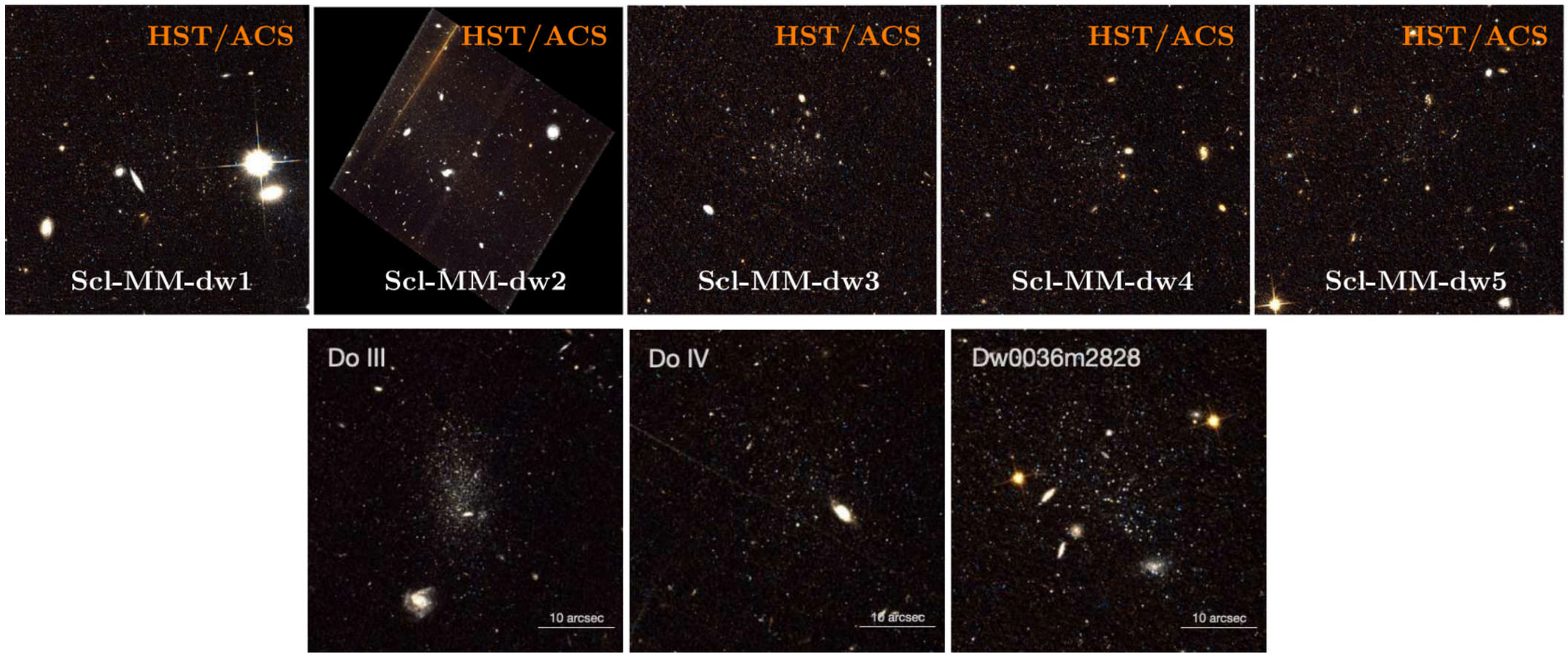
The Faint Satellite System of NGC 253: Insights into Low-Density Environments

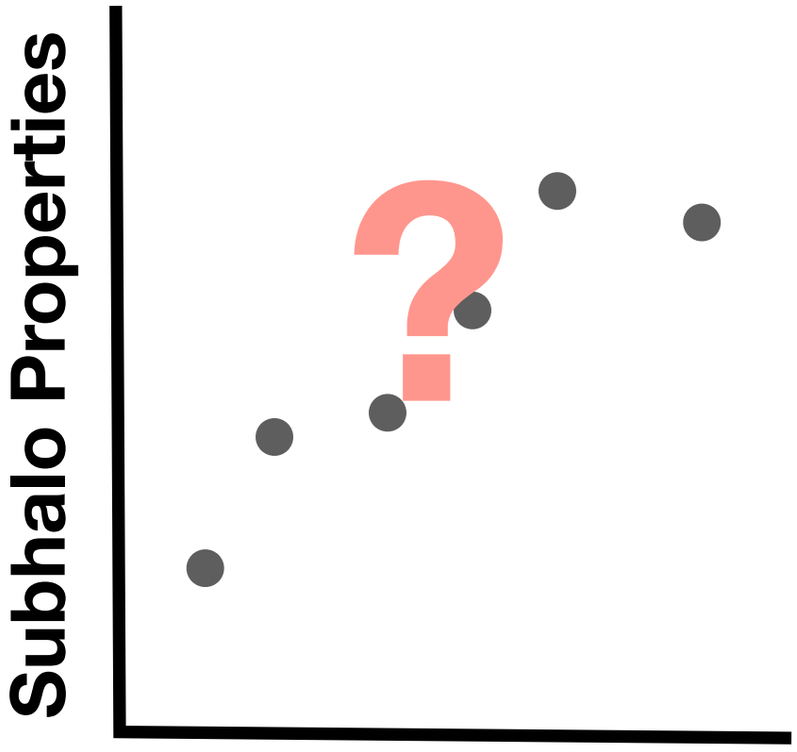


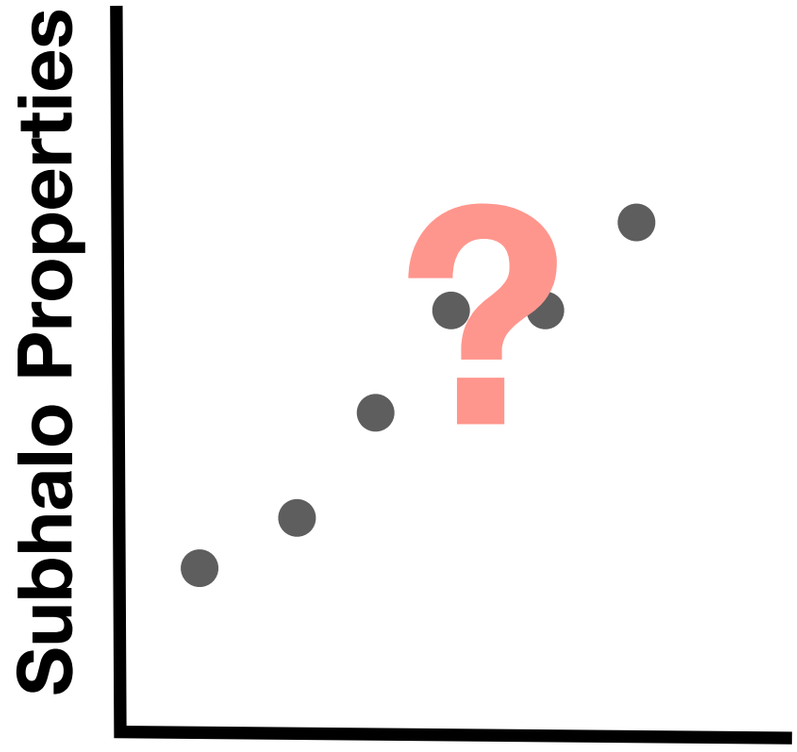
Burçin Mutlu-Pakdil

Dartmouth College

The Local Group is nice, but …

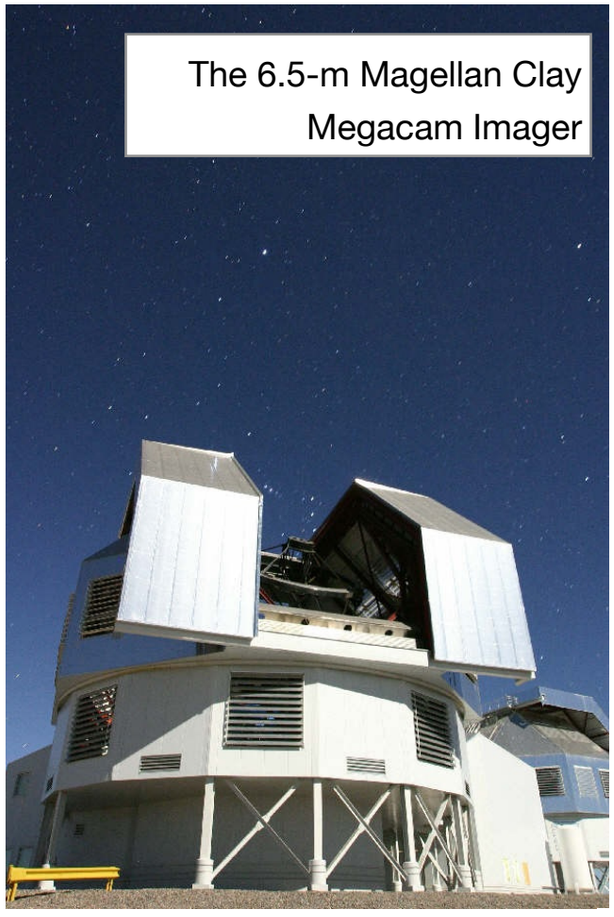
What we need:



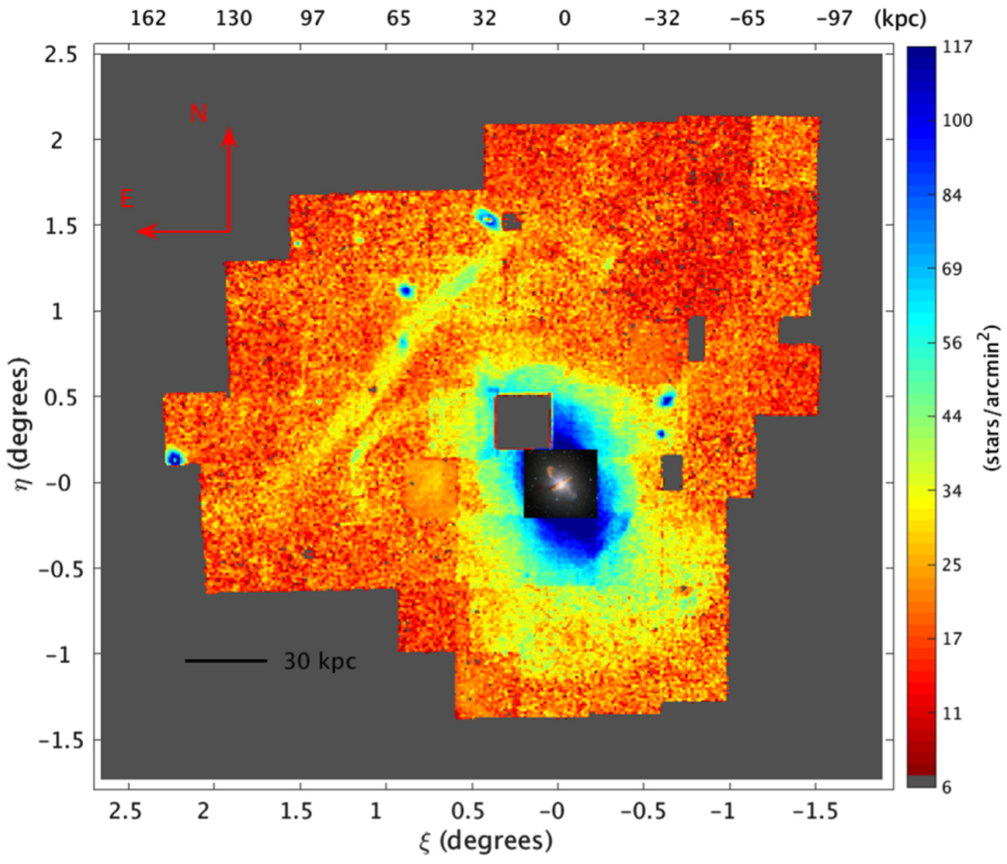


Subhalo Properties: satellite luminosity function, star formation fractions, etc

Search for Resolved Dwarfs and Stellar Streams Around Nearby Systems

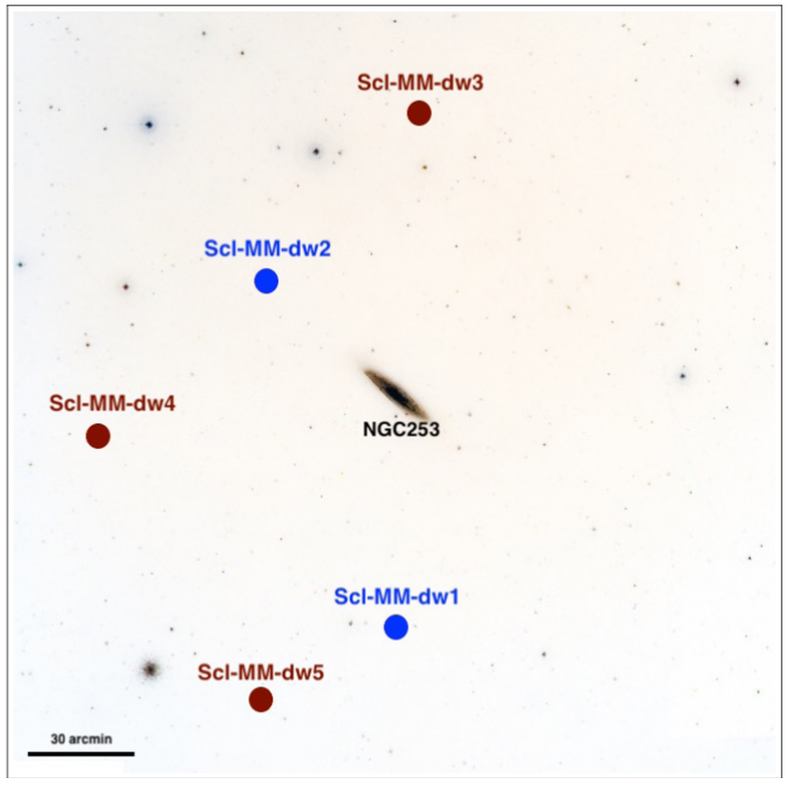


Cen A (D=3.7 Mpc)



Crnojević+ 2016, 2019

NGC253 (D=3.7 Mpc)



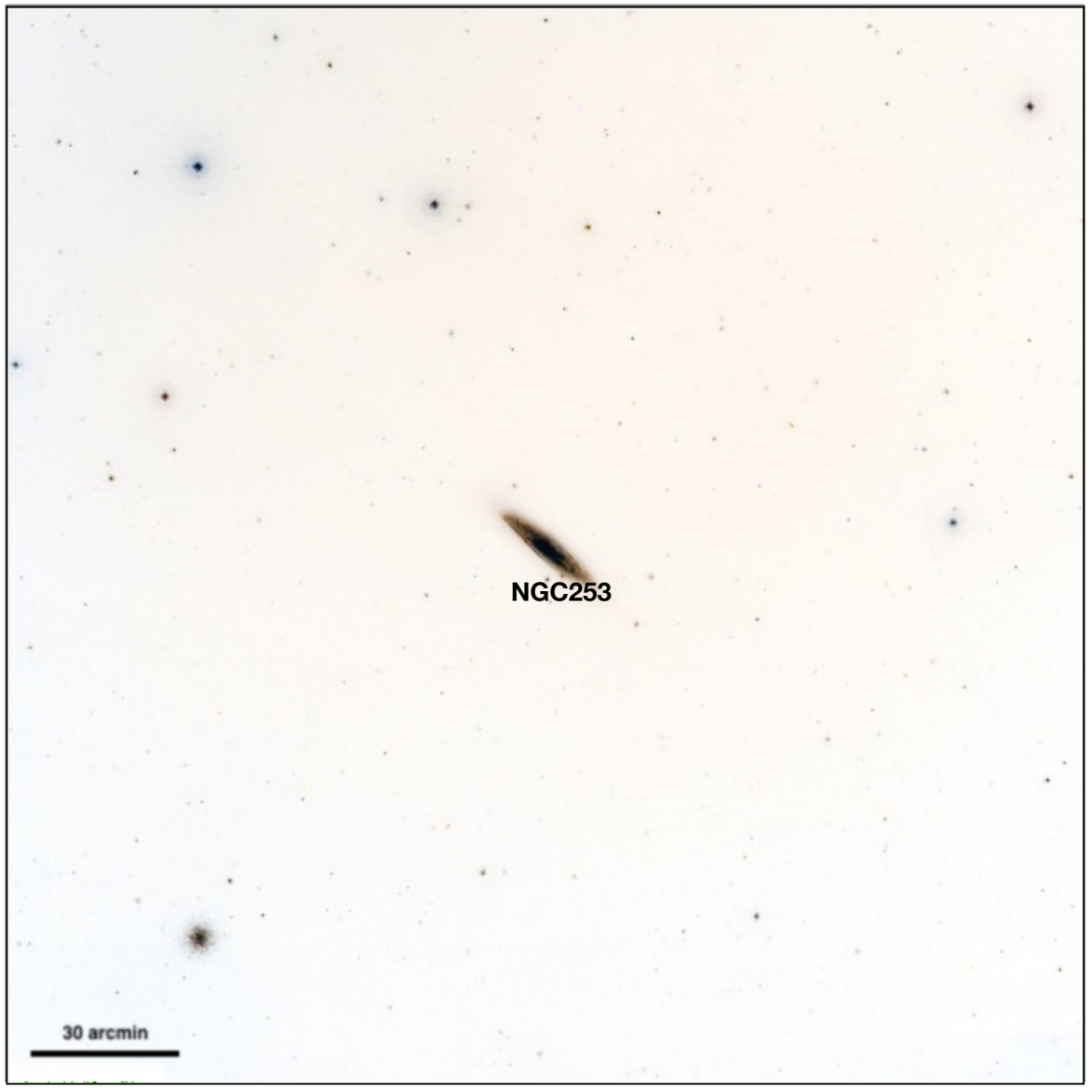
Mutlu-Pakdil+2022, 2024

PISCES: The Panoramic Imaging Survey of Centaurus and Sculptor

Burçin Mutlu-Pakdil, Dartmouth (she/her)

NGC 253 : An effectively isolated Milky Way-mass galaxy

Lianou+ 2013

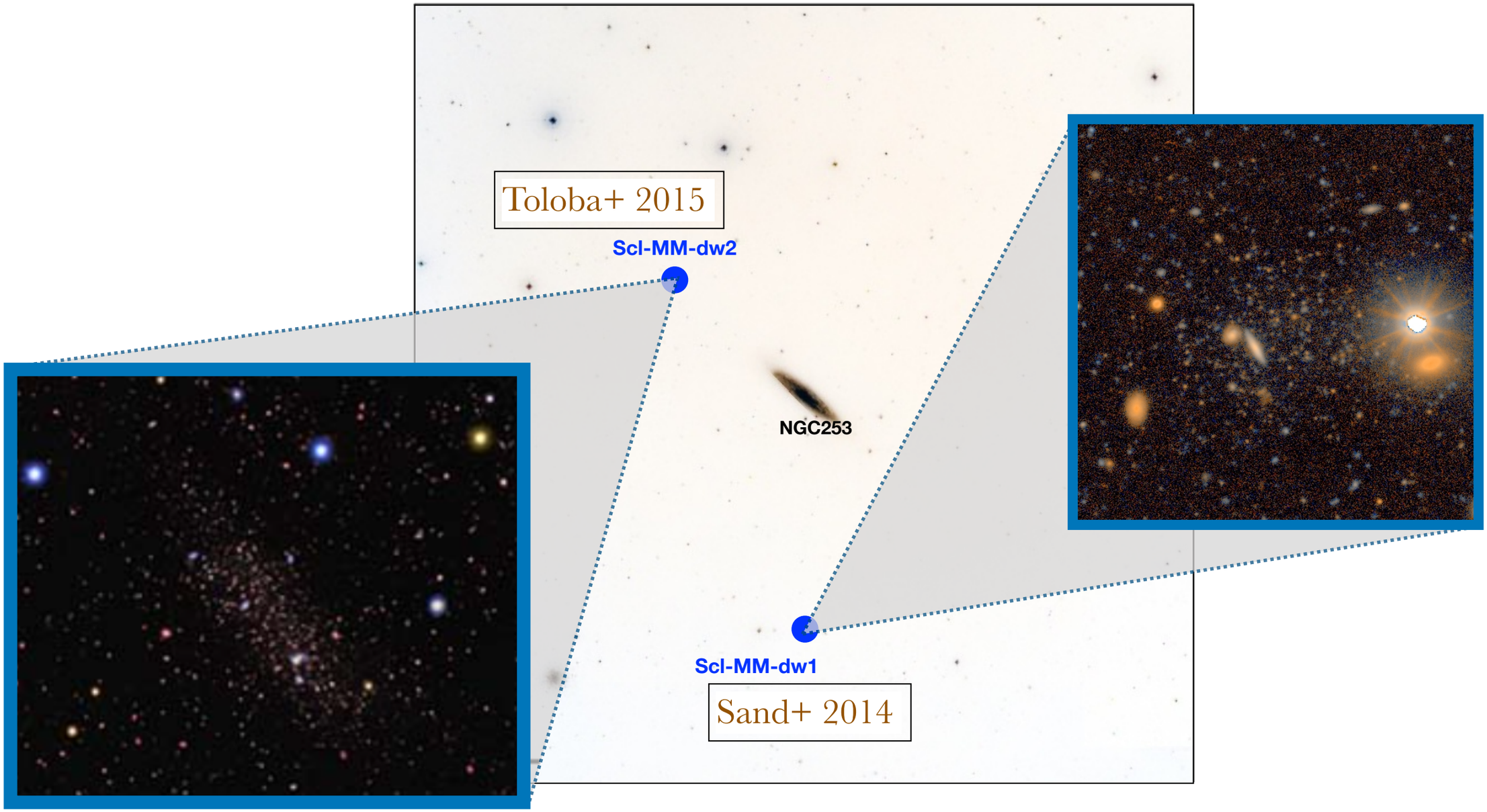


Burçin Mutlu-Pakdil, Dartmouth (she/her)

