Michelle Collins - University of Surrey

The low mass dwarfs of Andromeda - an update

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The unfinished works of Michelle Collins

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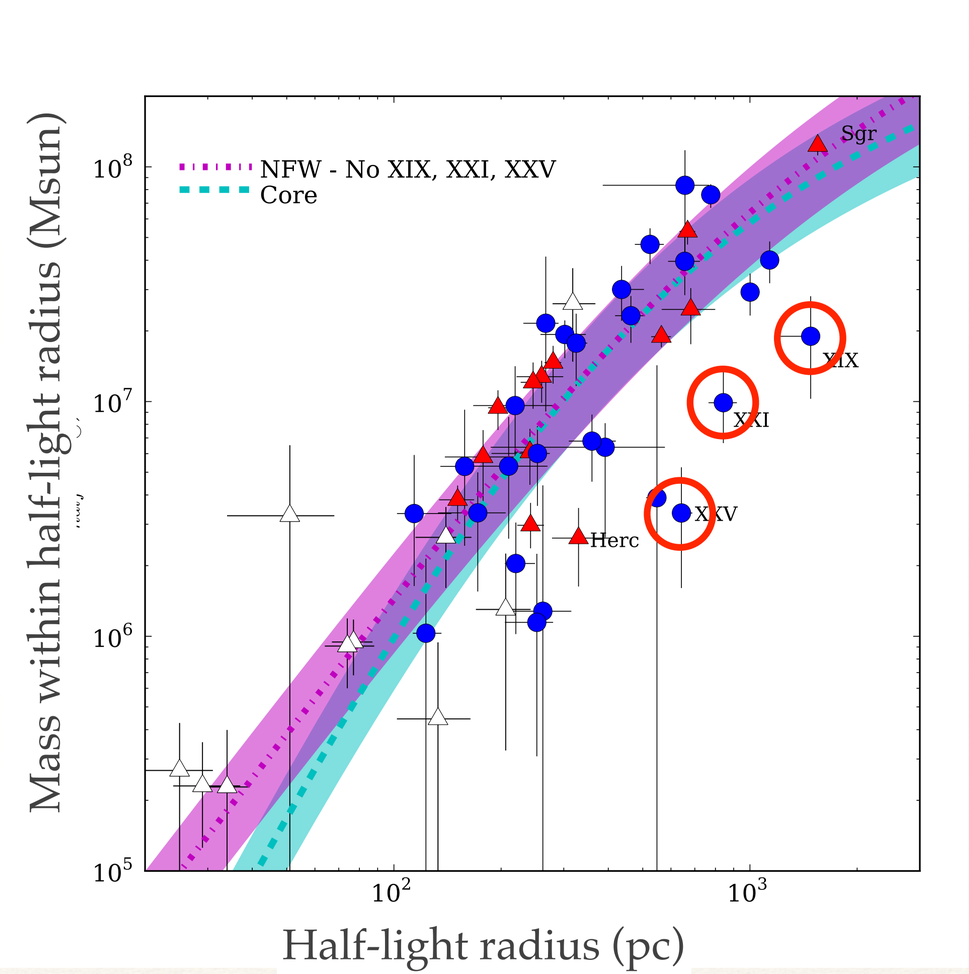
The best stuff comes from my students

Alexandra Gregory

Janet Preston

Back in 2013/2014…



Collins 2013, 2014, Tollerud 2012

- Measuring masses of *all* (known) Andromeda dwarf galaxies from spectra of red giant branch stars
- Comparing with the Milky Way population
- Identified a few low-mass outliers

Galaxies being stripped?
Extreme feedback?
Just small number statistics?
Or something else?!?

More spectroscopy with Keck in 2012-2015 to answer these questions…

So, where are the results?

Data in hand, but life gets in the way

- Two transatlantic moves
- Exciting new projects with Janet and Alexandra
- And exciting new projects with others! (PAndAS, Justin Read, Geraint Lewis, Ekta Patel, Erik Tollerud, Dave Sand, Duncan Forbes…)
- Bad at saying no to panels…
- Teaching and teaching and teaching…

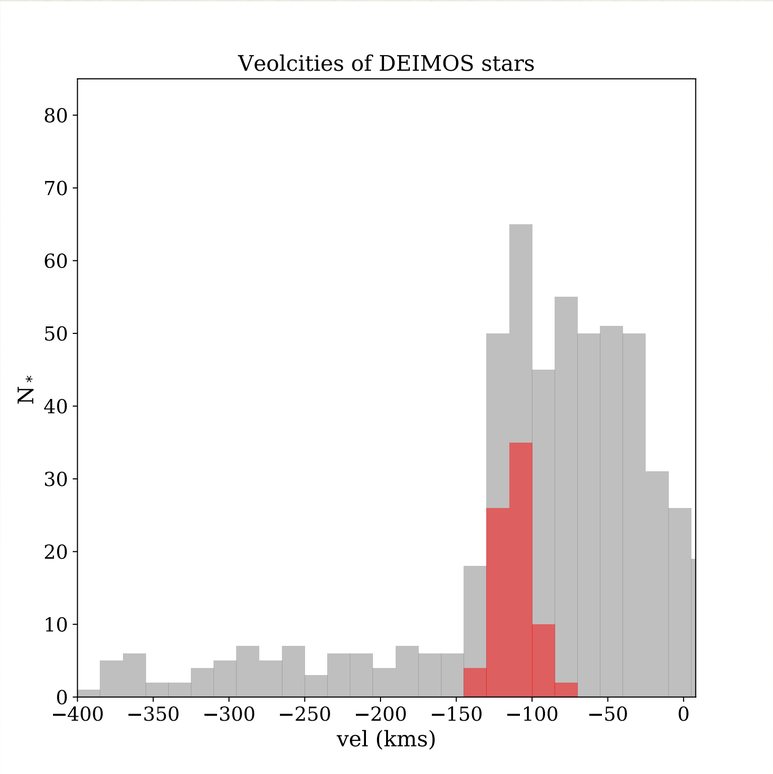
All takes a little adjusting to.

But, now almost ready to publish!

Or, at least, ready for an update

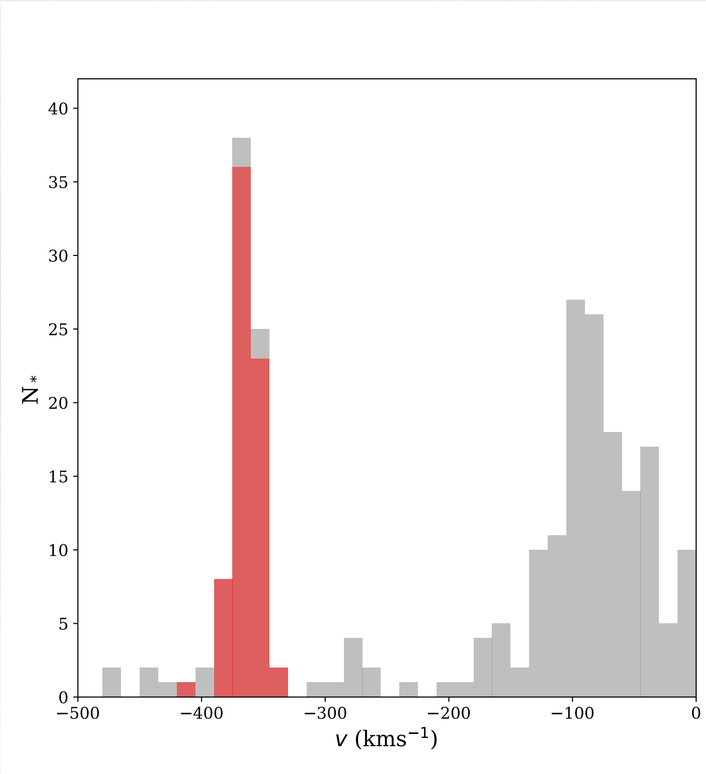
And XIX (Collins+ submitted)

