: the power of combining HST photometry and Gaia astrometry

Elena Sacchi [1], Hannah Richstein [2], Nitya Kallivayalil [2], Roeland van der Marel [1], and the Milky Way 6D collaboration

esacchi@stsci.edu – [1] Space Telescope Science Institute, [2] University of Virginia

Introduction

In the prevailing **ΛCDM** cosmology, galaxies grow continuously in mass through hierarchical assembly of smaller systems, and dark matter halos host substructures down to the resolution limit of the simulations.

Hierarchical evolution should occur at all scales, implying that the satellites of the Milky Way (MW) should also have companions.

The recent discoveries of several **ultra-faint dwarf** (UFD) galaxy candidates in close proximity to the **Magellanic Clouds** (MCs) provide a unique opportunity to test and understand this process.

Data

- **Milky Way 6D Cosmology** program (HST Treasury Program 14734; PI: Kallivayalil) to analyze the stellar populations and color-magnitude diagrams (CMDs) of 30 UFD galaxies.
- **Gaia DR2 proper motions** to better constrain the possible dynamical association of the dwarfs with the MCs (Kallivayalil+18).

Star Formation Histories: is the quenching different for the MC candidate satellites?

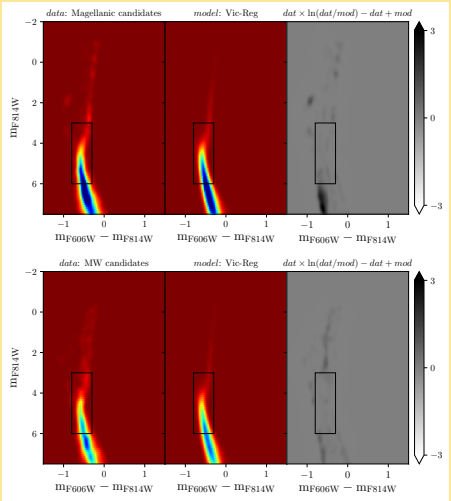
SFHs inferred with:

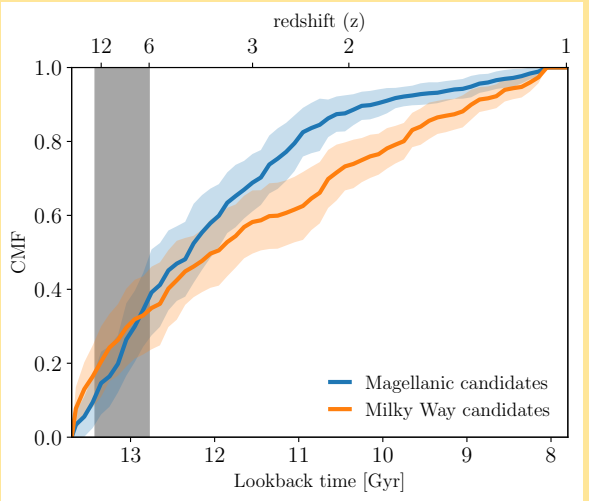
- synthetic CMD method (SFERA, Cignoni+15)
- age step: 100 Myr
- [Fe/H] from –4 to –1
- 2 sets of stellar models:
  Victoria–Regina
  MESA–MIST

stacks:

Dra II
Hor I
Hya II
Phx II

Cra 2
Gru I
Ret II
Tri II
Tuc II
Tuc III





(probability of association with the Milky Way or Magellanic Clouds from **Jehwa+16, Sales+17, Kallivayalil+18**)

Preliminary interpretation

The CMDs and quenching times seem to be different for the two stacked samples. MC candidates have a brighter **horizontal branch** and a less disperse red giant branch, and their star formation stopped ~ 1–2 Gyr before the MW candidates. These systematic differences might imply that satellite behavior is very sensitive to the specific **accretion history** of the host galaxy, as found in other studies (see, e.g., **Weisz+15** on the differences between MW and M31 satellites).