PISCES: The Panoramic Imaging Survey of Sculptor

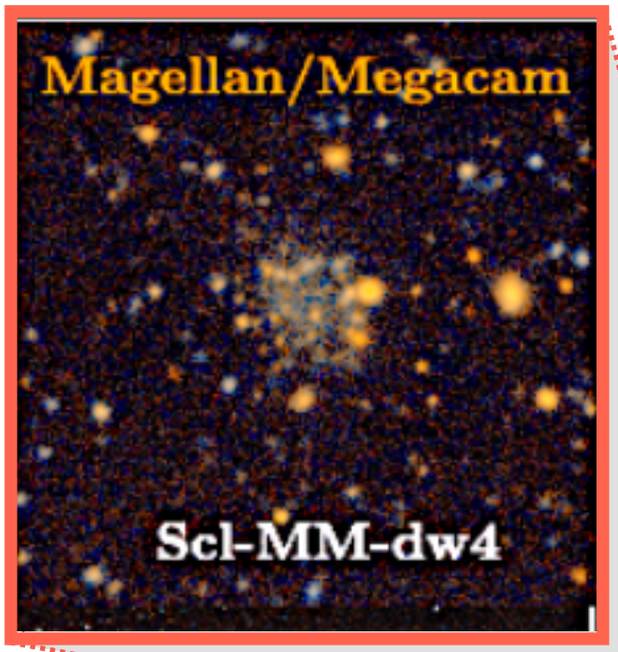
NGC 253 : An effectively isolated Milky Way-mass galaxy

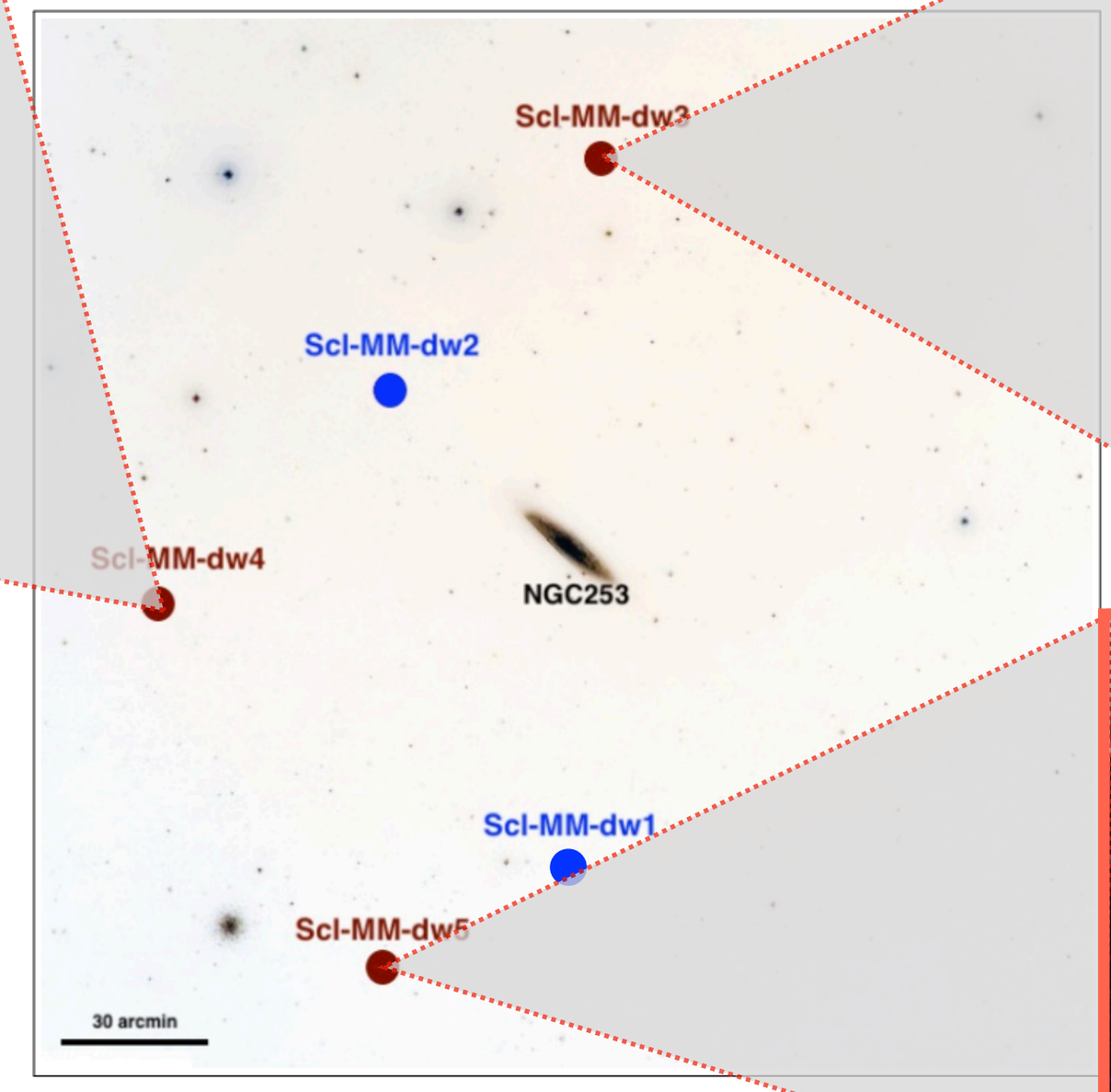
Lianou+ 2013

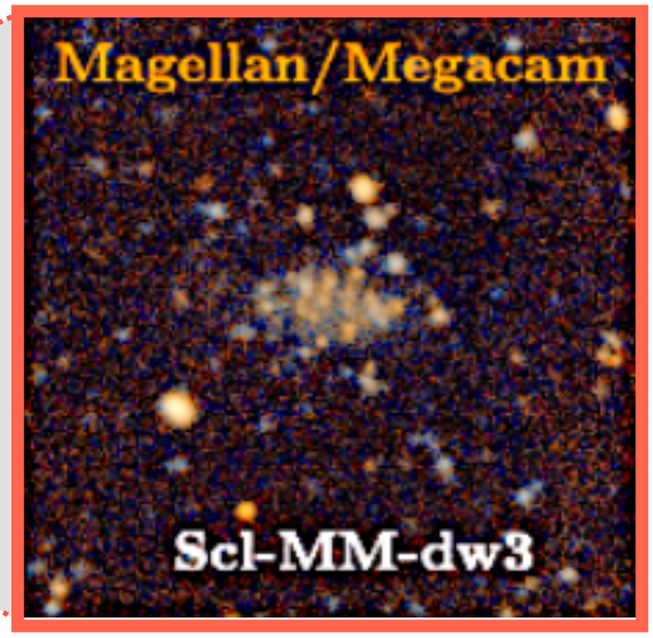


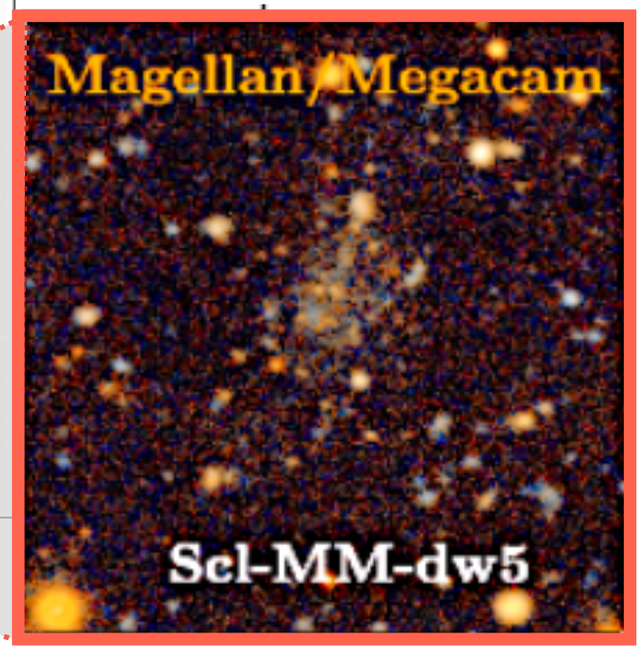
PISCES: The Panoramic Imaging Survey of Sculptor

Discovery of 3 New Dwarf Companions: Now Total 5 Dwarfs







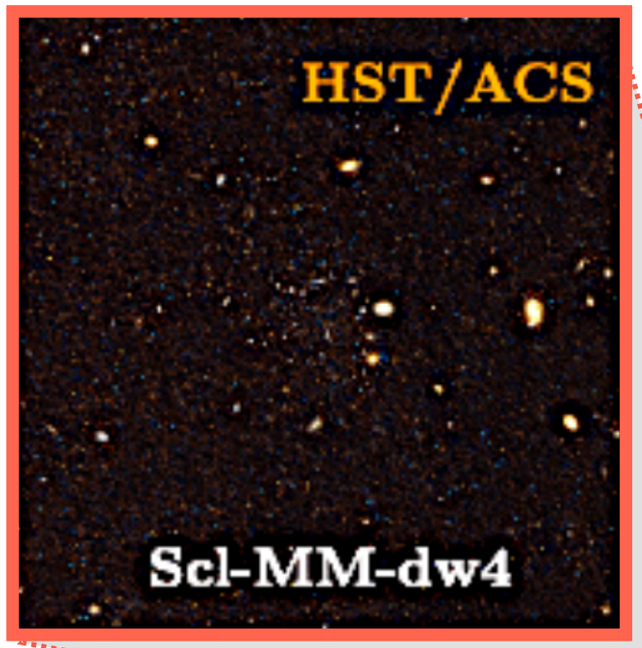


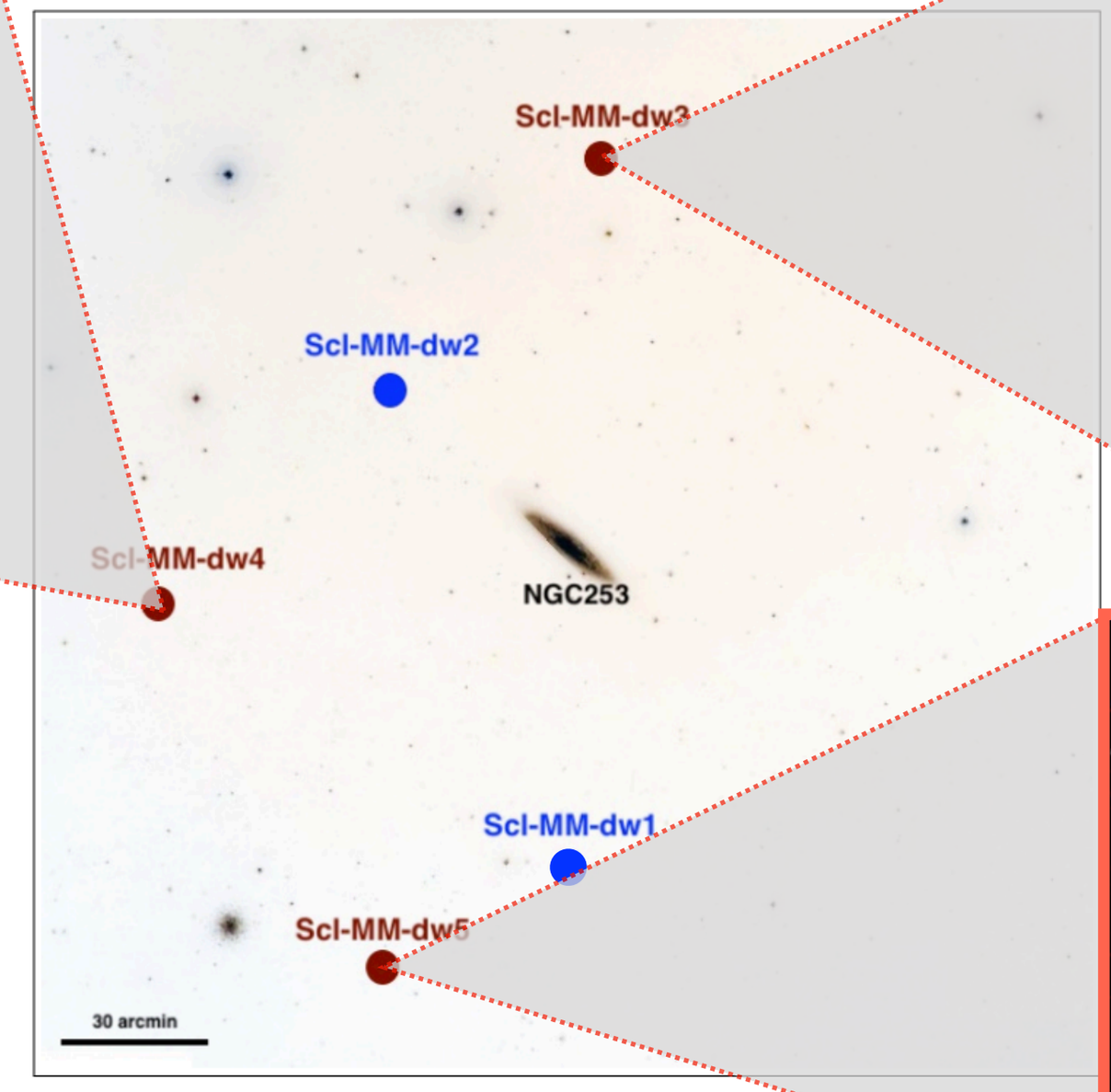
Mutlu-Pakdil+2022

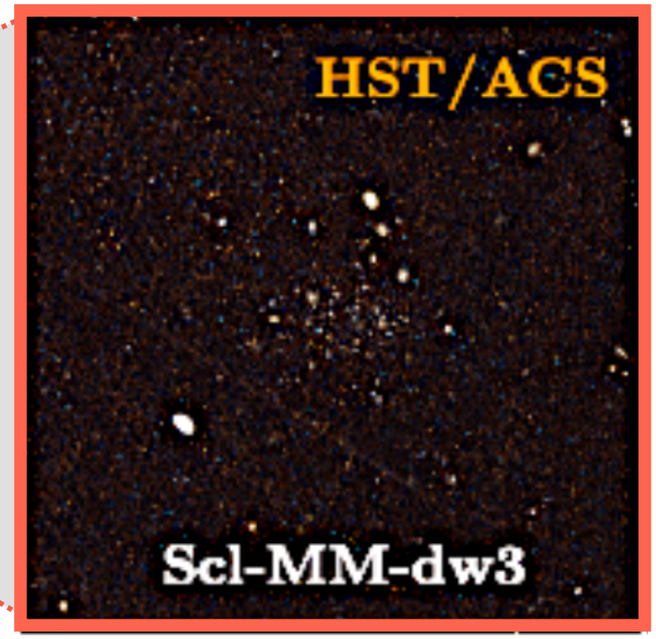
Burçin Mutlu-Pakdil, Dartmouth (she/her)

PISCES: The Panoramic Imaging Survey of Sculptor

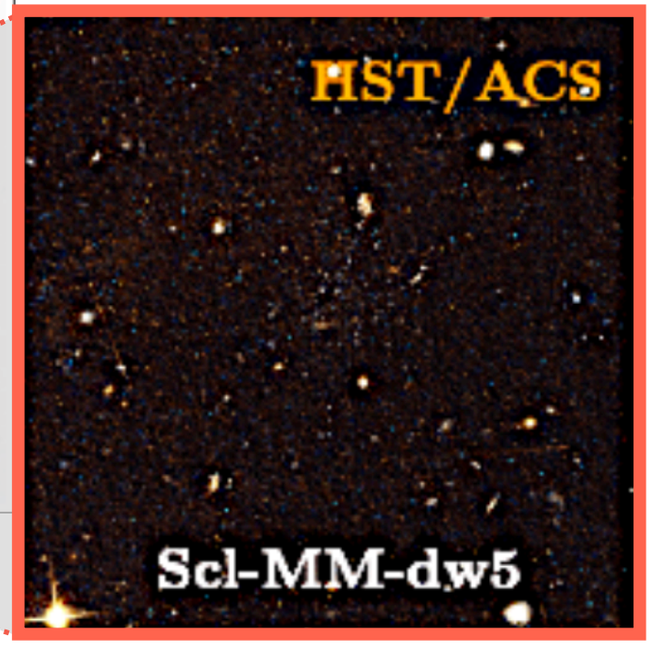
The First Faintest Dwarf Galaxies Around A Distant Milky Way Analog







We have Hubble images!