126 member stars



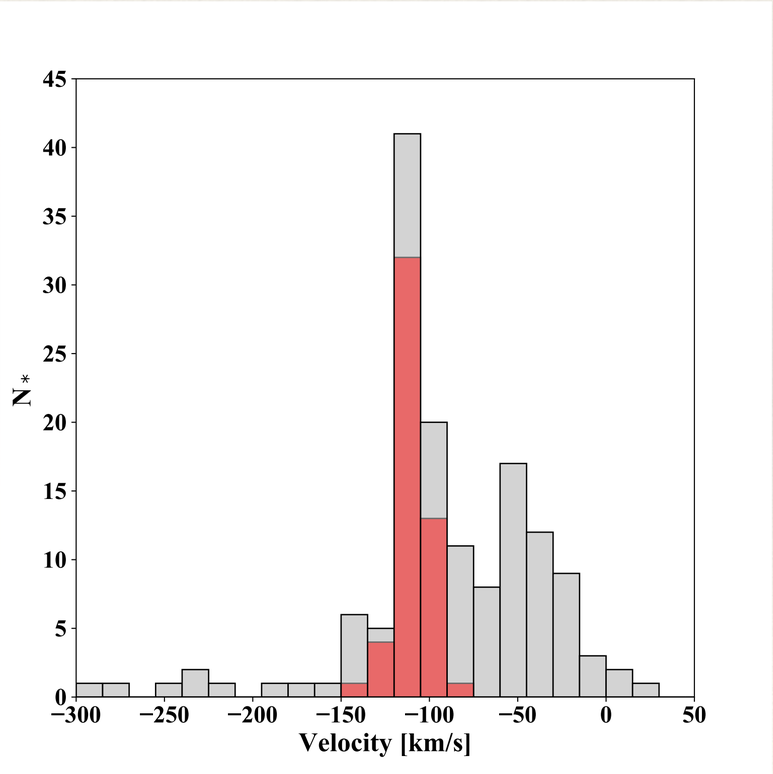
And XXI (Collins, Read+ in prep)

77 member stars

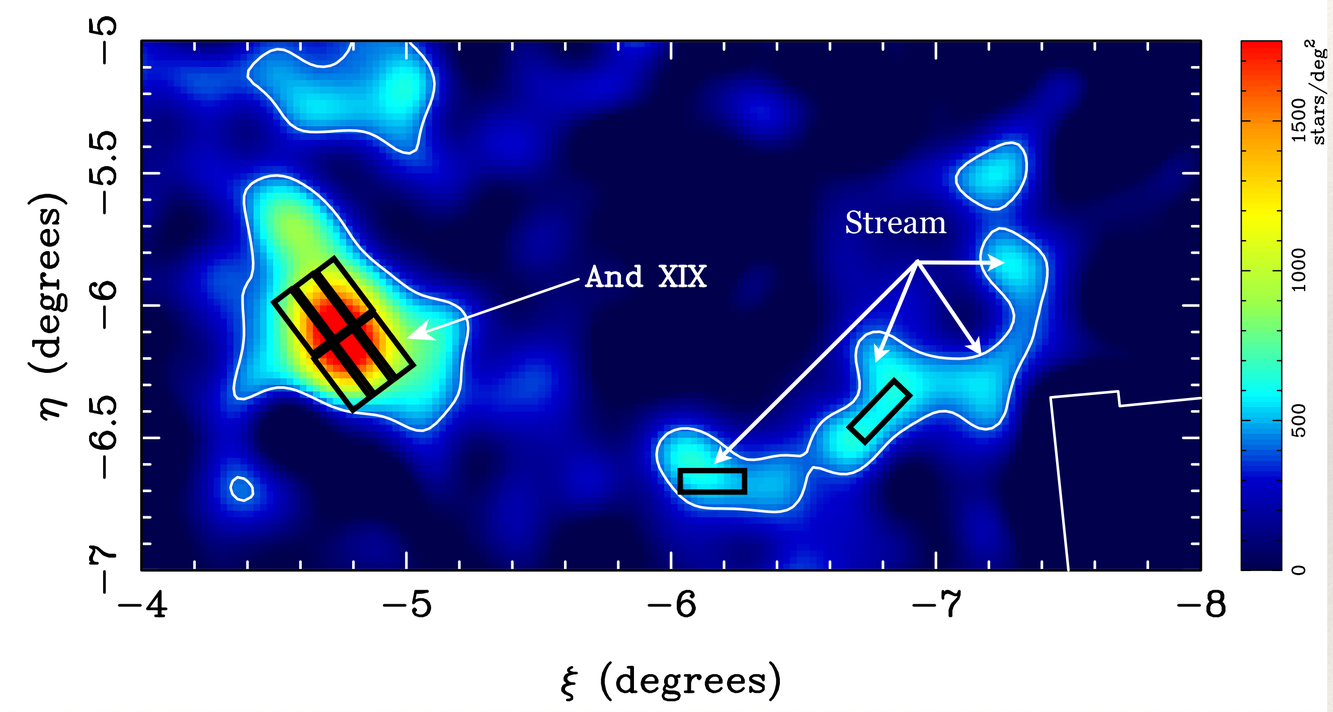


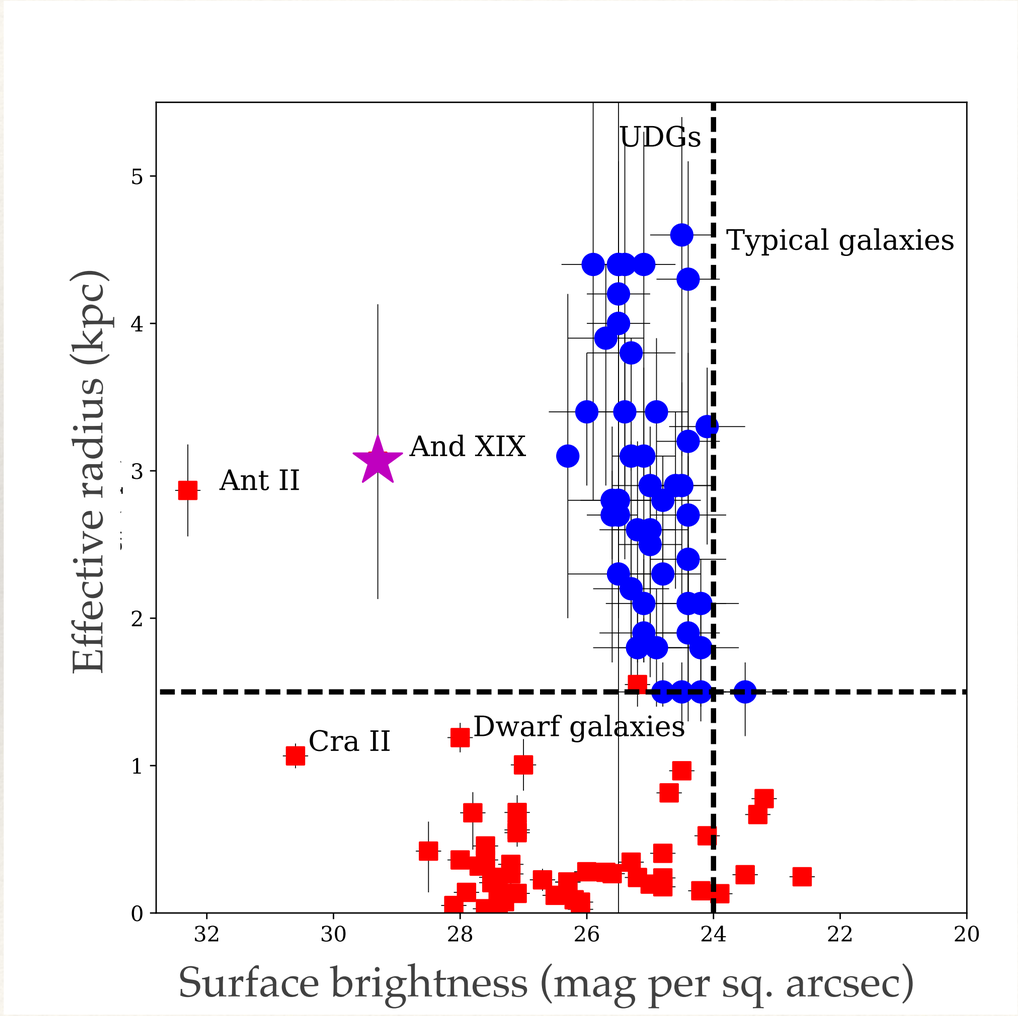
And XXV (results from an undergrad)