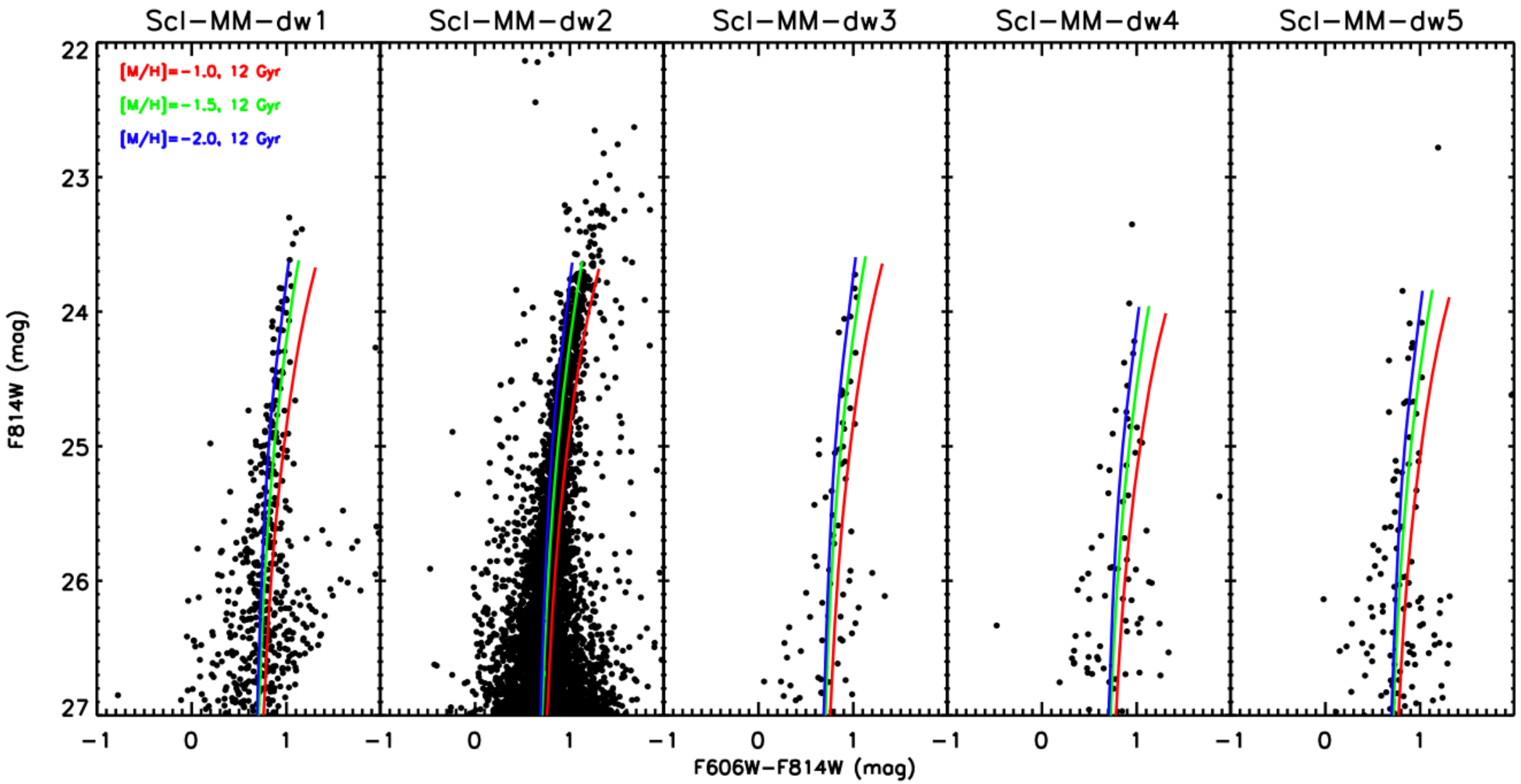
Mutlu-Pakdil+2022

Burçin Mutlu-Pakdil, Dartmouth (she/her)

PISCES: The Panoramic Imaging Survey of Sculptor

Two “classical” dwarfs

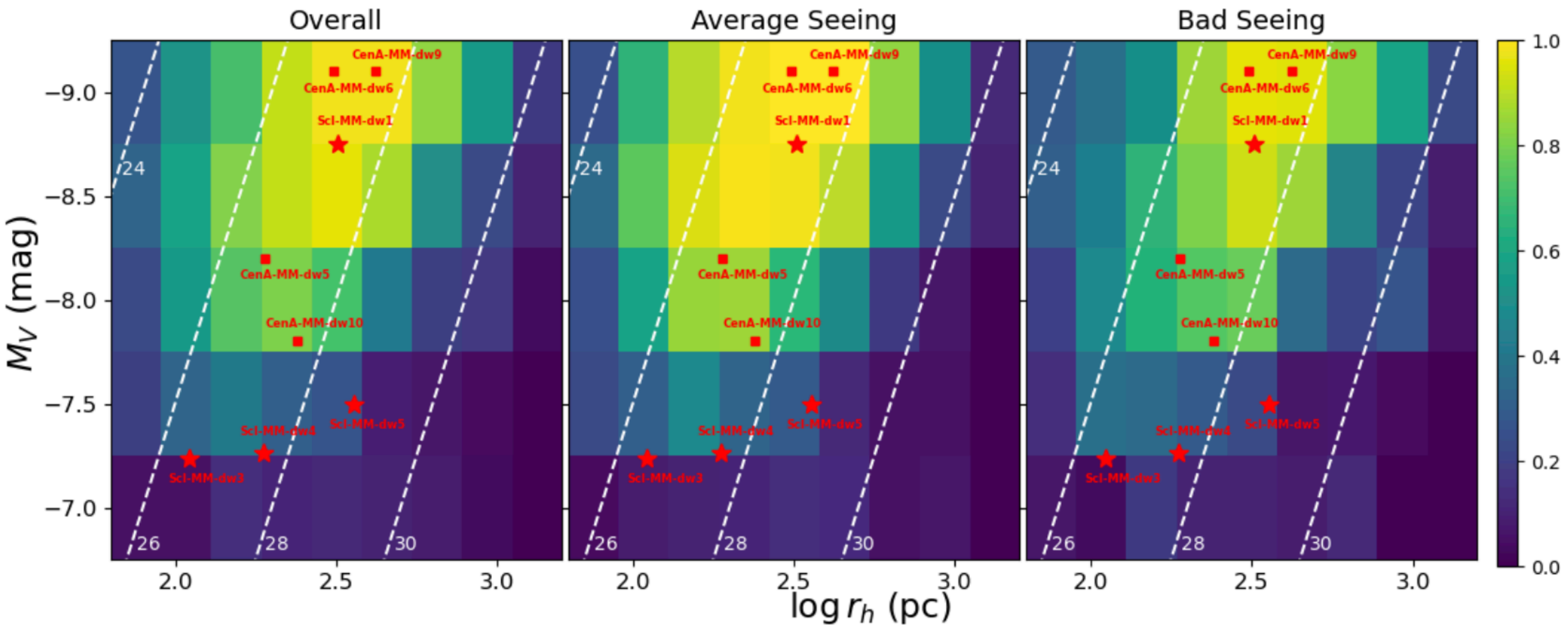
First Ultra-Faint Dwarfs around a Distant Milky Way Analog



Mutlu-Pakdil+2022

PISCES: The Panoramic Imaging Survey of Sculptor

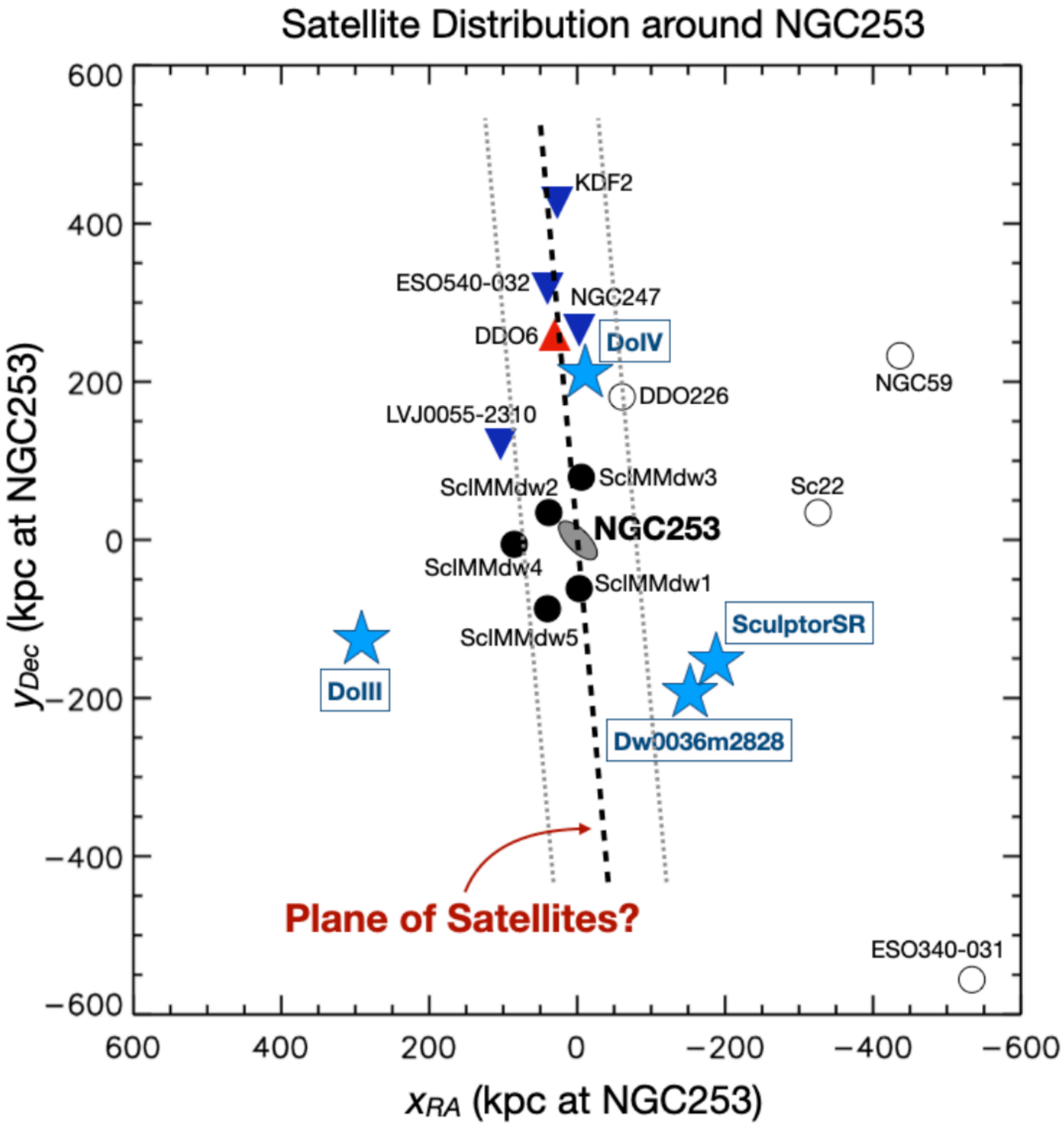
Survey Completeness Limits



Physical Size

Mutlu-Pakdil+ 2024

Beyond the PISCES Footprint

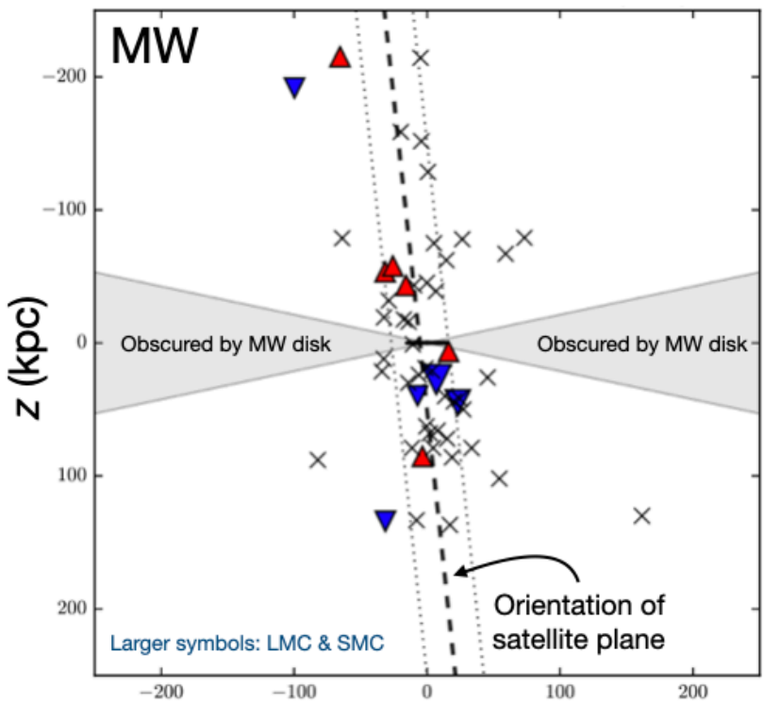


Mutlu-Pakdil+ 2024

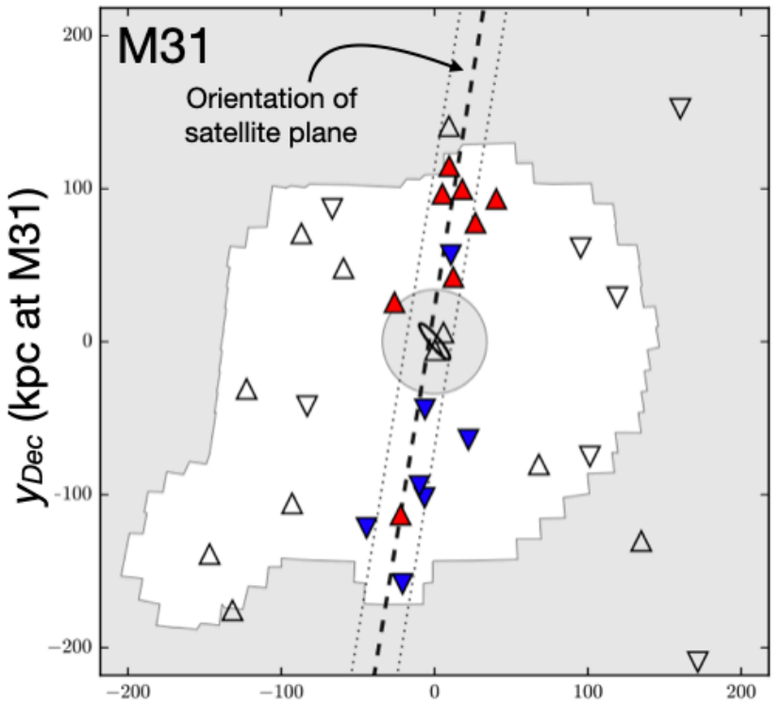
Martínez-Delgado+ 2021

Planes of Satellites Problem?

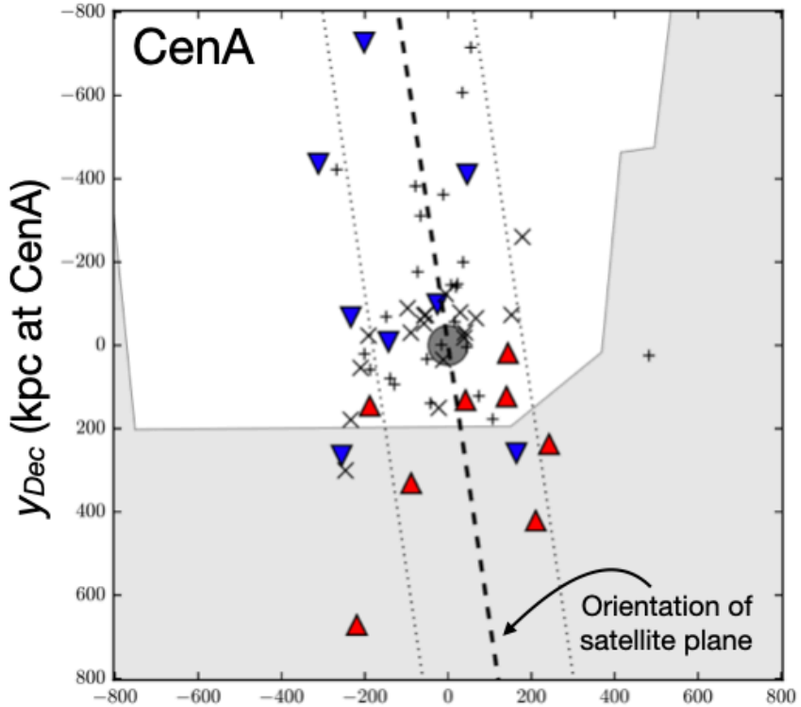
Planes of satellite galaxies are best studied for three nearby systems: the Milky Way, M31, and CenA



Pawlowski 2018

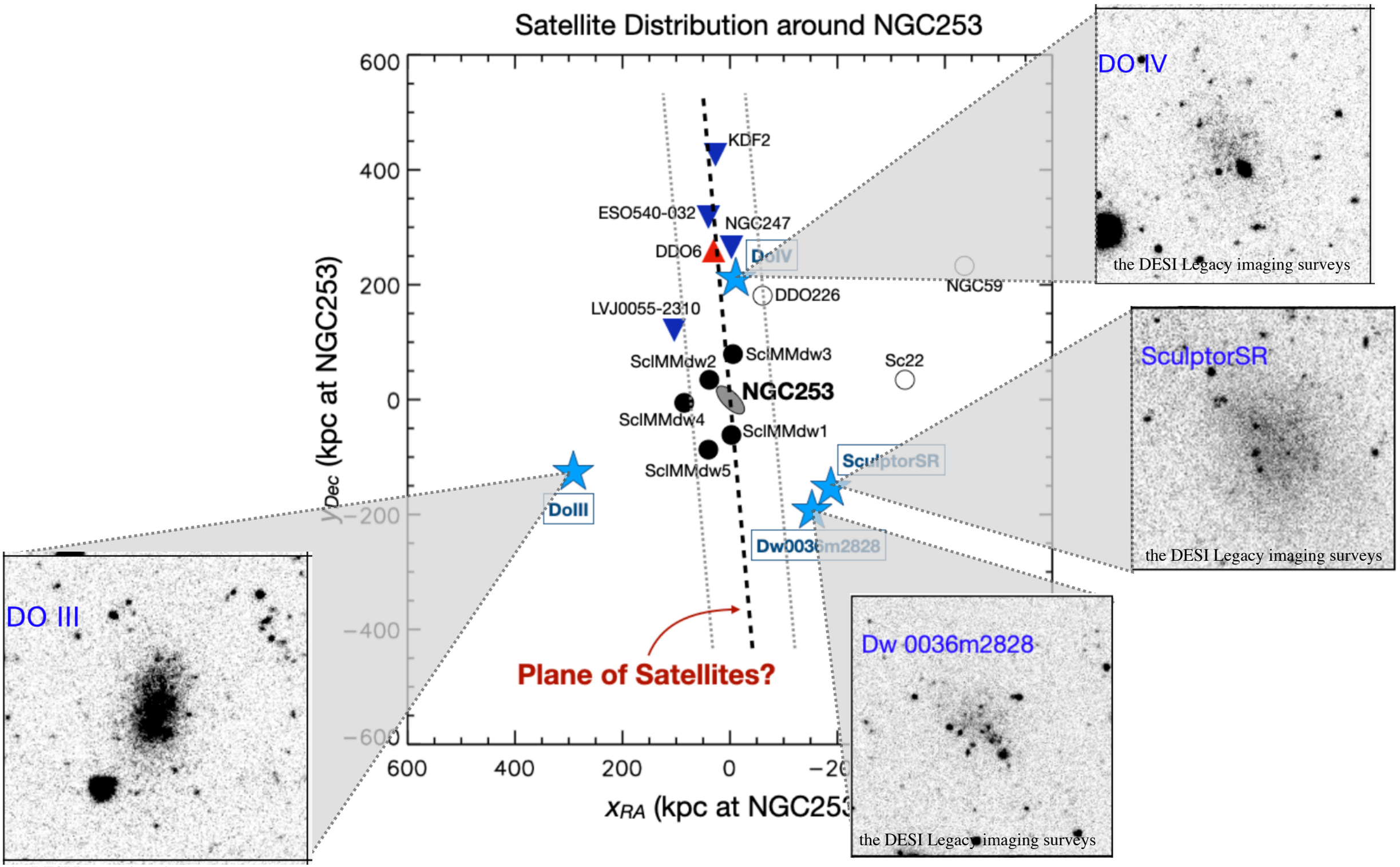


Ibata+ 2013



Müller+ 2018

Beyond the PISCES Footprint

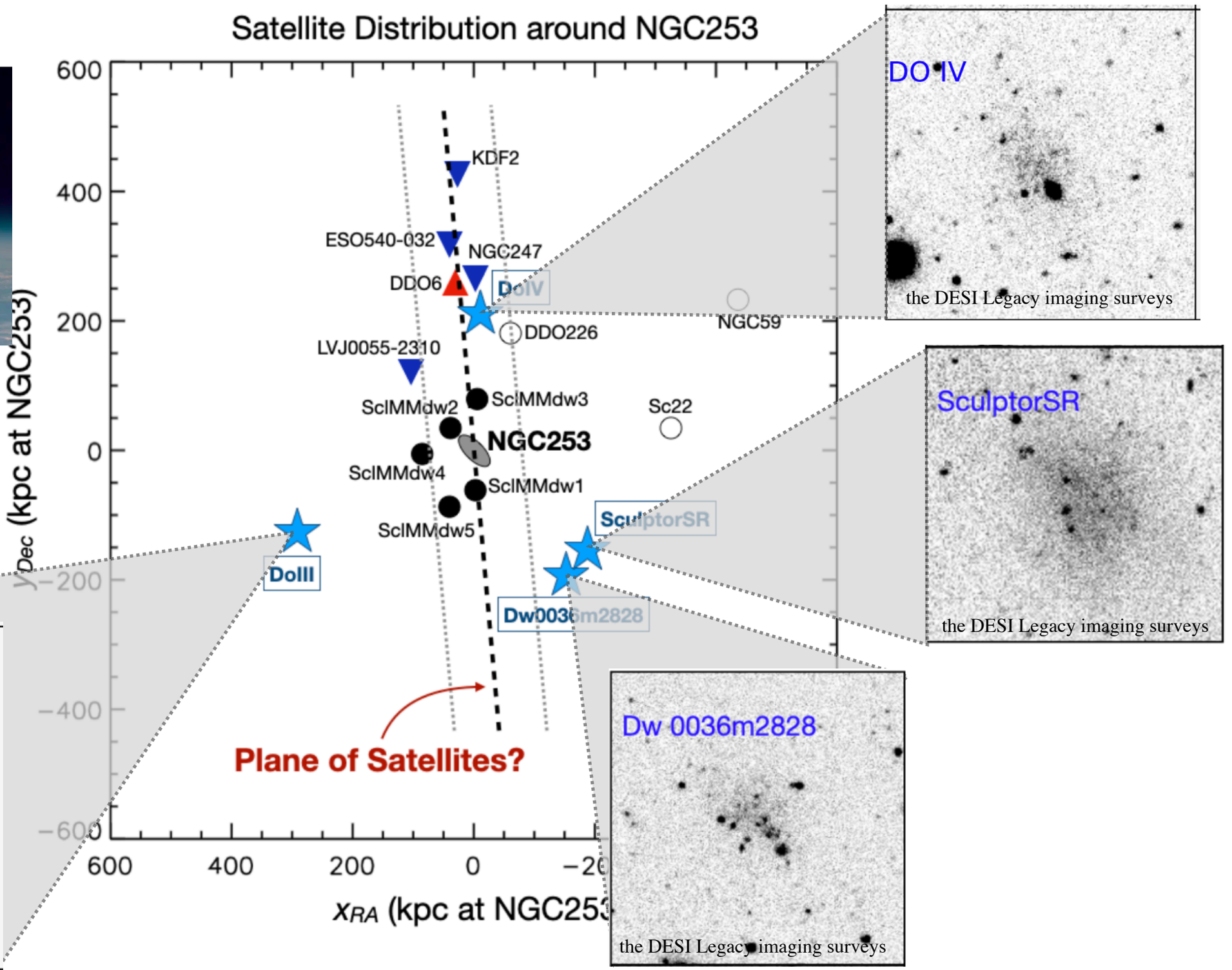


Mutlu-Pakdil+ 2024

Martínez-Delgado+ 2021, 2024

Beyond the PISCES Footprint

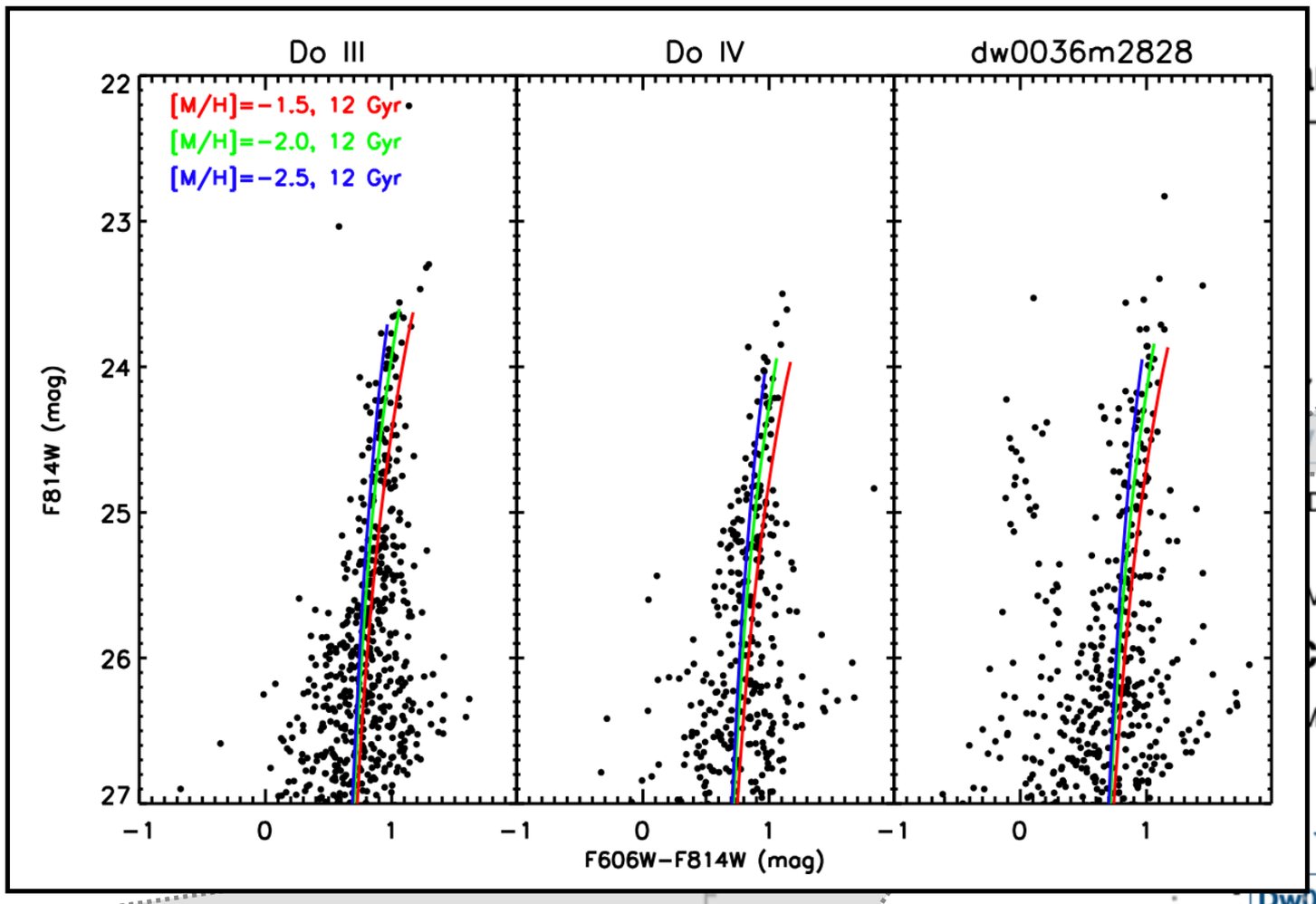
New Hubble images!

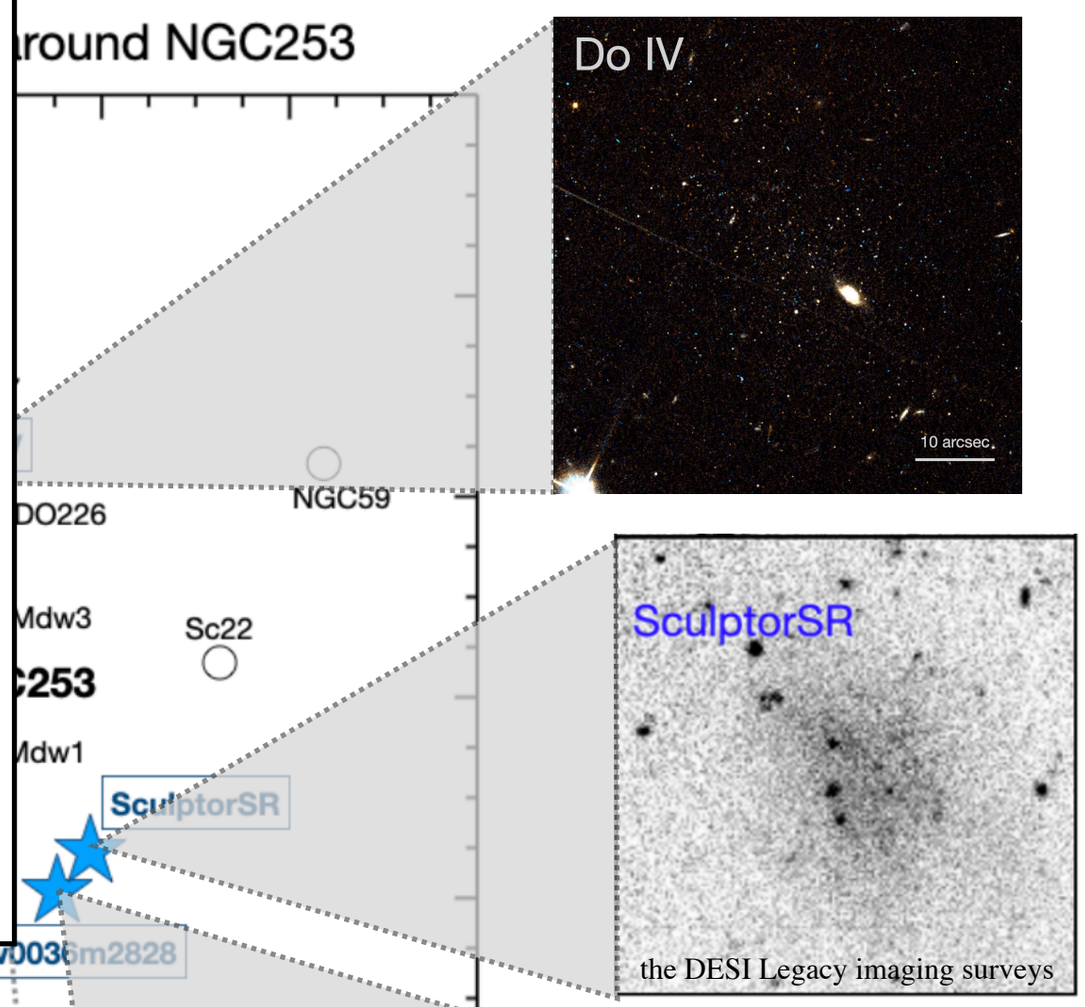


Mutlu-Pakdil+ 2024

Martínez-Delgado+ 2021, 2024

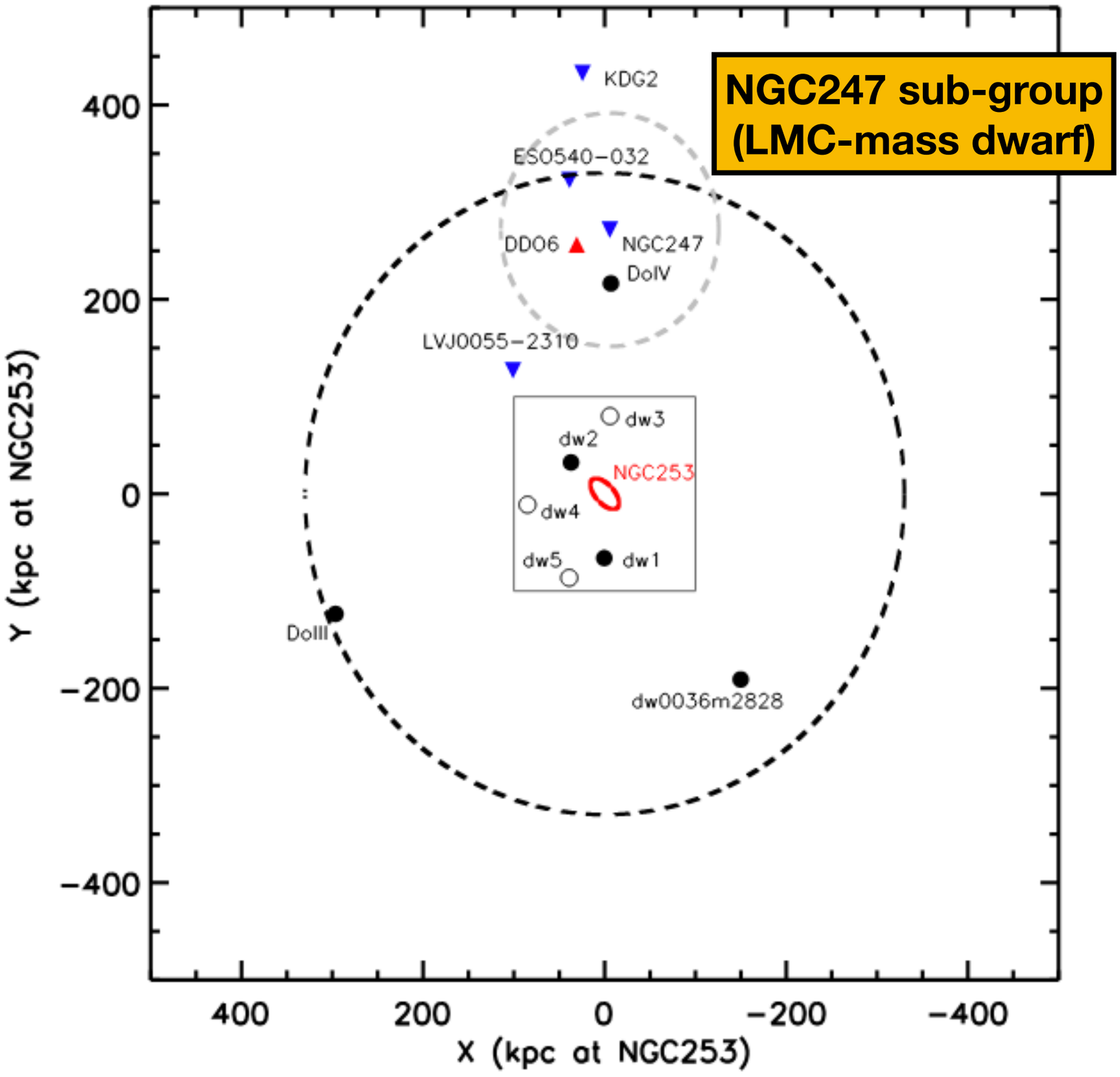
Beyond the PISCES Footprint





Mutlu-Pakdil+ 2024

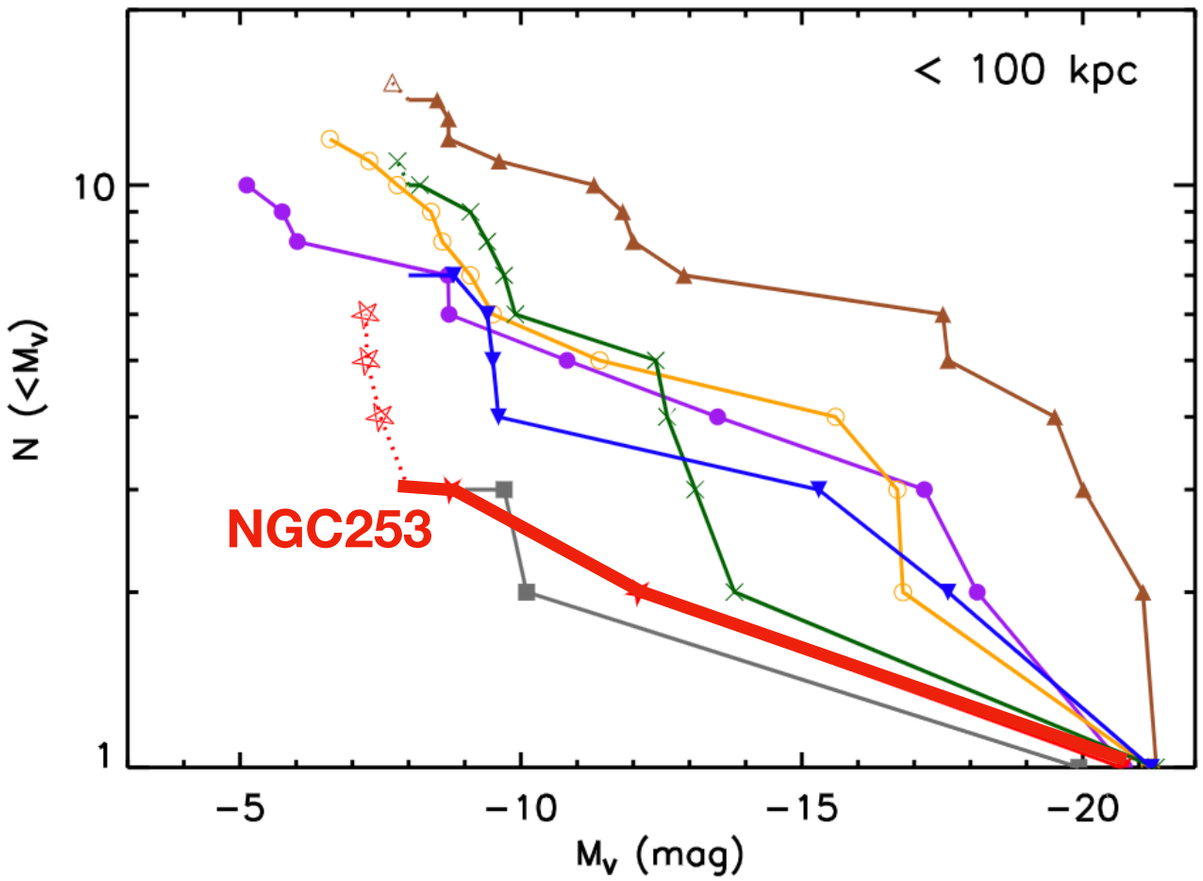
Beyond the PISCES Footprint: No Satellite Plane!