55 member stars



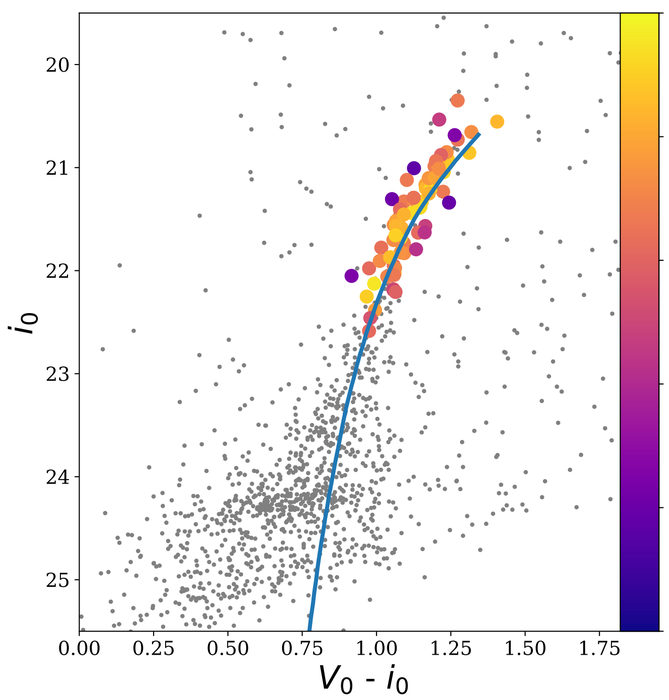
And XIX - a Local Smudge

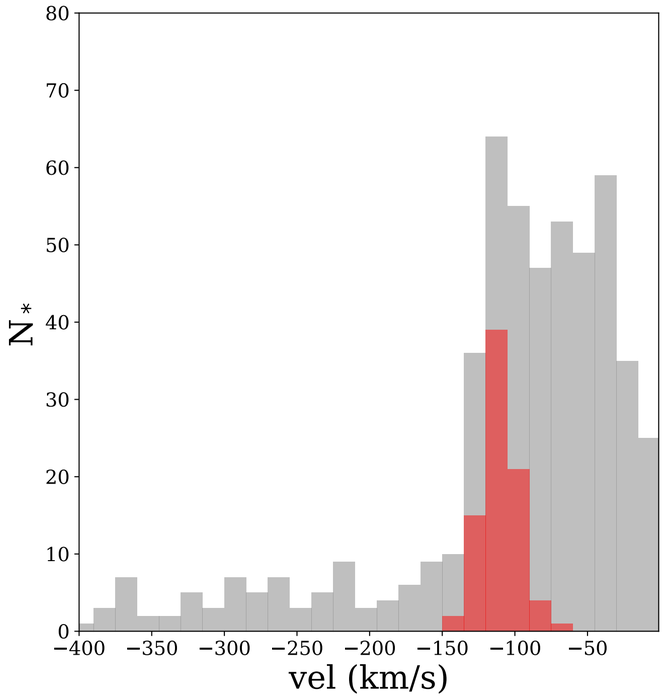




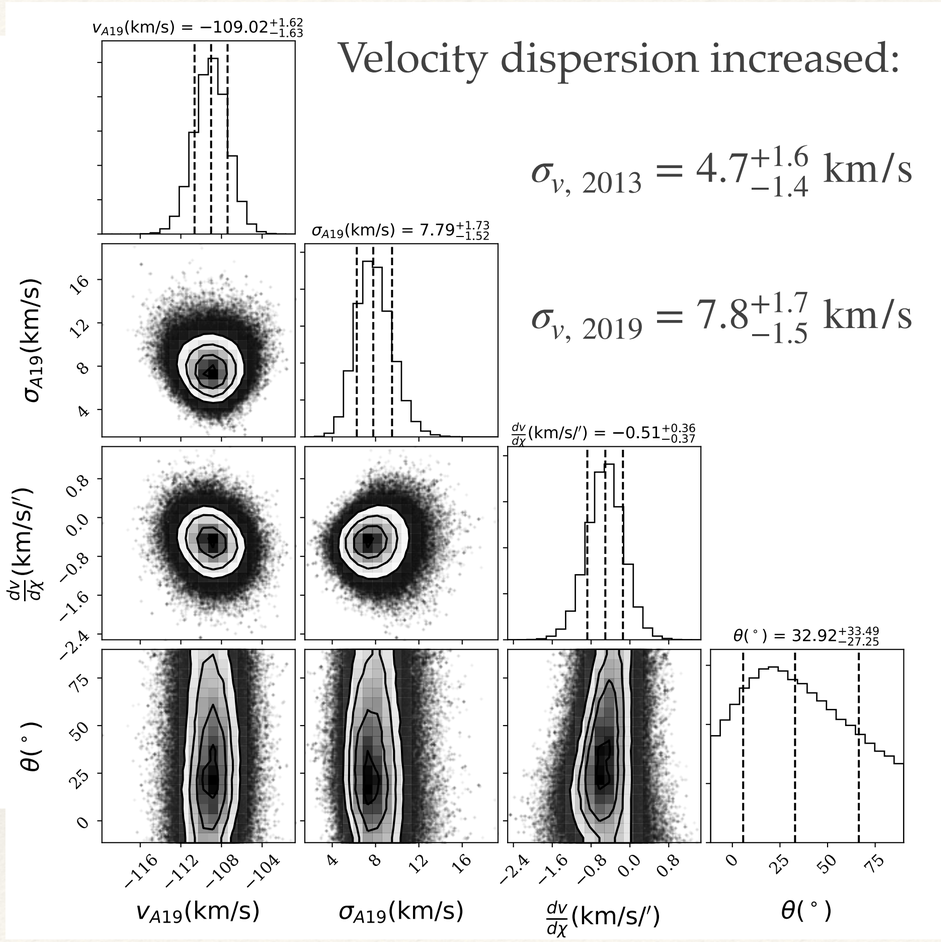
Tidally stripped? Ultra-diffuse analogue? Low mass?

And XIX - a Local Smudge





Sample increased from 24 to 126 probable members

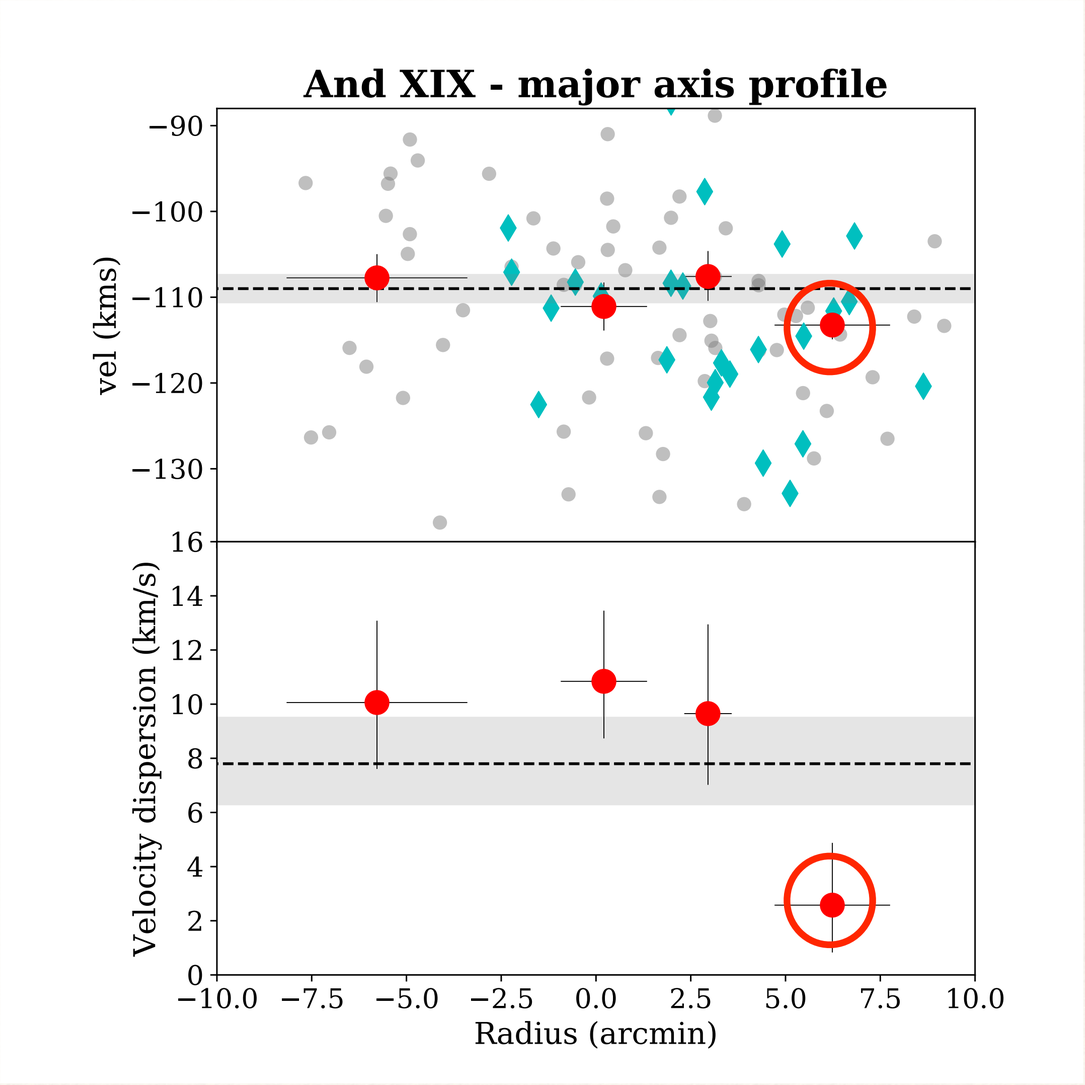


Velocity dispersion increased:

$$\sigma_{v,\ 2013} = 4.7^{+1.6}_{-1.4}\ \text{km/s}$$

$$\sigma_{v,\ 2019} = 7.8^{+1.7}_{-1.5}\ \text{km/s}$$

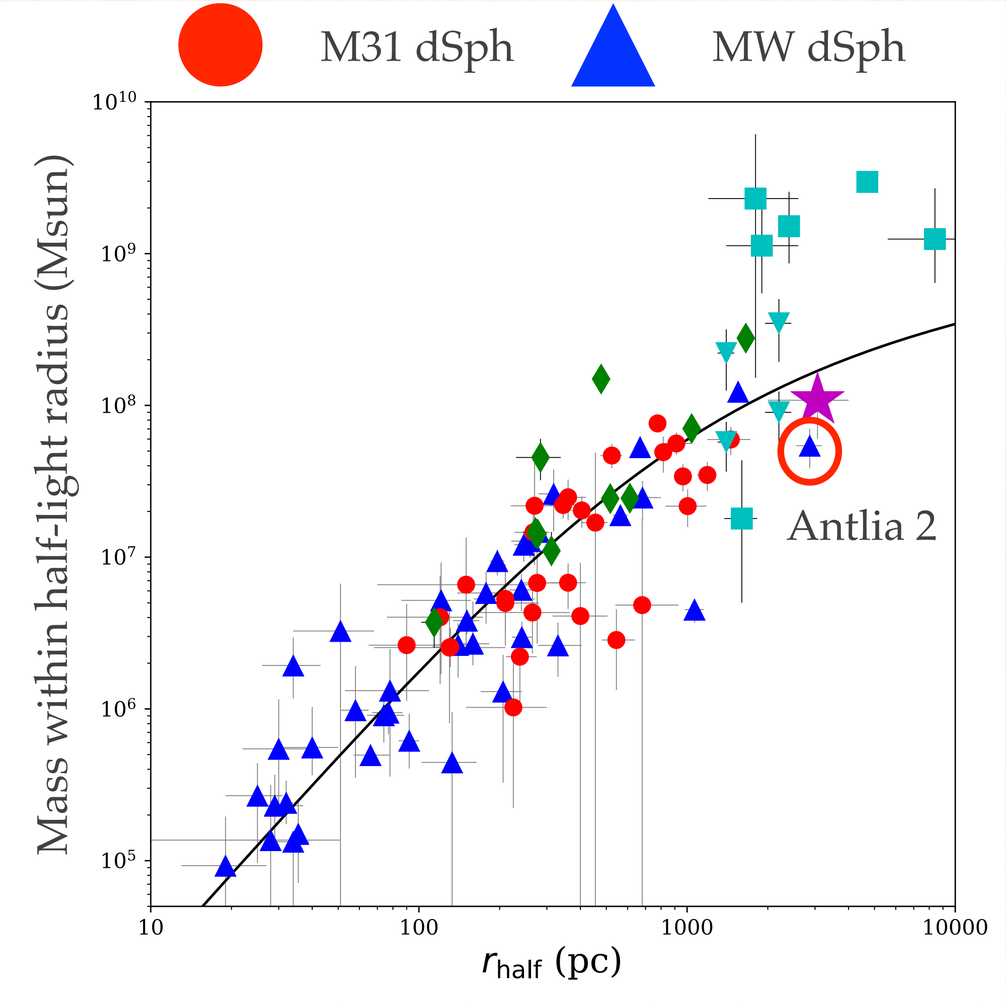
Why such a change?

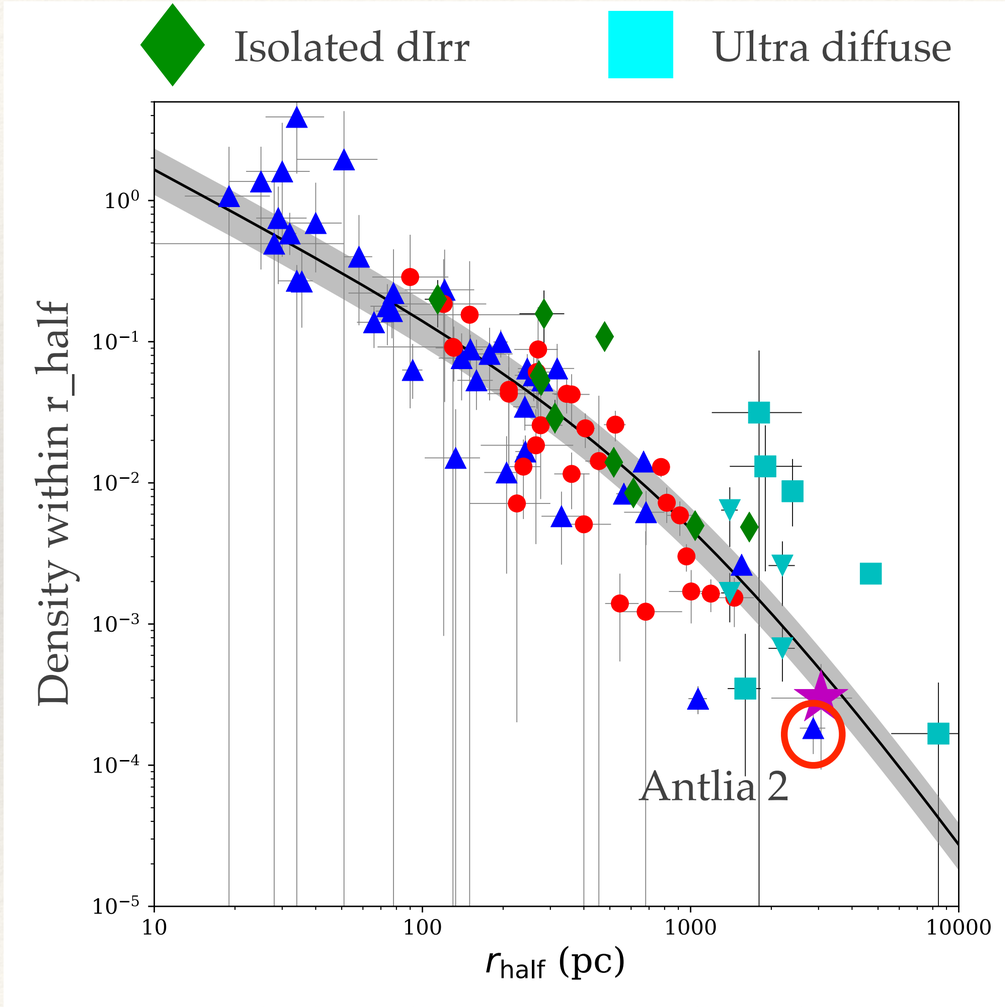


2013 sample

Possible substructure?

What does this mean for the mass?

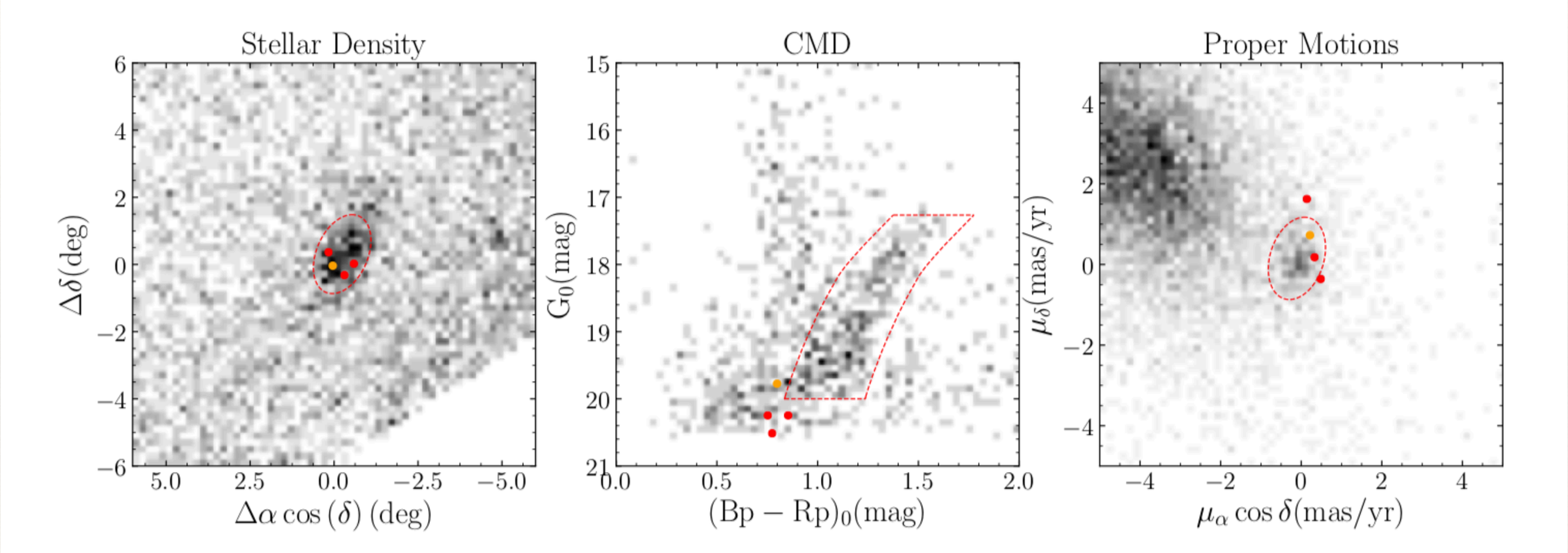




Antlia 2 and And XIX

Similar in size, stellar mass, and central density

Torrealba et al. 2019



And XIX

$\sigma_v = 7.8^{+1.7}_{-1.5}$ km/s

$M_* = 1.1 \times 10^6 M_\odot$

$r_h = 3065^{+955}_{-1065}$ pc

Antlia 2

$\sigma_v = 5.7 \pm 1.1$ km/s

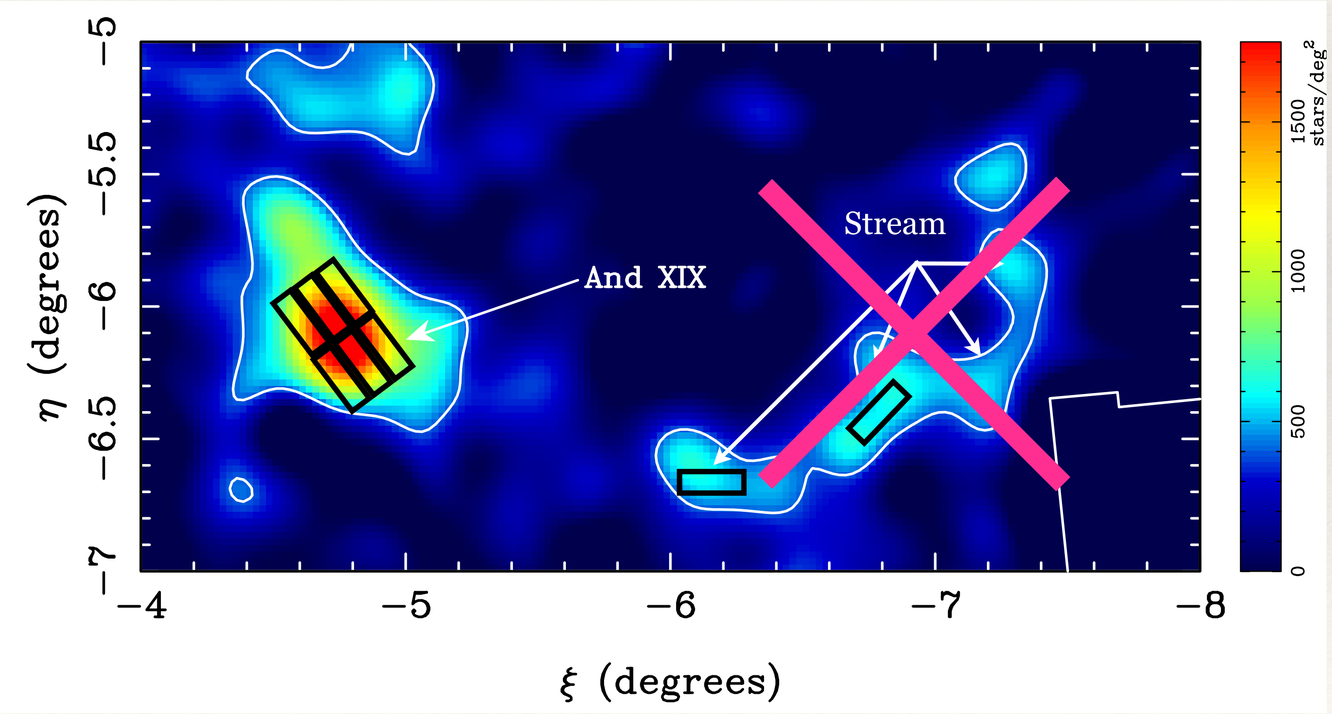
$M_* = 0.88 \times 10^6 M_\odot$

$r_h = 2920 \pm 311$ pc

Antlia 2 - hard to understand without feedback +tides

The low density, and large half light radius make it difficult/impossible to understand without DM heating through feedback, combined with tidal stripping (Torrealba et al. 2019).
Based on Erkal+19, has very close pericentre passage with Milky Way (~26 kpc)

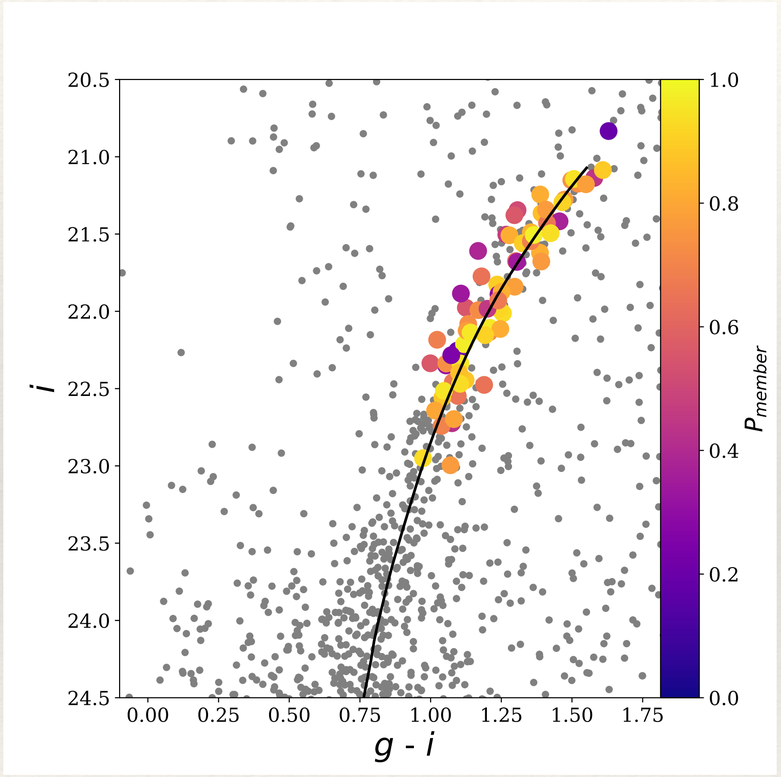
What about And XIX?