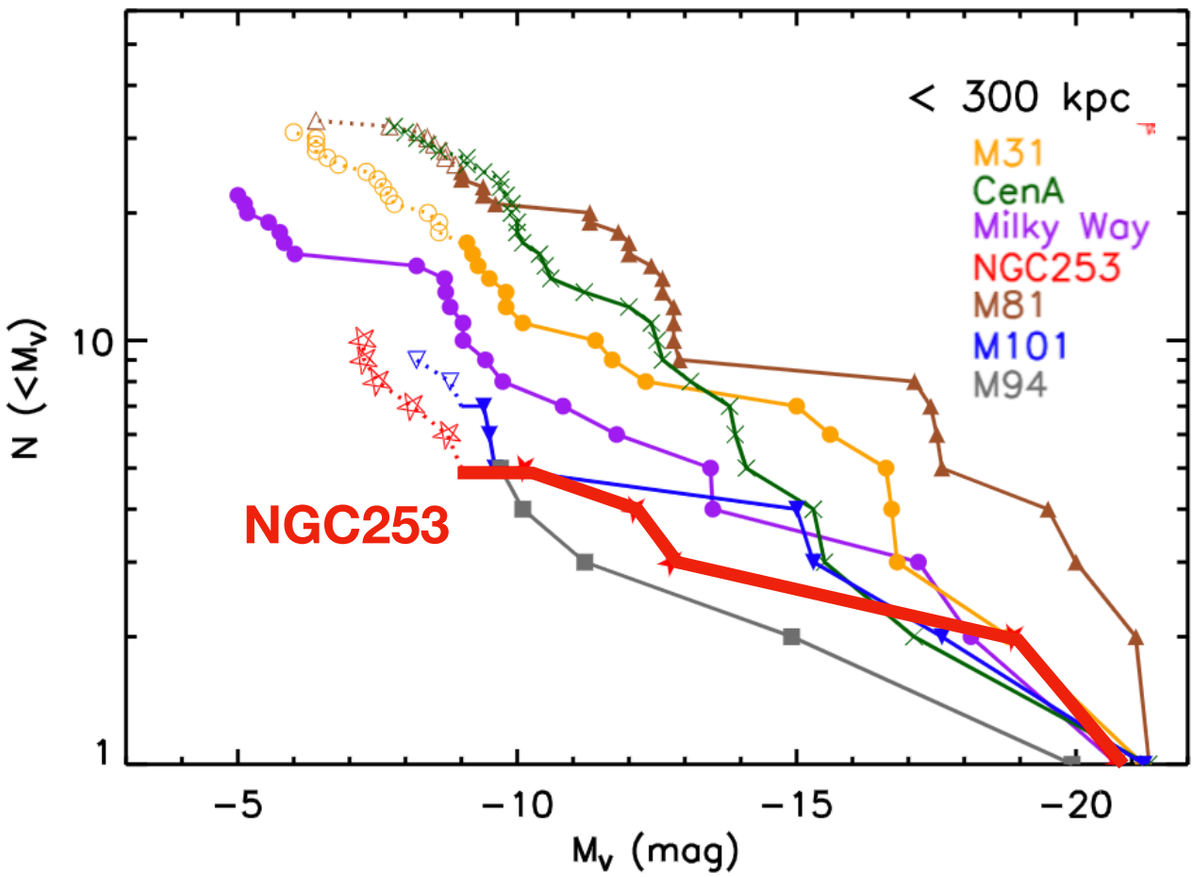
Mutlu-Pakdil+ 2024

NGC253 Satellite Luminosity Function

within 100 kpc



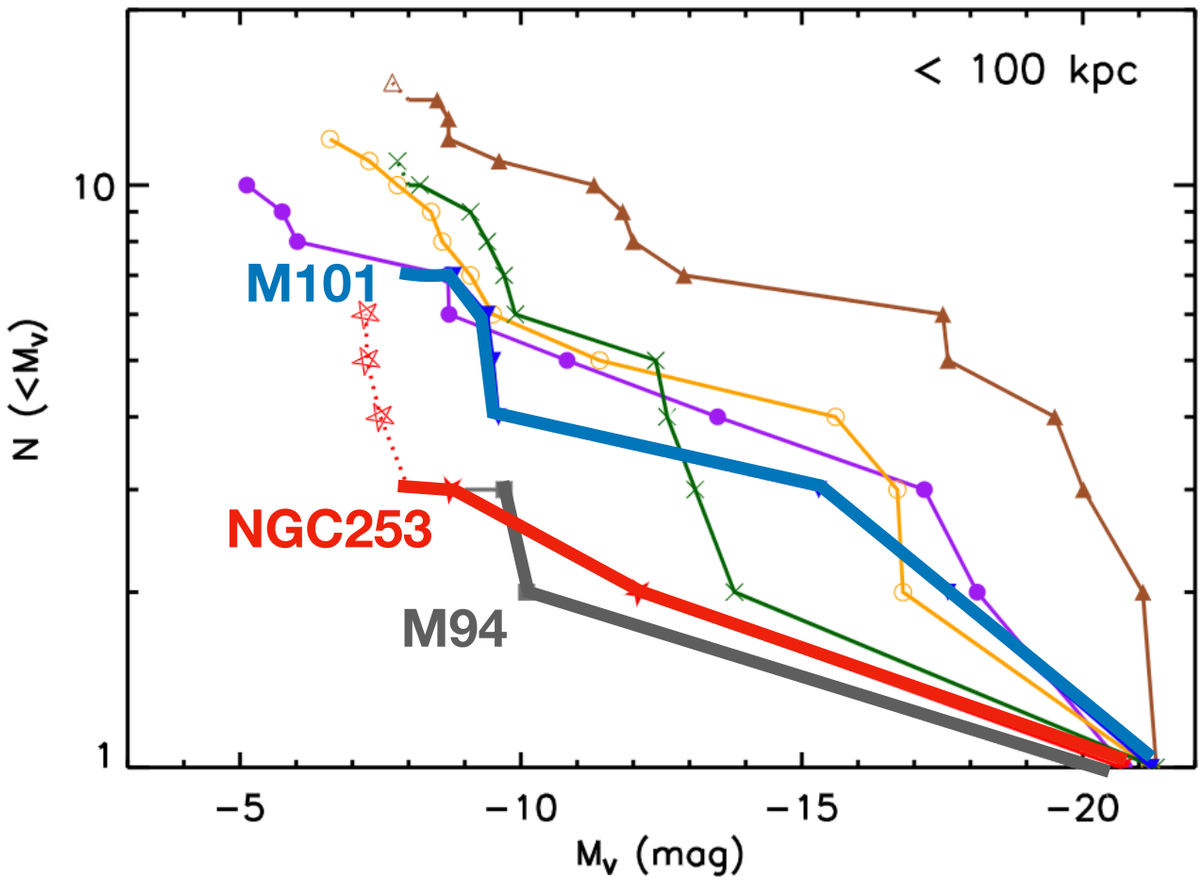
within 300 kpc



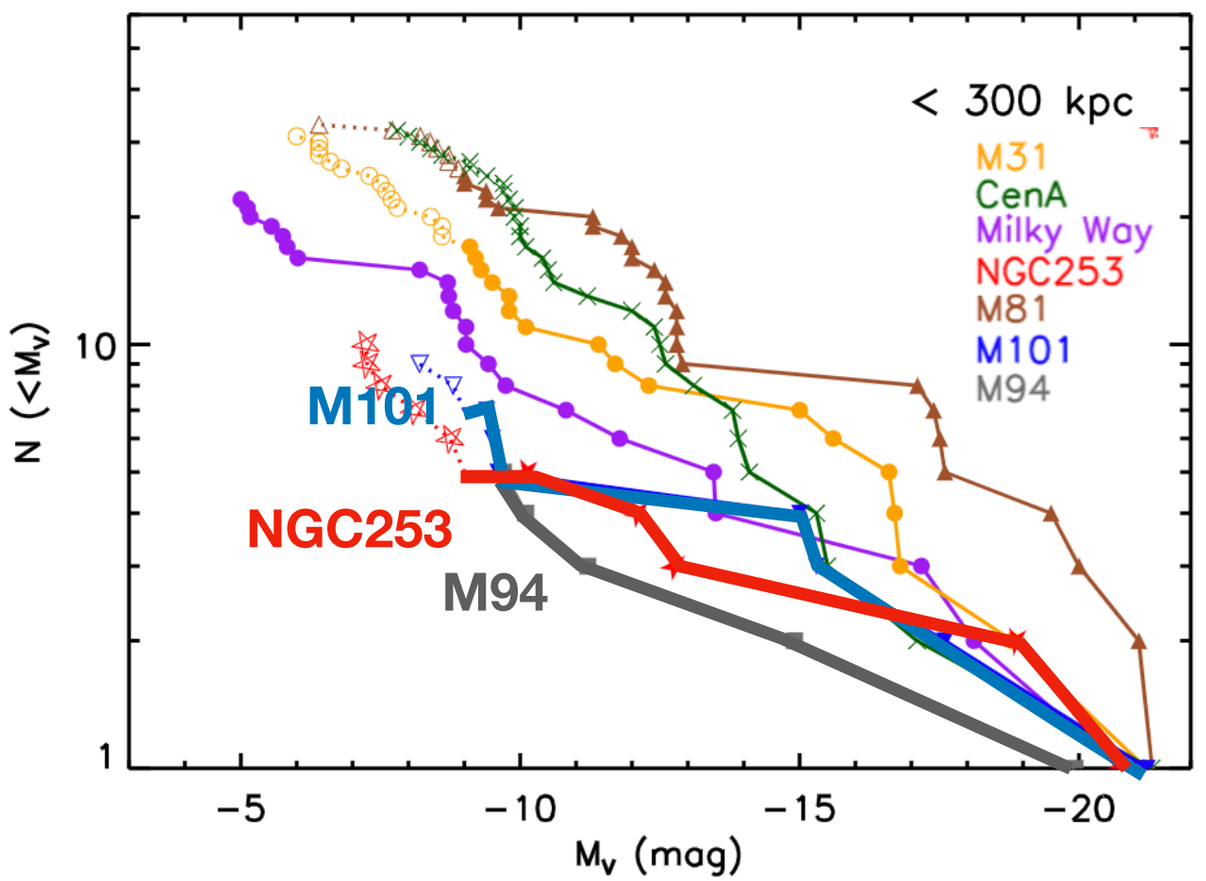
Mutlu-Pakdil+ 2024

NGC253 Satellite Luminosity Function

within 100 kpc



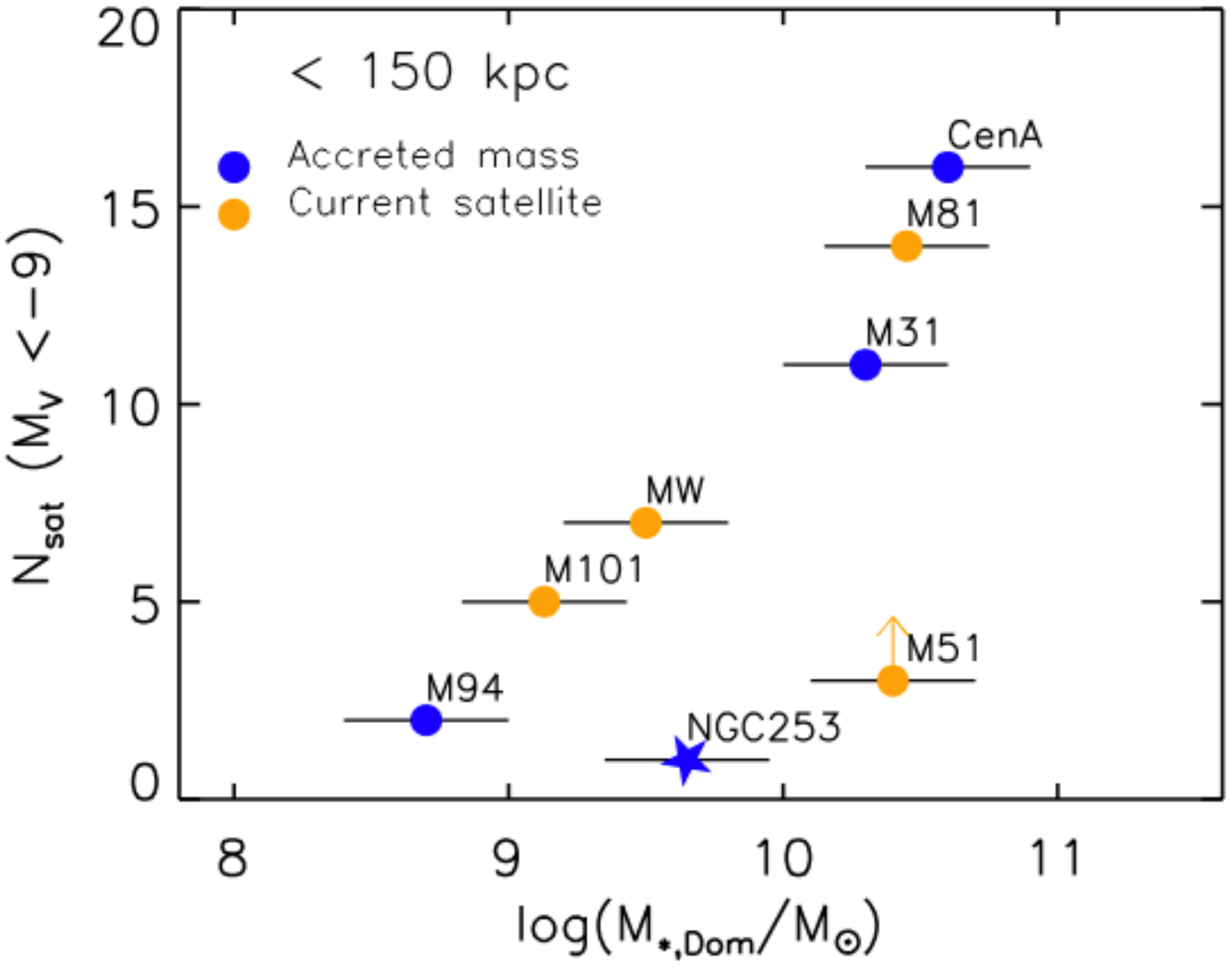
within 300 kpc



an environmental dependence for the slope of satellite LF?

Mutlu-Pakdil+ 2024

Satellite Abundance vs Dominant Merger Mass

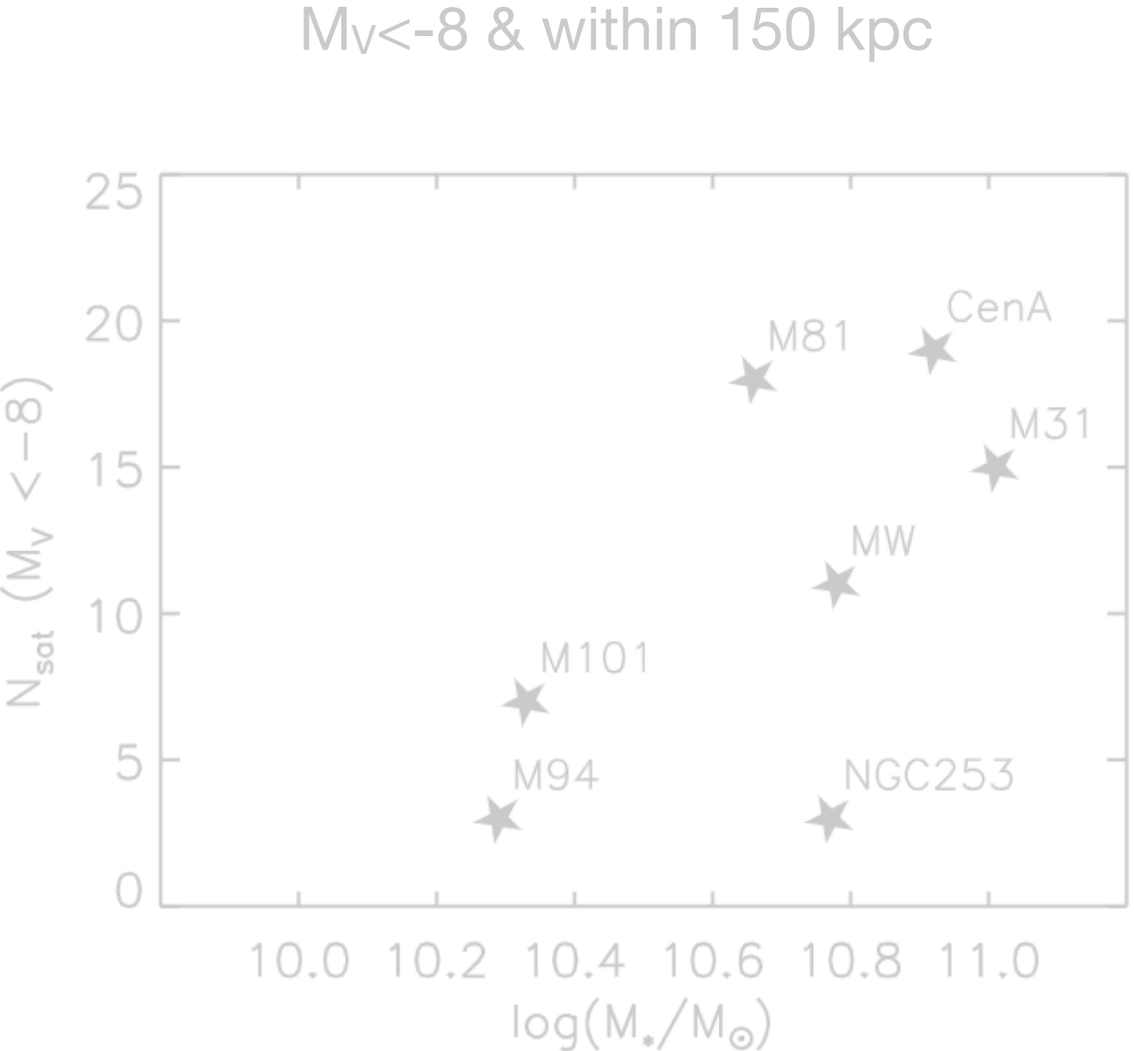


Mutlu-Pakdil+ 2024

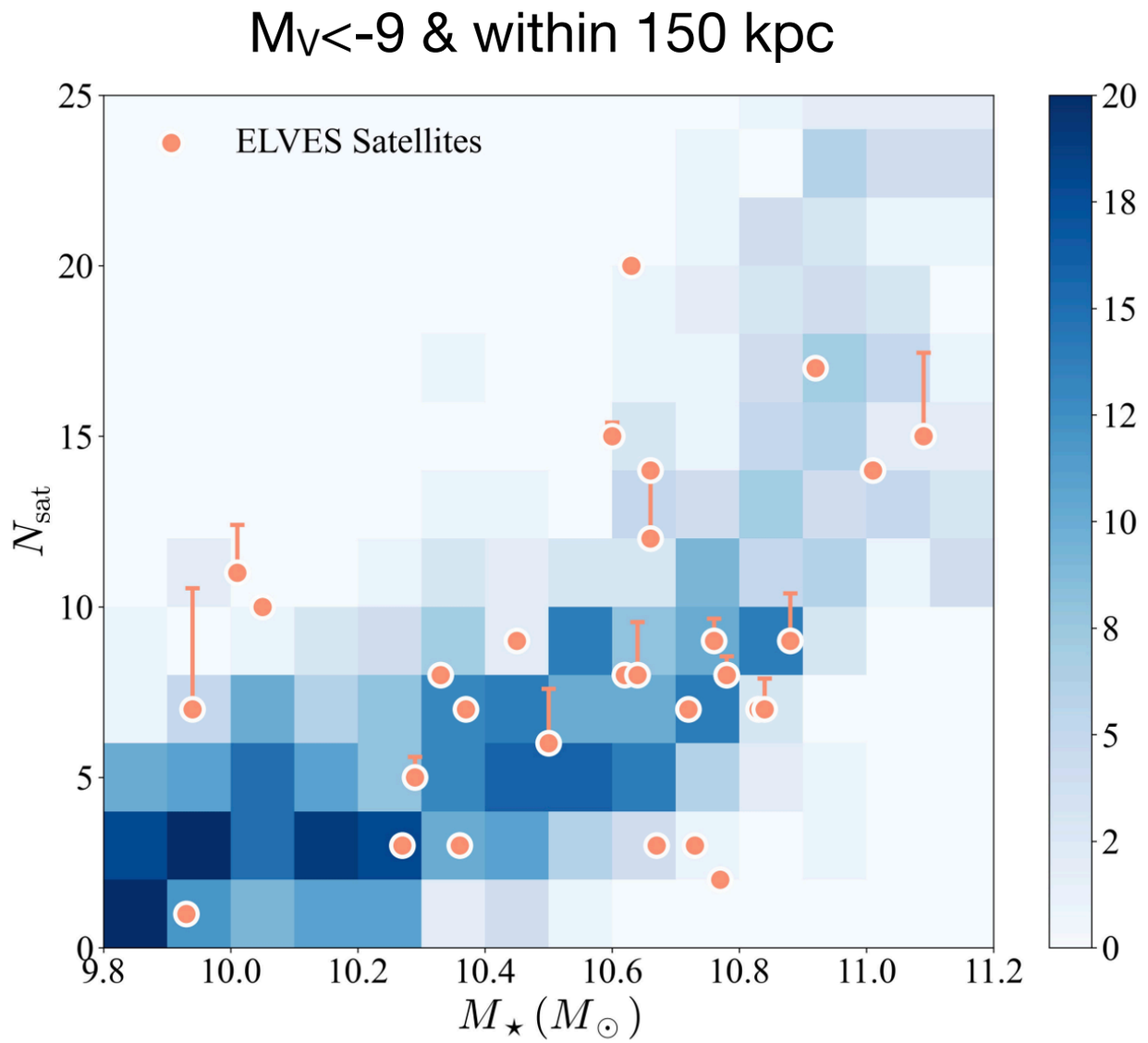
see Smercina+ 2022

Burçin Mutlu-Pakdil, Dartmouth (she/her)

Satellite Abundance vs Host Stellar Mass



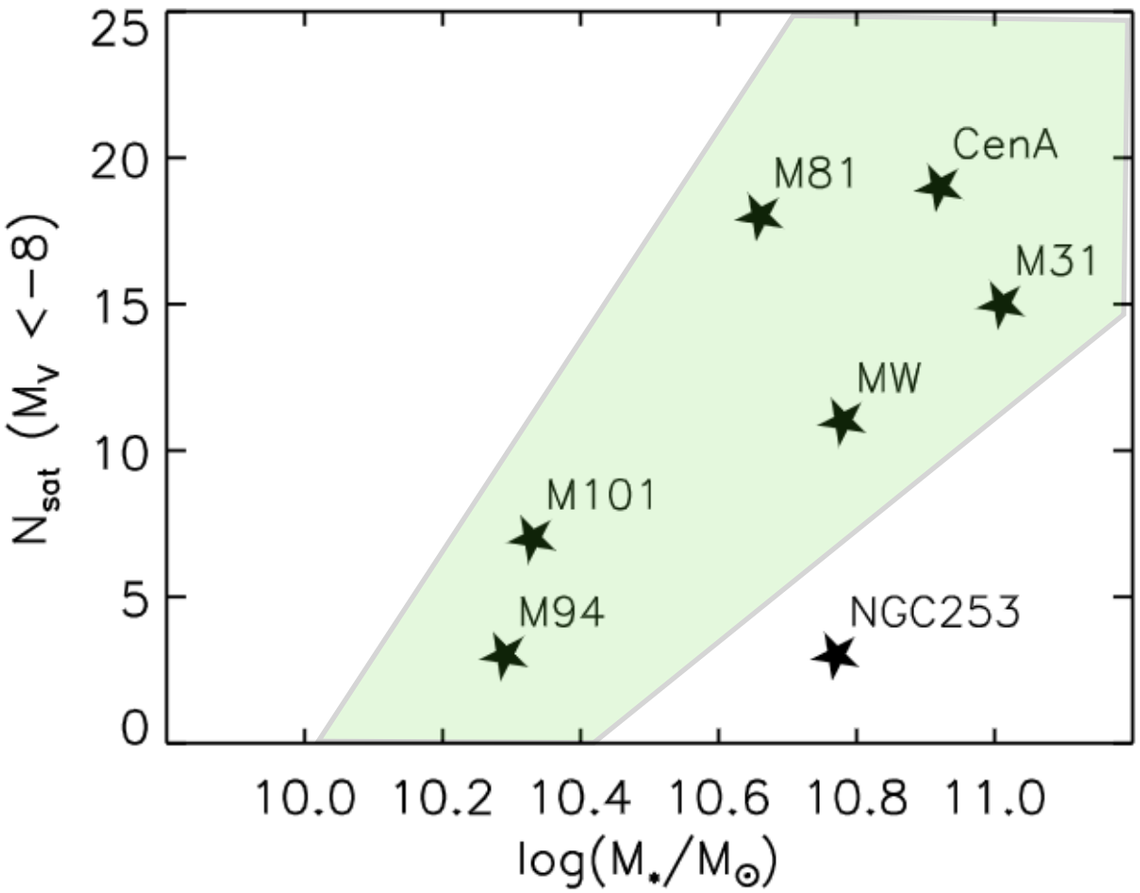
Mutlu-Pakdil+ 2024



Danieli+ 2022

Satellite Abundance vs Host Stellar Mass

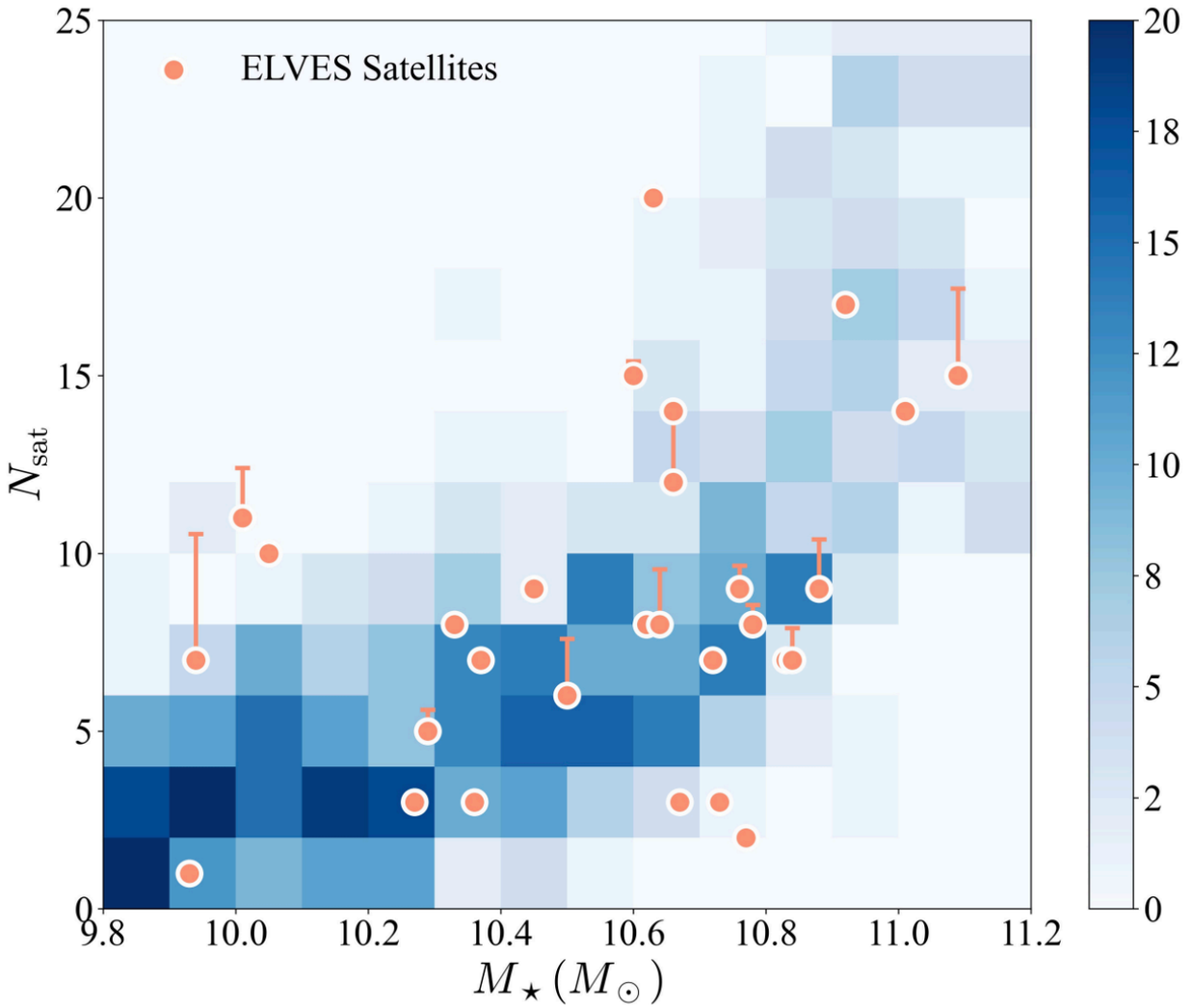
M_V<-8 & within 150 kpc



Host Stellar Mass

Mutlu-Pakdil+ 2024

M_V<-9 & within 150 kpc

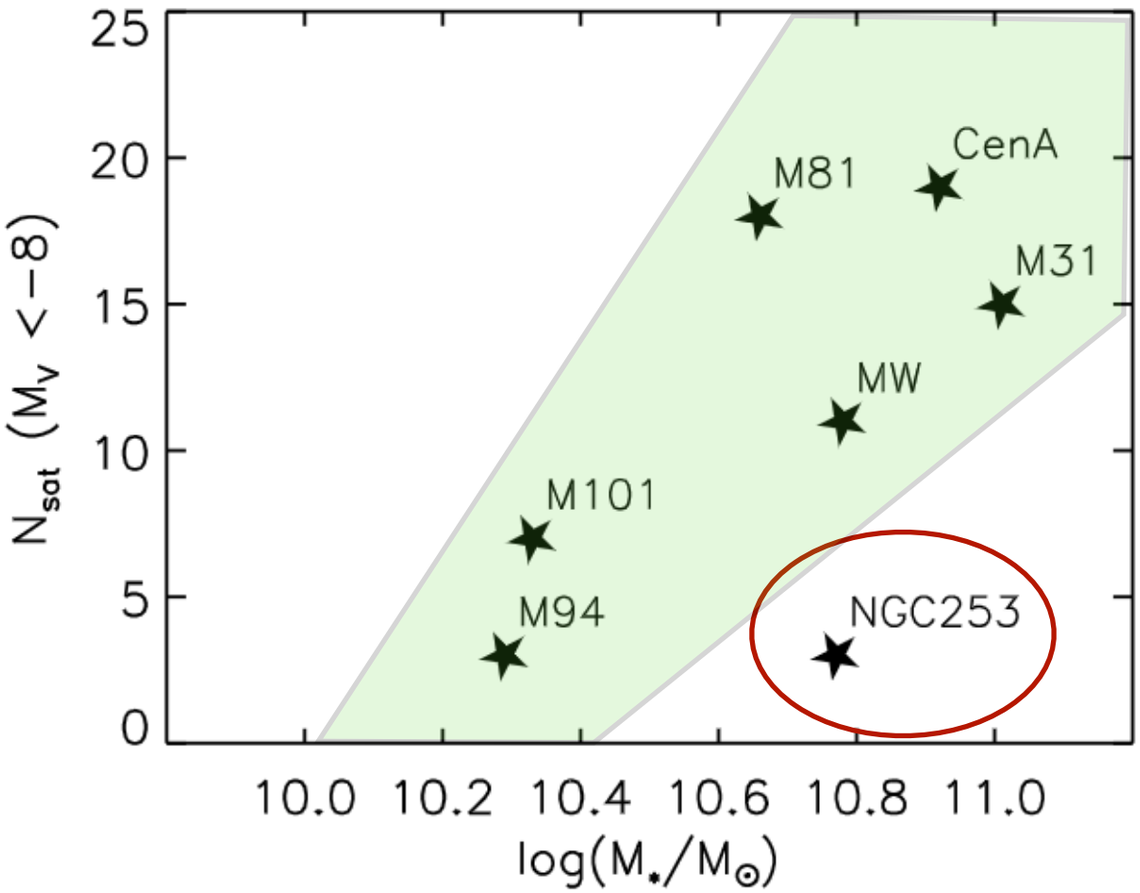


Host Stellar Mass

Danieli+ 2022

Satellite Abundance vs Host Stellar Mass

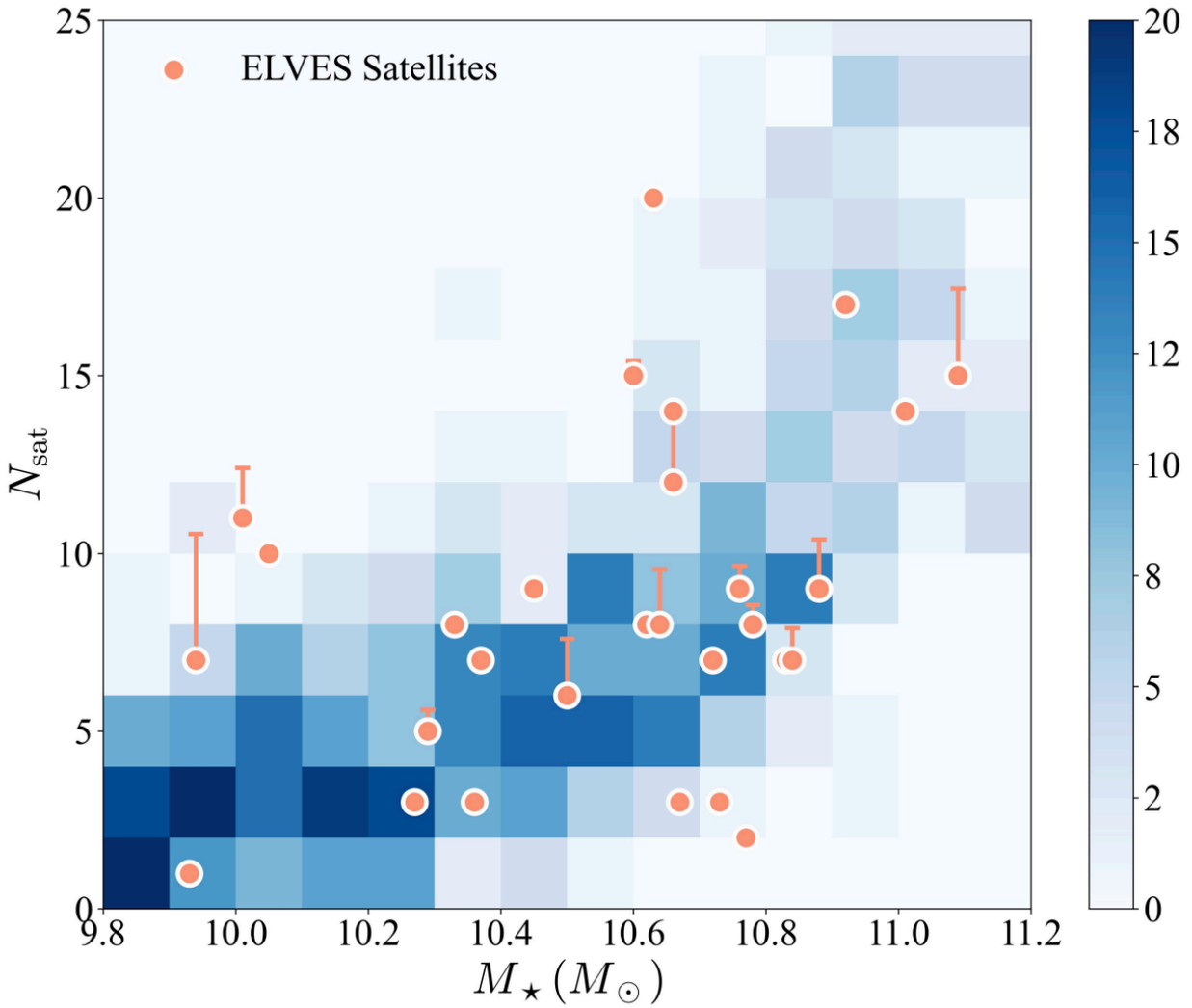
M_V<-8 & within 150 kpc



Host Stellar Mass

Mutlu-Pakdil+ 2024

M_V<-9 & within 150 kpc

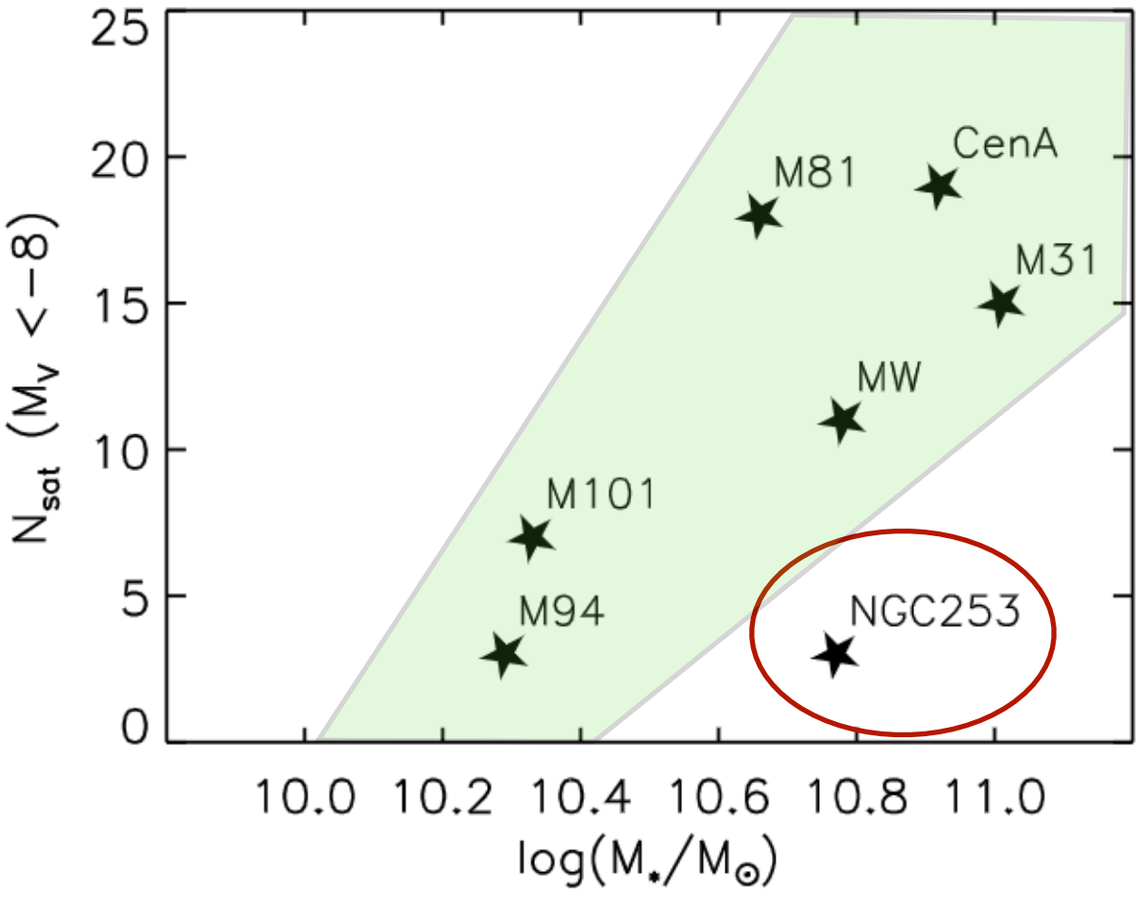


Host Stellar Mass

Danieli+ 2022

Satellite Abundance vs Environment

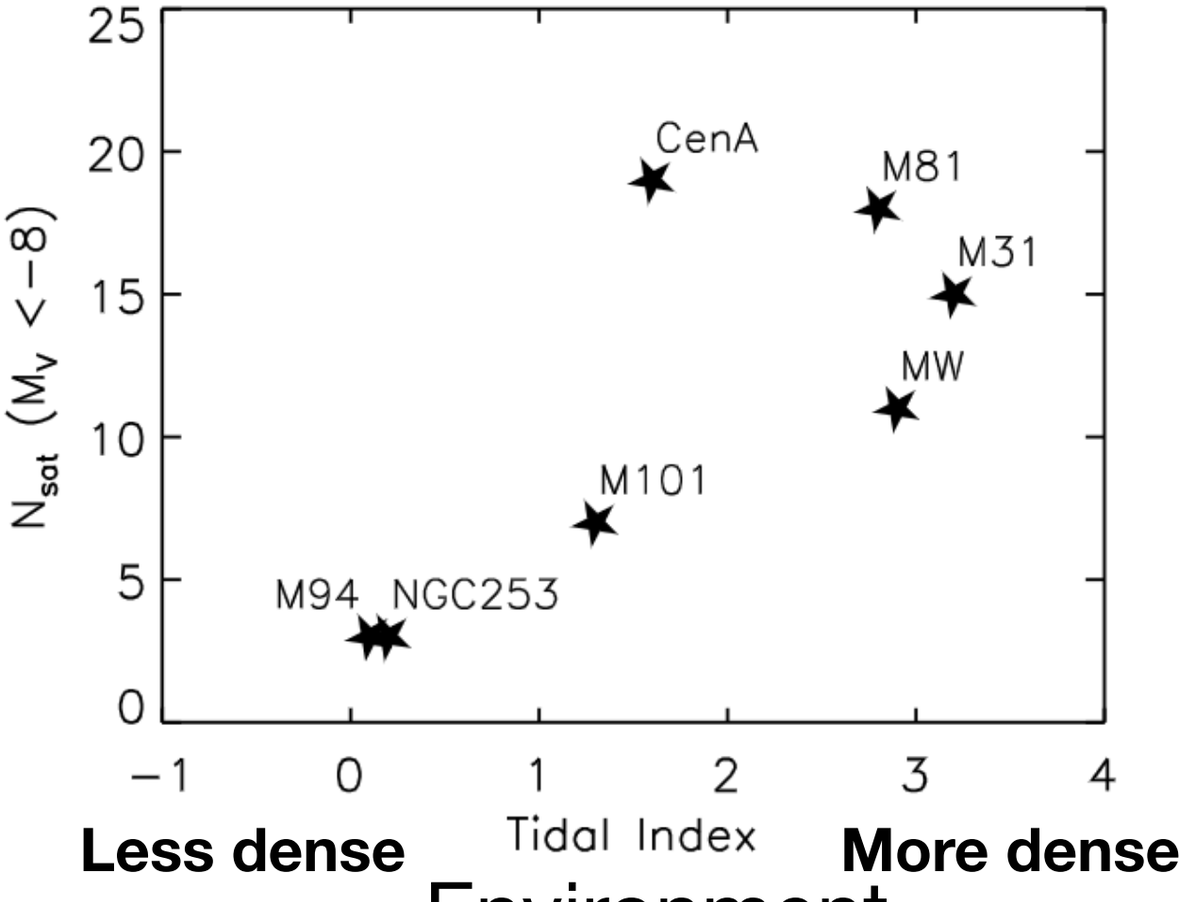
M_V<-8 & within 150 kpc



Host Stellar Mass

Mutlu-Pakdil+ 2024

M_V<-8 & within 150 kpc

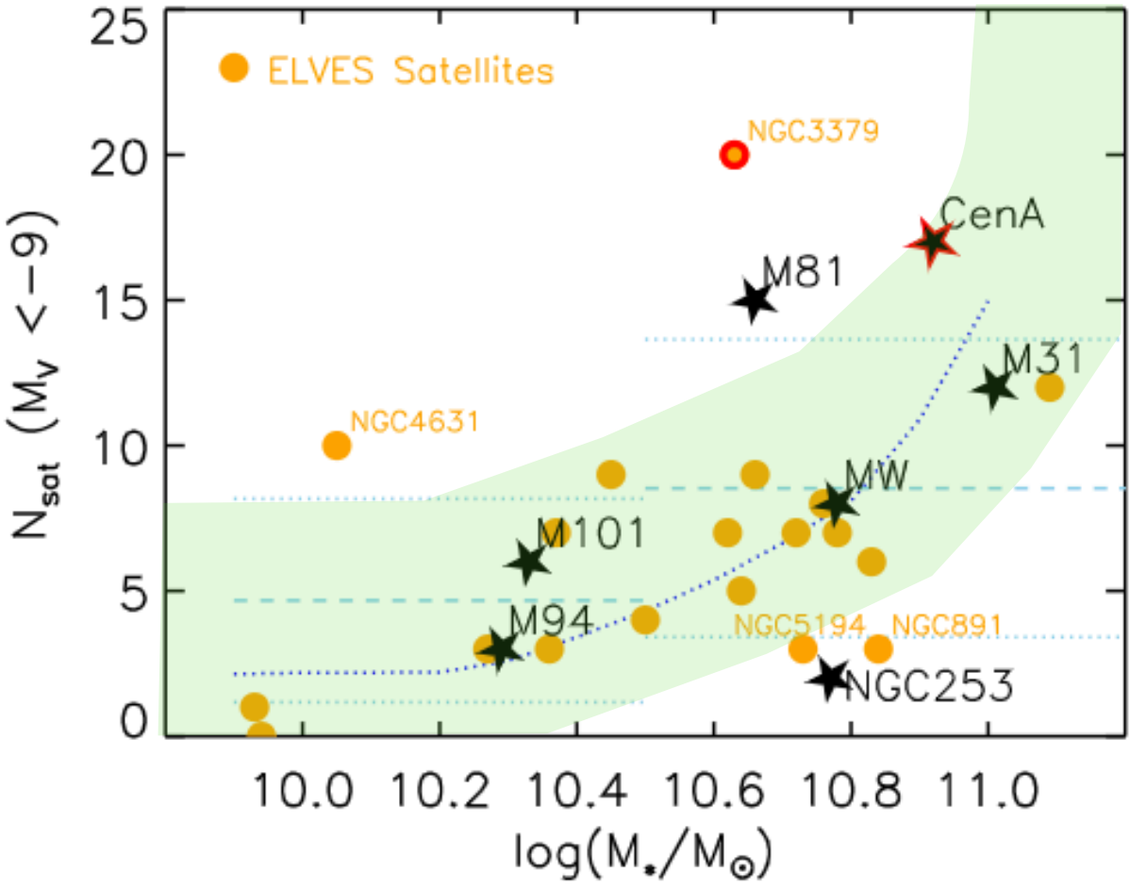


Environment

See also Bennet+2019
Karachentsev+ 2013

Satellite Abundance vs Environment

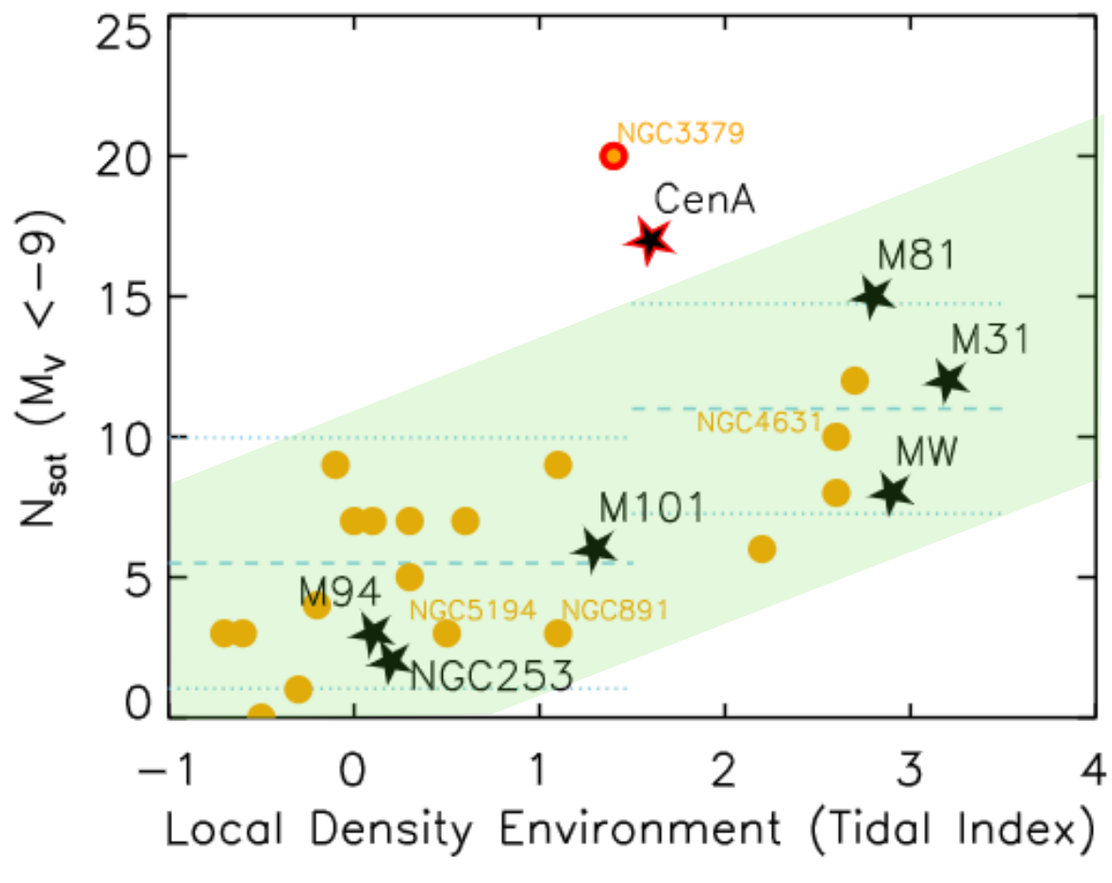
M_V<-9 & within 150 kpc



Host Stellar Mass