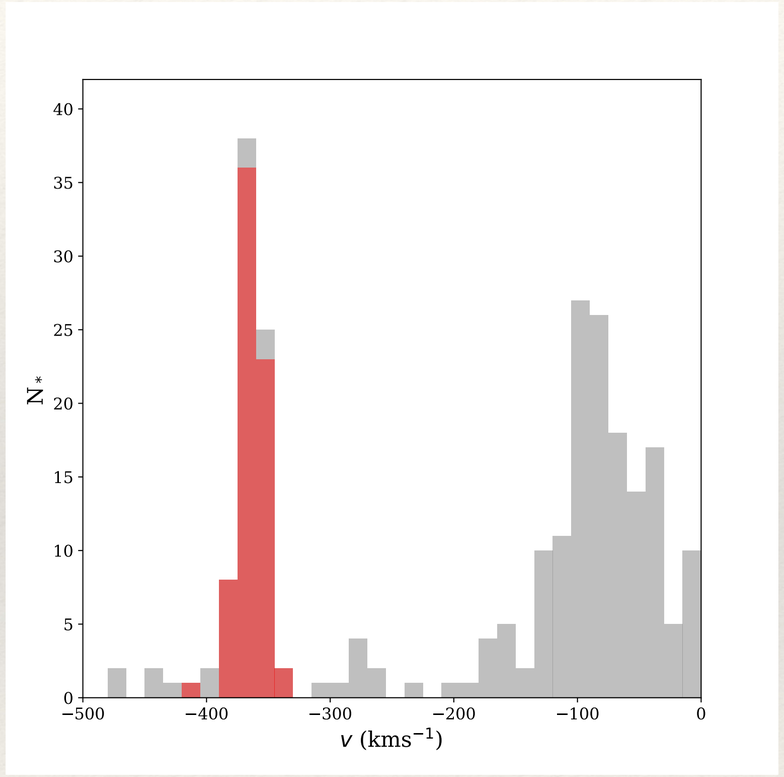


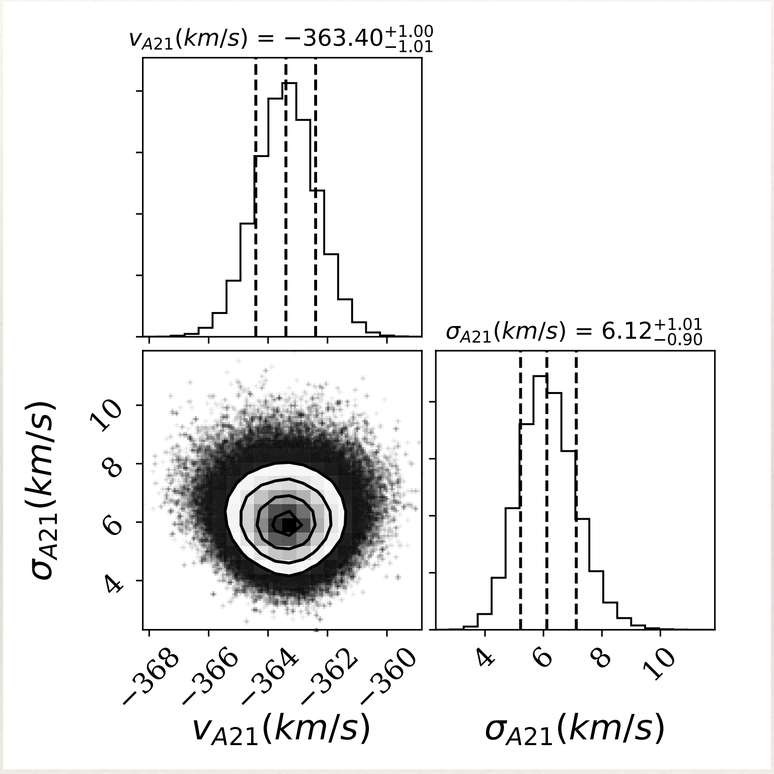
- Also extremely large, and low density
- (Tentative) velocity gradient
- Evidence of irregular kinematics
- But, stream is **not** associated

Paper 2: Dynamical modelling
(heads up, Justin)

And XXI - still low mass







Sample increased from 32 to 77 likely members

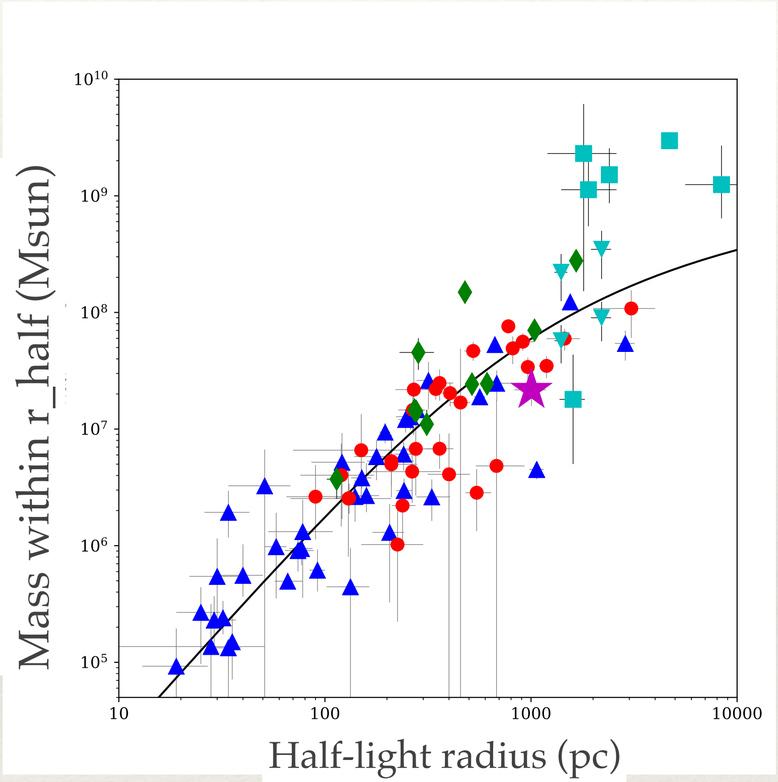
Collins, Read + in prep.

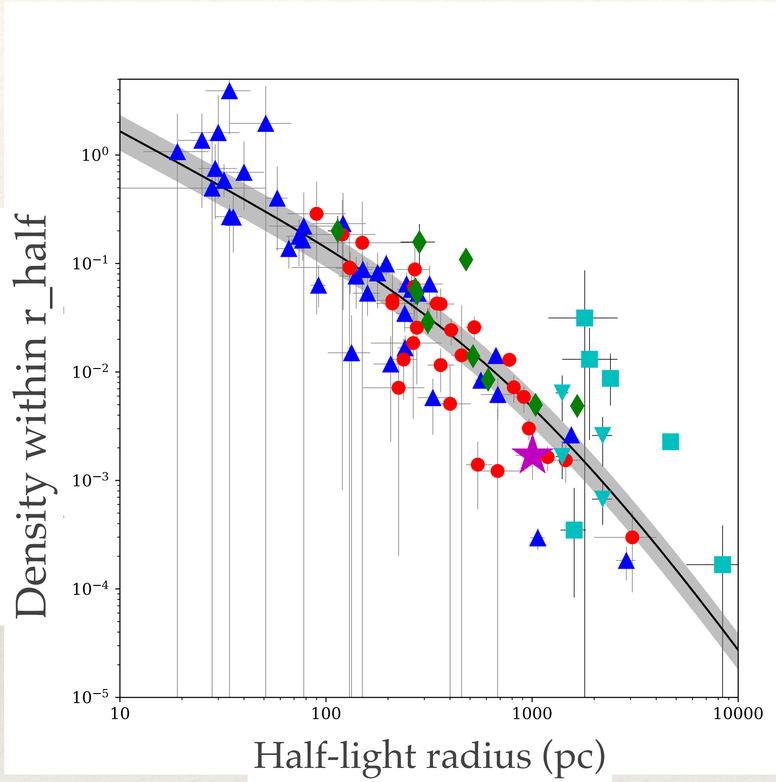
Velocity dispersion:

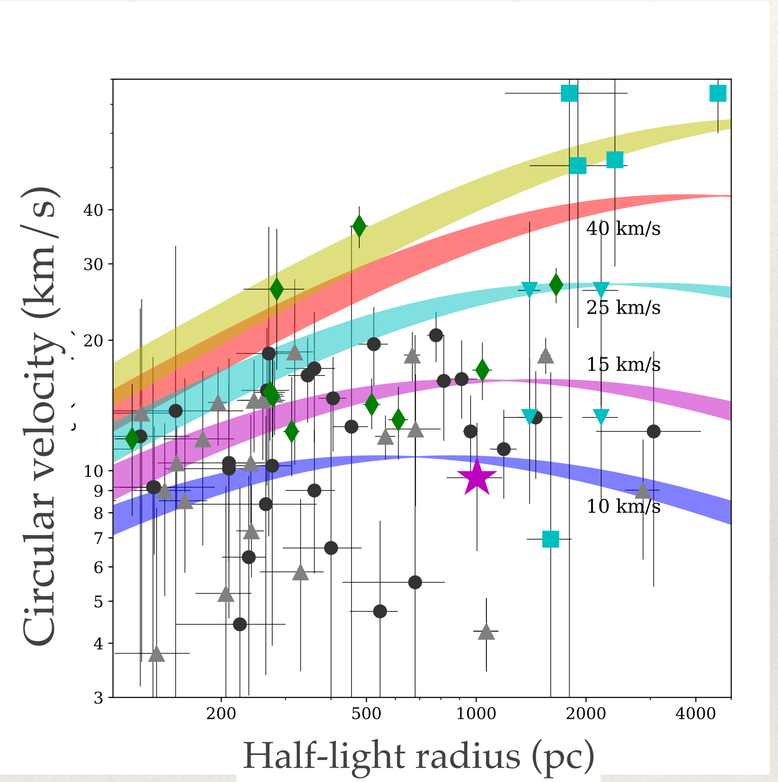
$\sigma_{v,\ 2014} = 5.4 \pm 0.9$ km/s

$\sigma_{v,\ 2019} = 6.1^{+1.0}_{-0.9}$ km/s

Remains a low mass & low density outlier





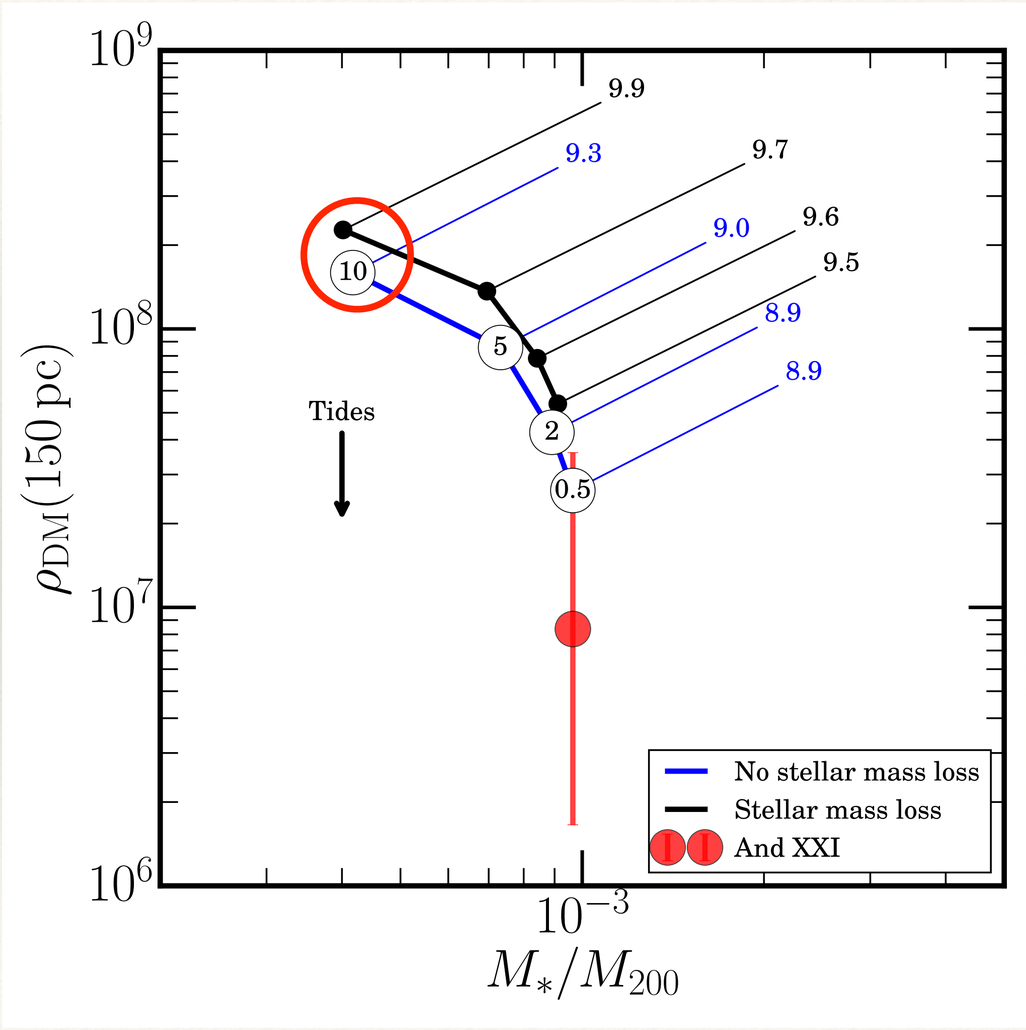


Collins, Read + in prep.

- Lower than expected density
- Still consistent with low mass halo
- Can this be done with feedback?
- GravSphere modelling with Justin Read

GravSphere Modelling

- Jeans modelling of density profile
- Use CoreNFW profile to fit data (surface brightness profile + kinematics)
- And XXI consistent with cored profile
- Would need to form stars for almost a Hubble time to explain density
- HST imaging shows no stars younger than 3-5 Gyr (Martin et al. 2017)
- Tides..?

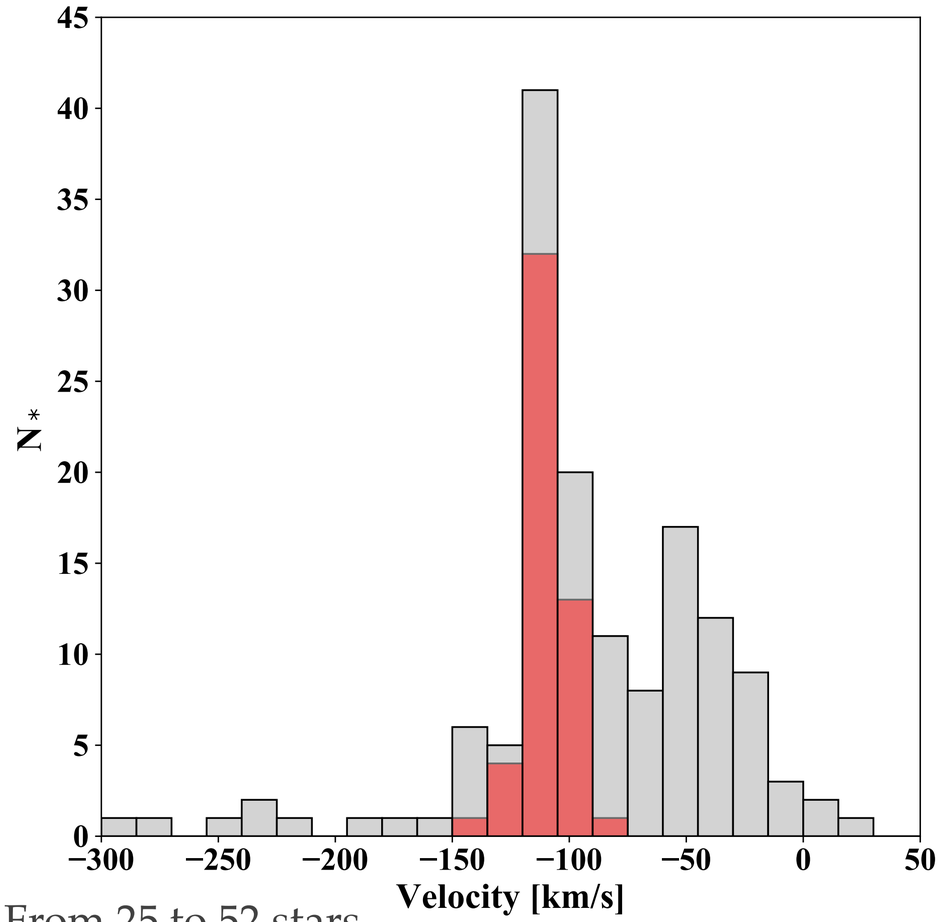


Read, Walker and Steger (2018), Read et al. 2019, Read & Erkal 2019
Collins, Read et al. in prep.