Mutlu-Pakdil+ 2024

M_V<-9 & within 150 kpc



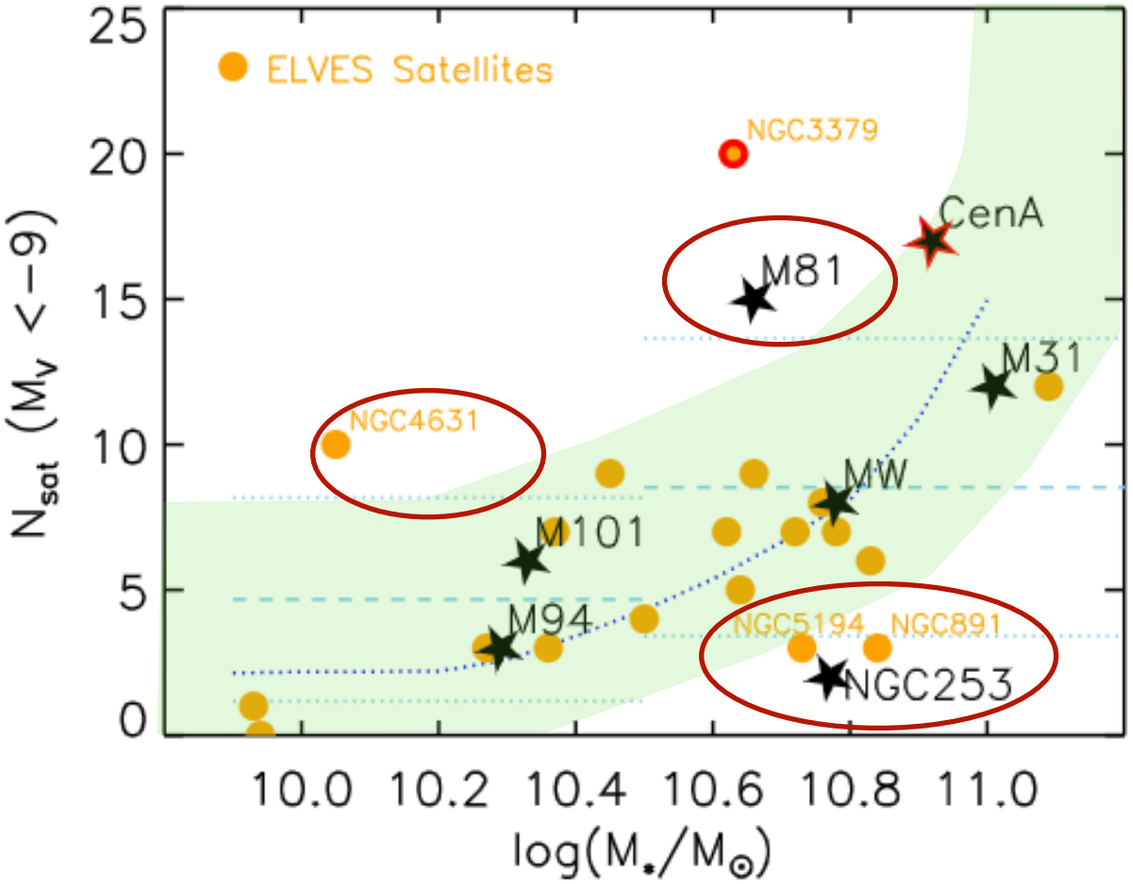
Less dense **More dense**

Environment

See also Bennet+2019
Karachentsev+ 2013

Satellite Abundance vs Environment

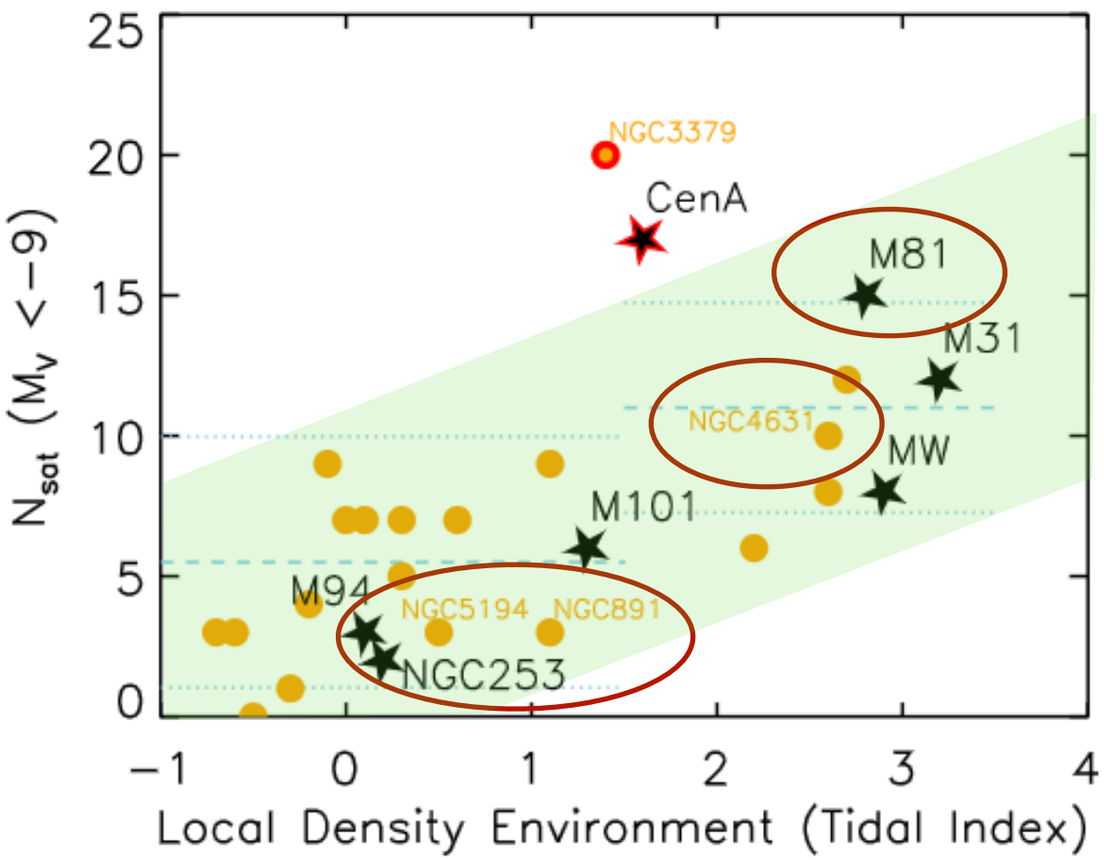
M_V<-9 & within 150 kpc



Host Stellar Mass

Mutlu-Pakdil+ 2024

M_V<-9 & within 150 kpc



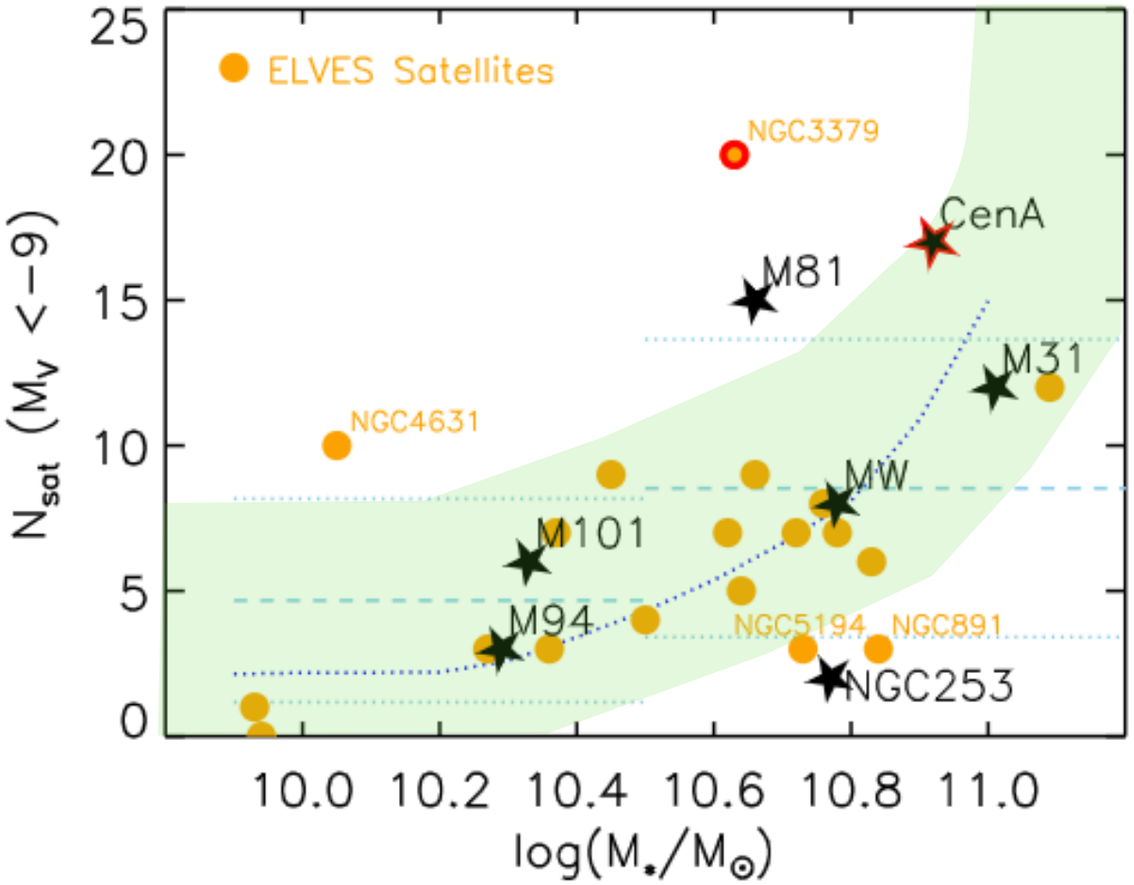
Less dense **More dense**

Environment

See also Bennet+2019
Karachentsev+ 2013

Satellite Abundance vs Environment

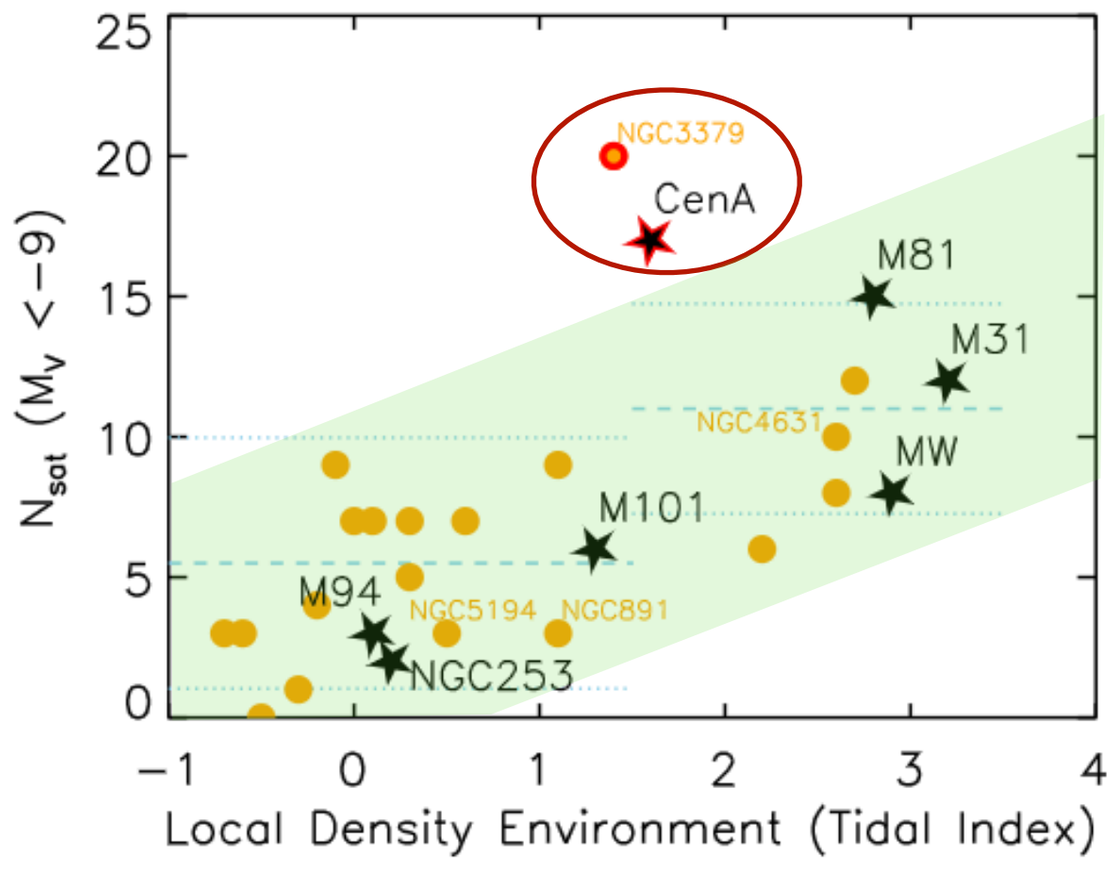
M_V<-9 & within 150 kpc



Host Stellar Mass

Mutlu-Pakdil+ 2024

M_V<-9 & within 150 kpc

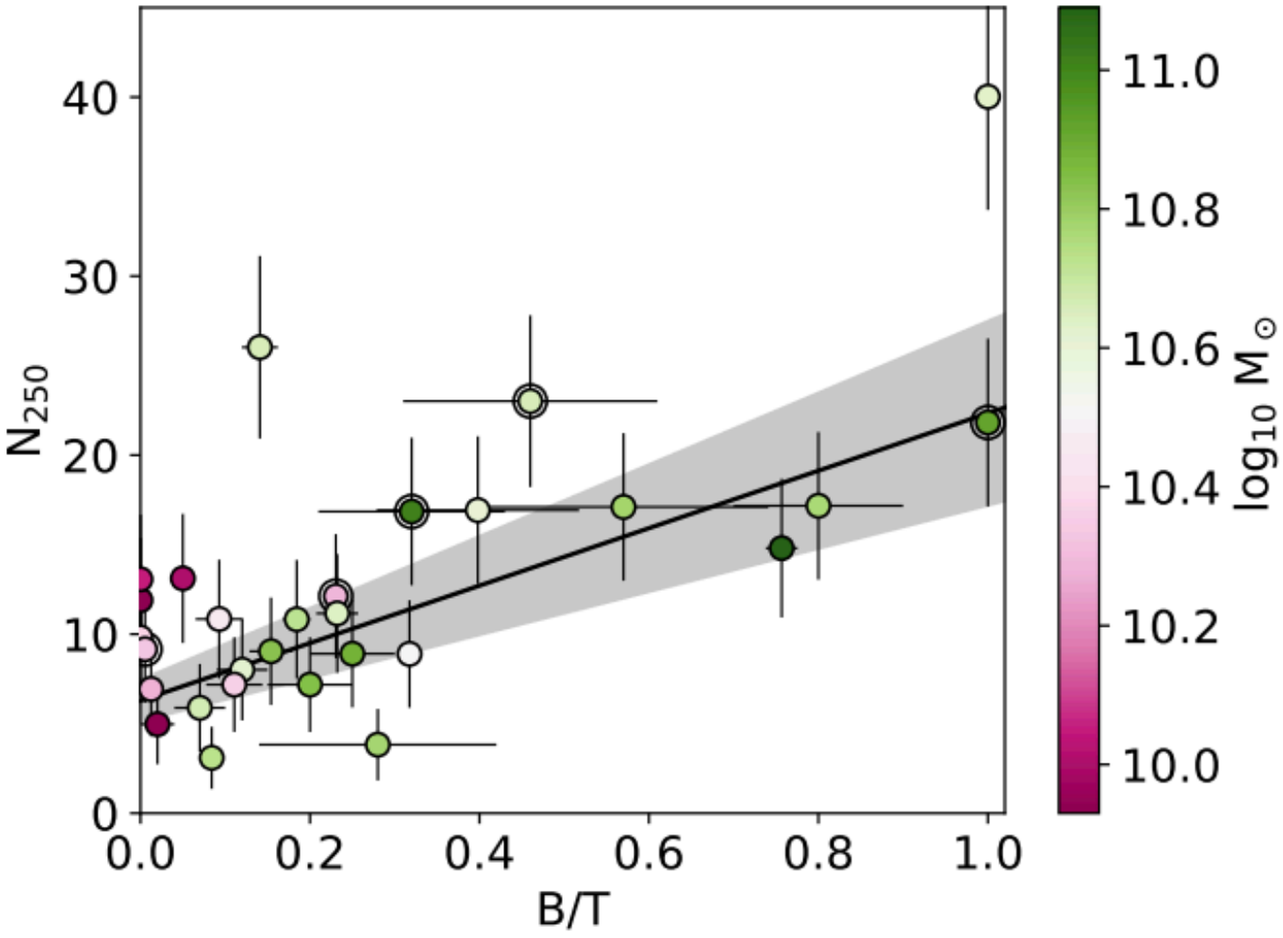


Less dense **More dense**

Environment

See also Bennet+2019
Karachentsev+ 2013

Satellite Abundance vs Morphology

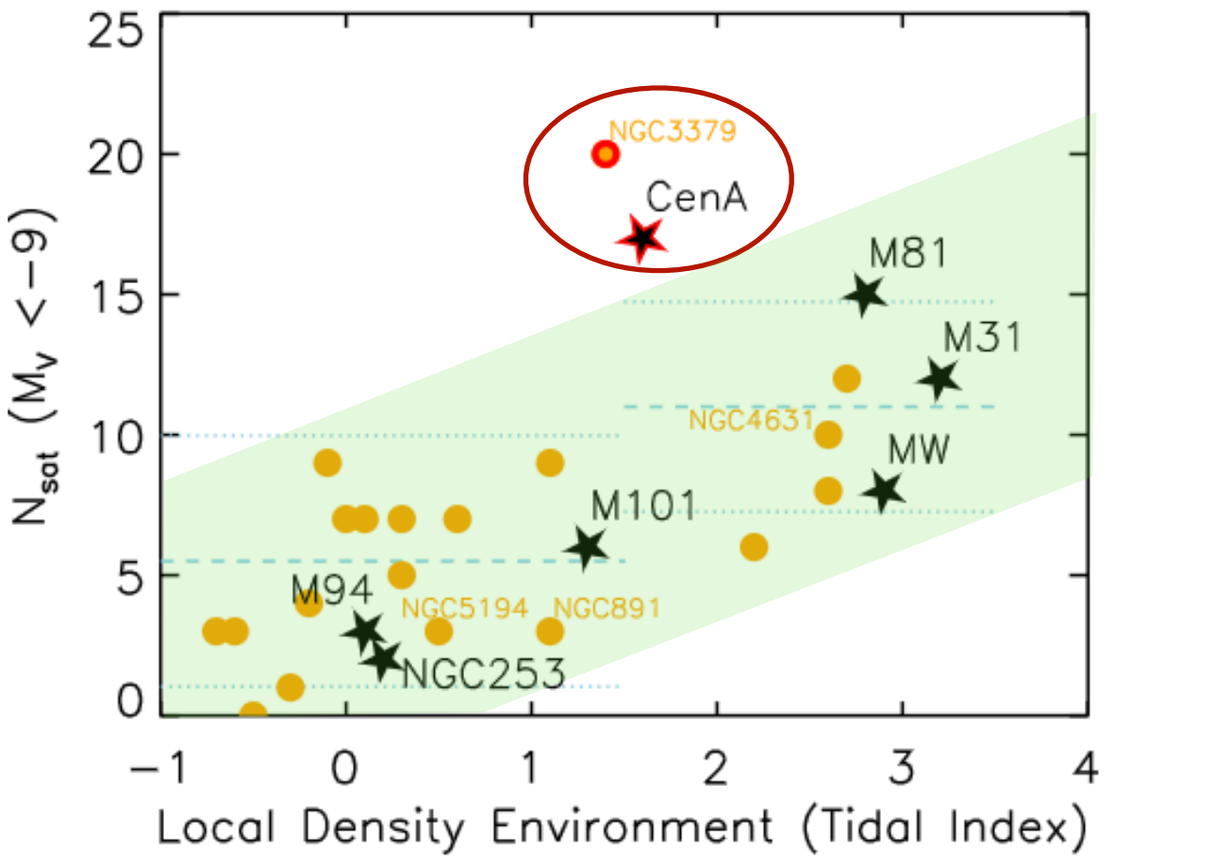


Bulge to Total Stellar Mass

Müller & Crosby 2023

Mutlu-Pakdil+ 2024

M_V<-9 & within 150 kpc



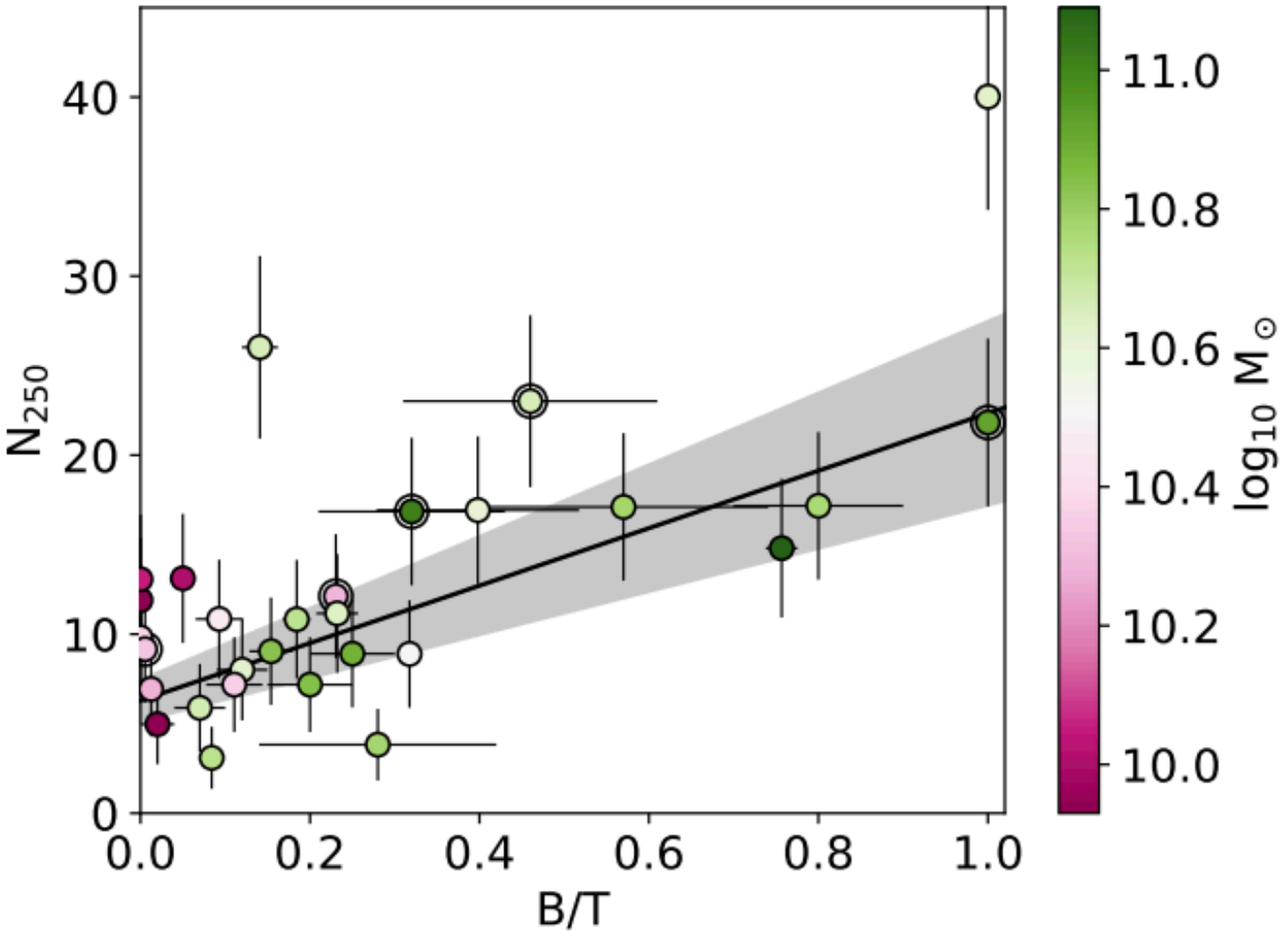
Less dense **More dense**

Environment

See also Bennet+2019

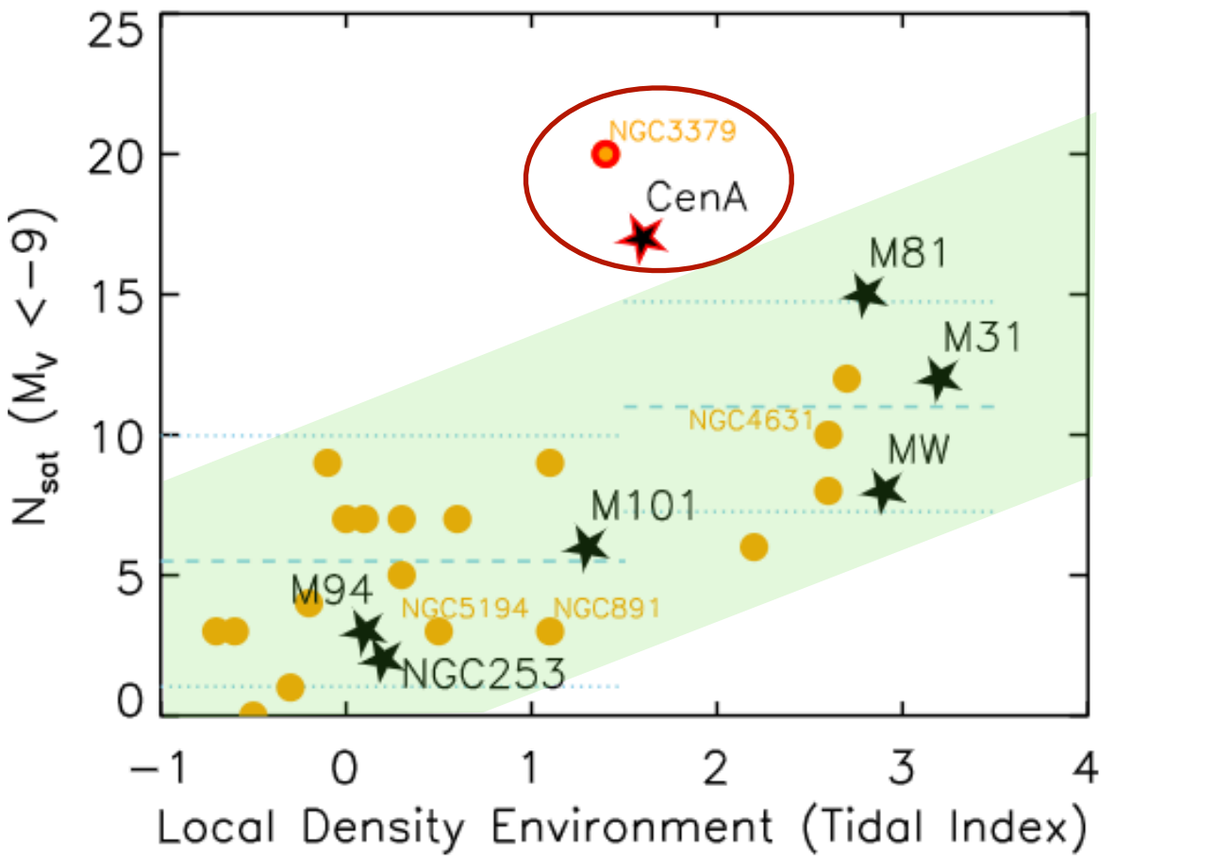
Karachentsev+ 2013

Satellite Abundance vs Morphology



Bulge to Total Stellar Mass

M_V<-9 & within 150 kpc



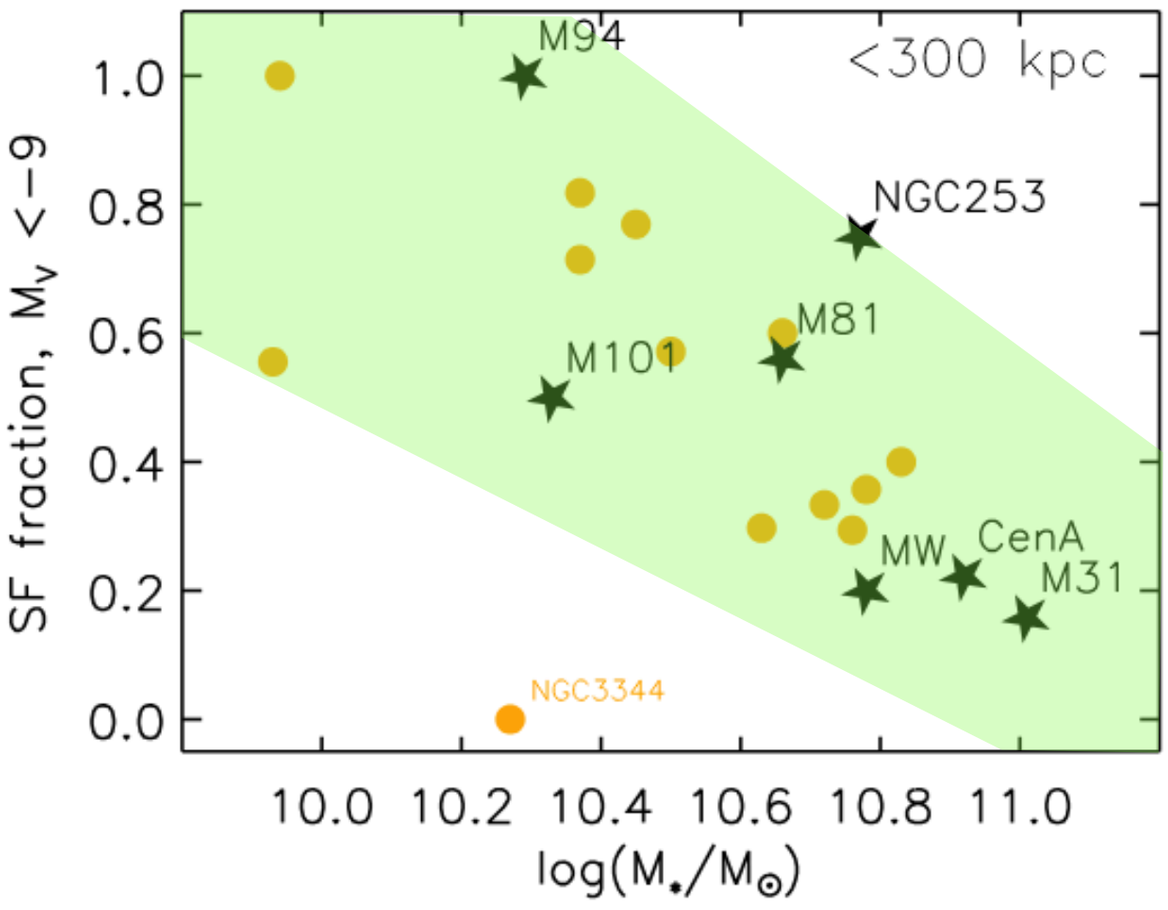
Less dense **More dense**

Environment

Importance of host stellar mass, environment, and morphology!

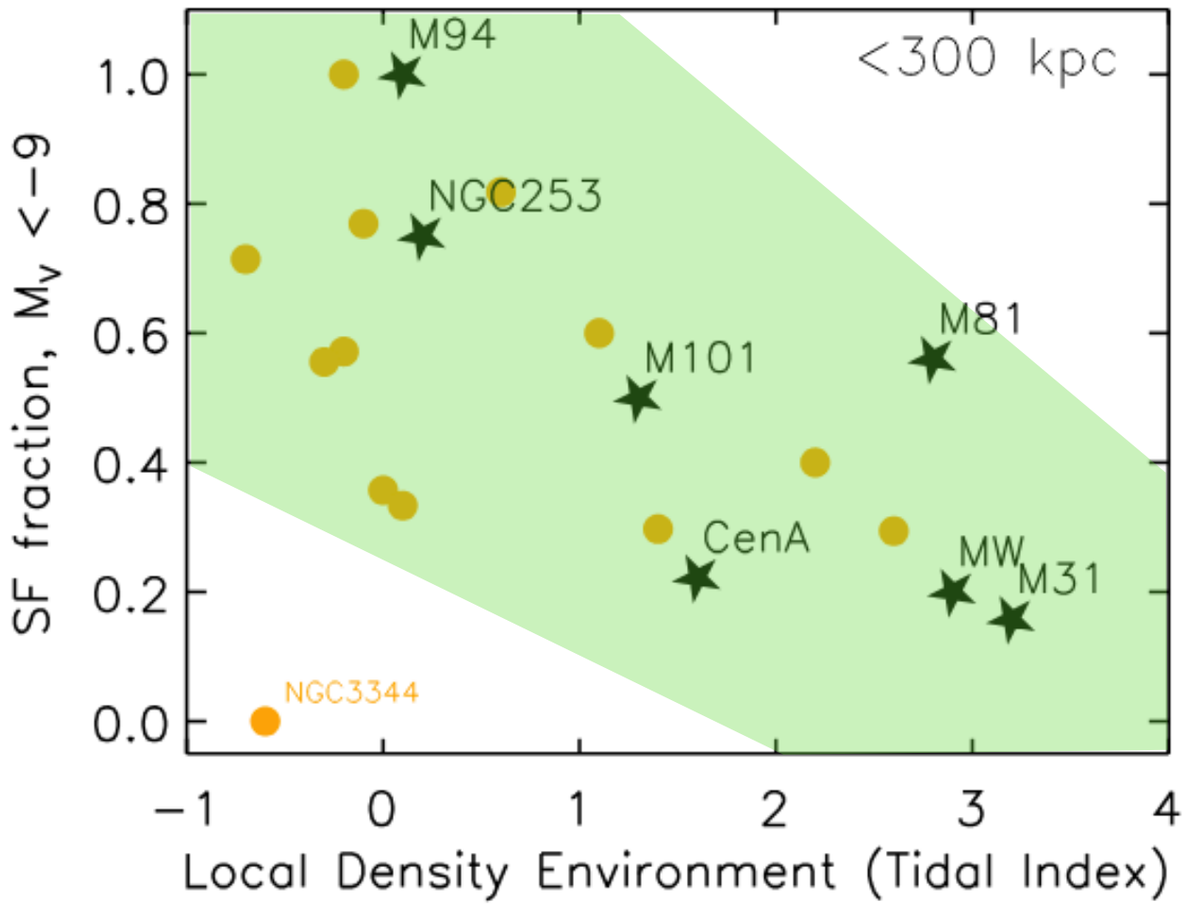
Star formation Fractions

M_V<-9 & within 300 kpc



Host Stellar Mass

M_V<-9 & within 300 kpc



Less dense **More dense**

Environment

TAKE AWAY NOTES:

1) We need to explore faintest satellite systems beyond Local Group

2) NGC253 PISCeS provides a unique window **for isolated environments.**

3) No evidence for a satellite plane around NGC253!

4) Exploring trends in satellite counts and star-forming fractions among satellite systems, we find **relationships with host stellar mass, environment, and morphology,** pointing to a complex picture of satellite formation, and **a successful model has to reproduce all of these trends.**