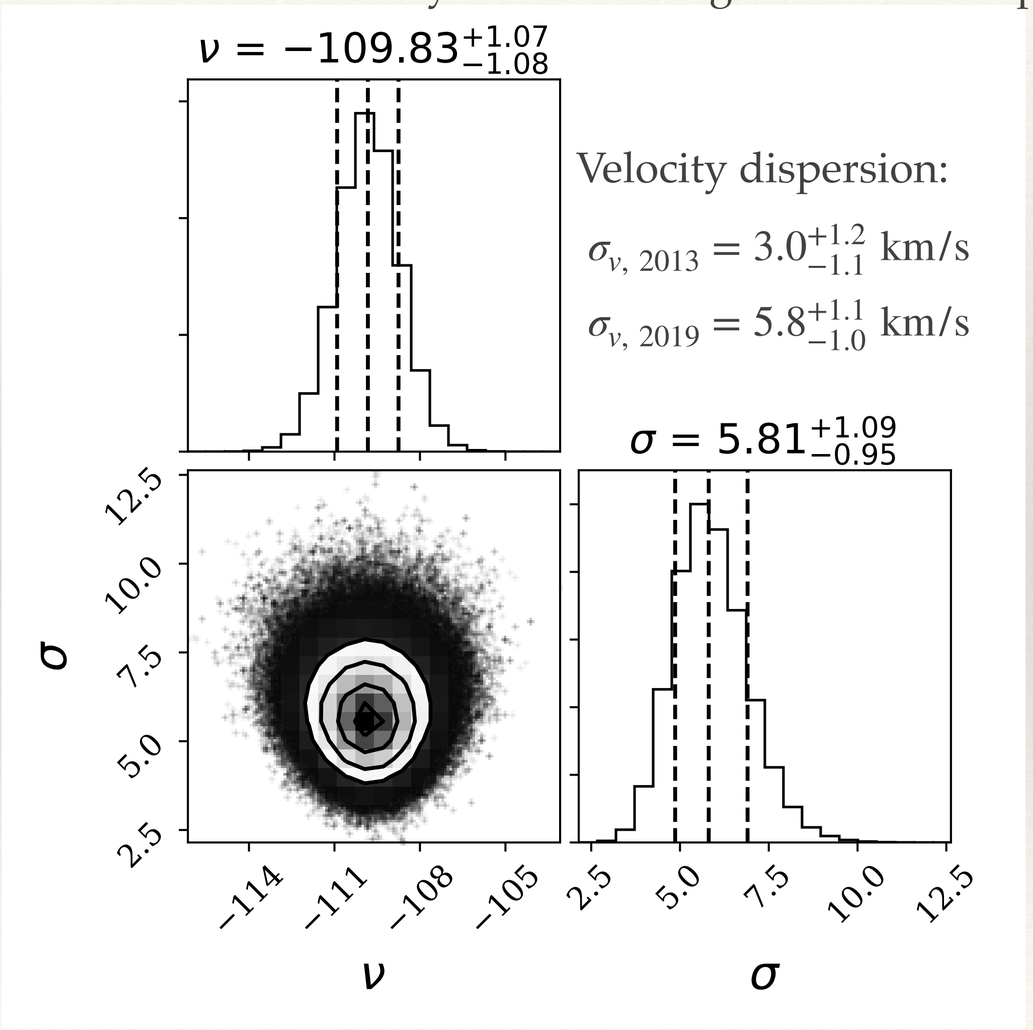
And XXV - hot off the UG press

Preliminary - Still working on membership

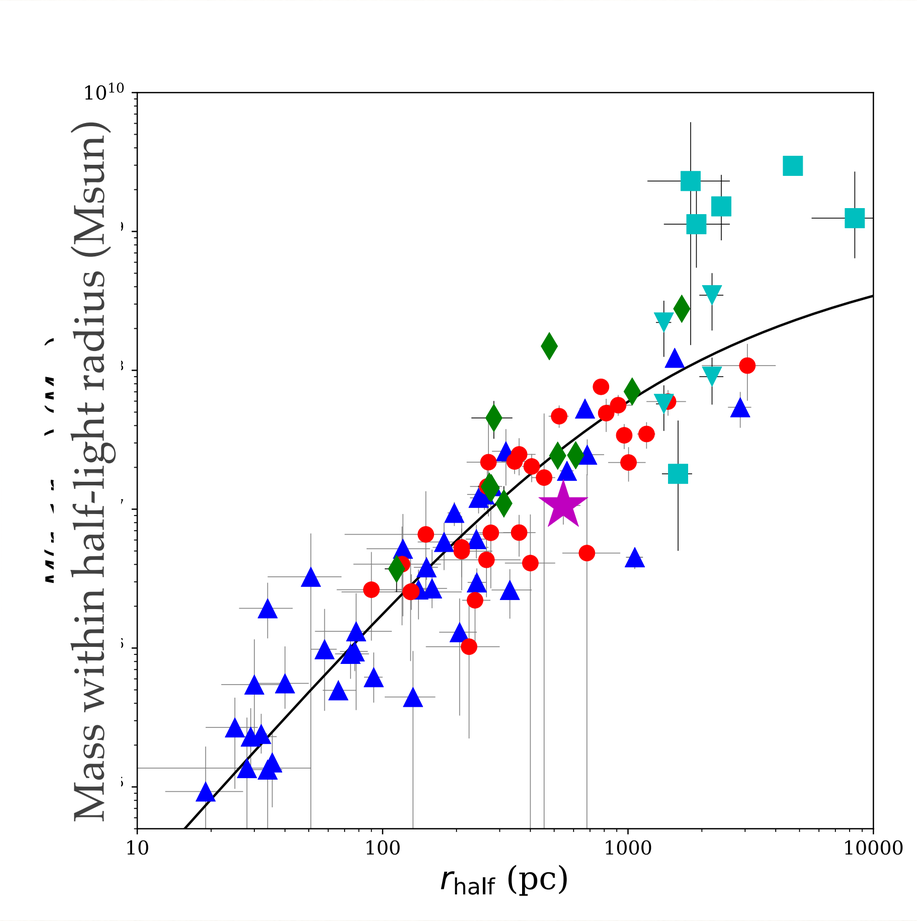
Work by Emily Charles

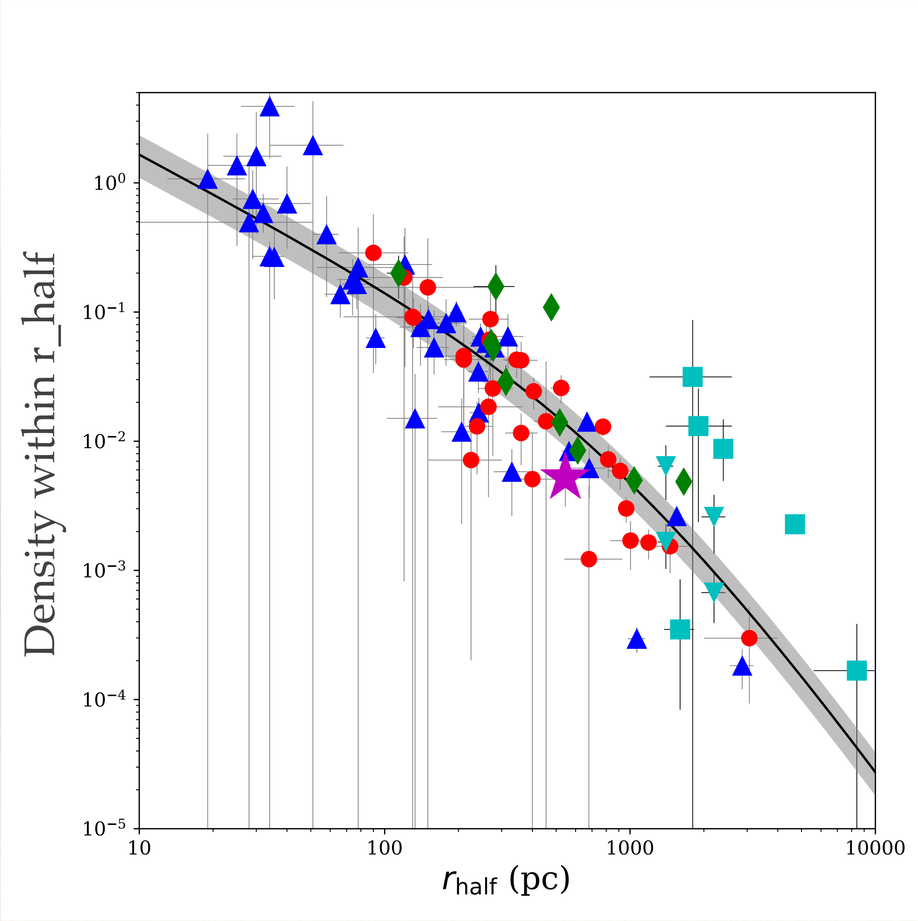


From 25 to 52 stars



Still a bit of an outlier, but less extreme





Next up - Working with Emily to refine analysis

Conclusions

- Increased membership in 3 ‘low mass’ dwarf galaxies
- And XIX - mass has gone up, but still quite low density
- And XXI - remains a low mass outlier - feedback plus tides?
- And XXV - mass has increased, more from Emily soon