Tidally Perturbed Dwarf Galaxies: Crater II & Antlia II

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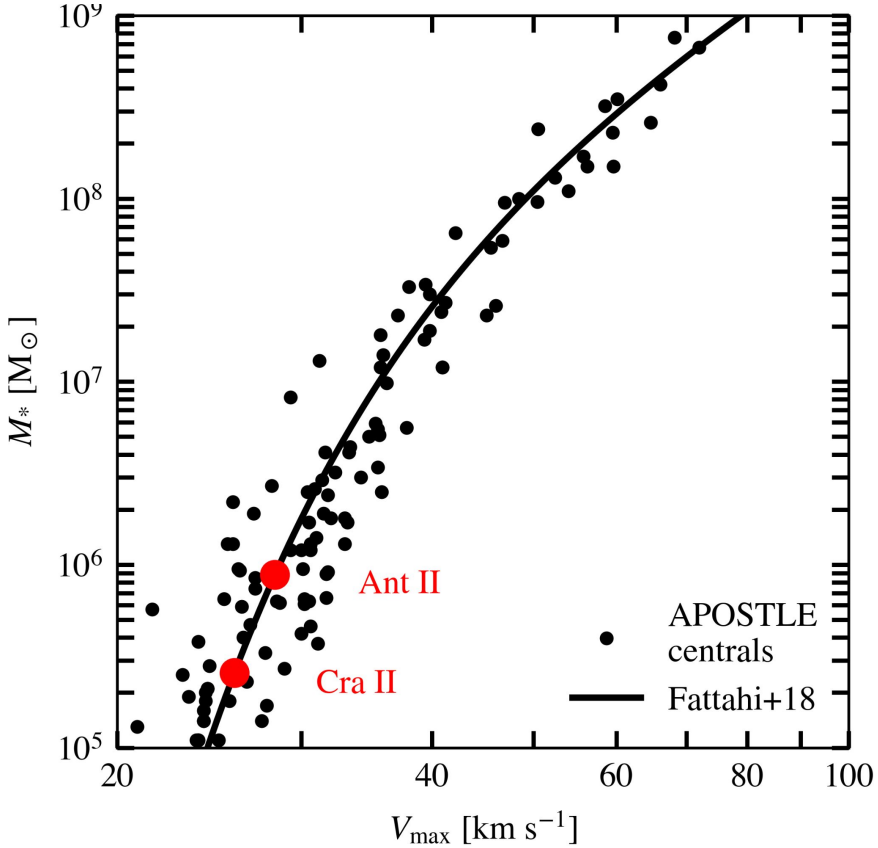
Introduction & Motivation

What do we expect?

- Structure forms through a hierarchy of mergers
- The more massive a halo, the more gas it accretes, the more stars it can form
- Not as simple on low mass end:
  - gas may have been forced out due to reionization or stellar feedback... → reduced ability to form stars
- Relationship between $M_\star$ and M_{halo}

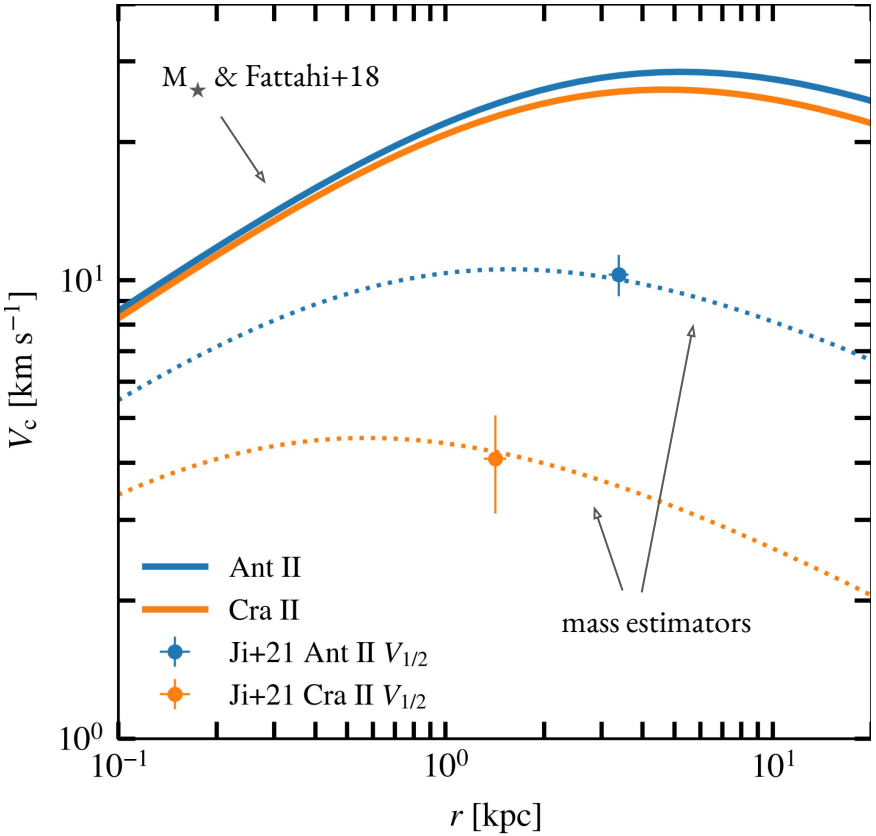


→ If we know a galaxy's $M_\star$, we can predict M_{halo}!

Introduction & Motivation

What do we see?

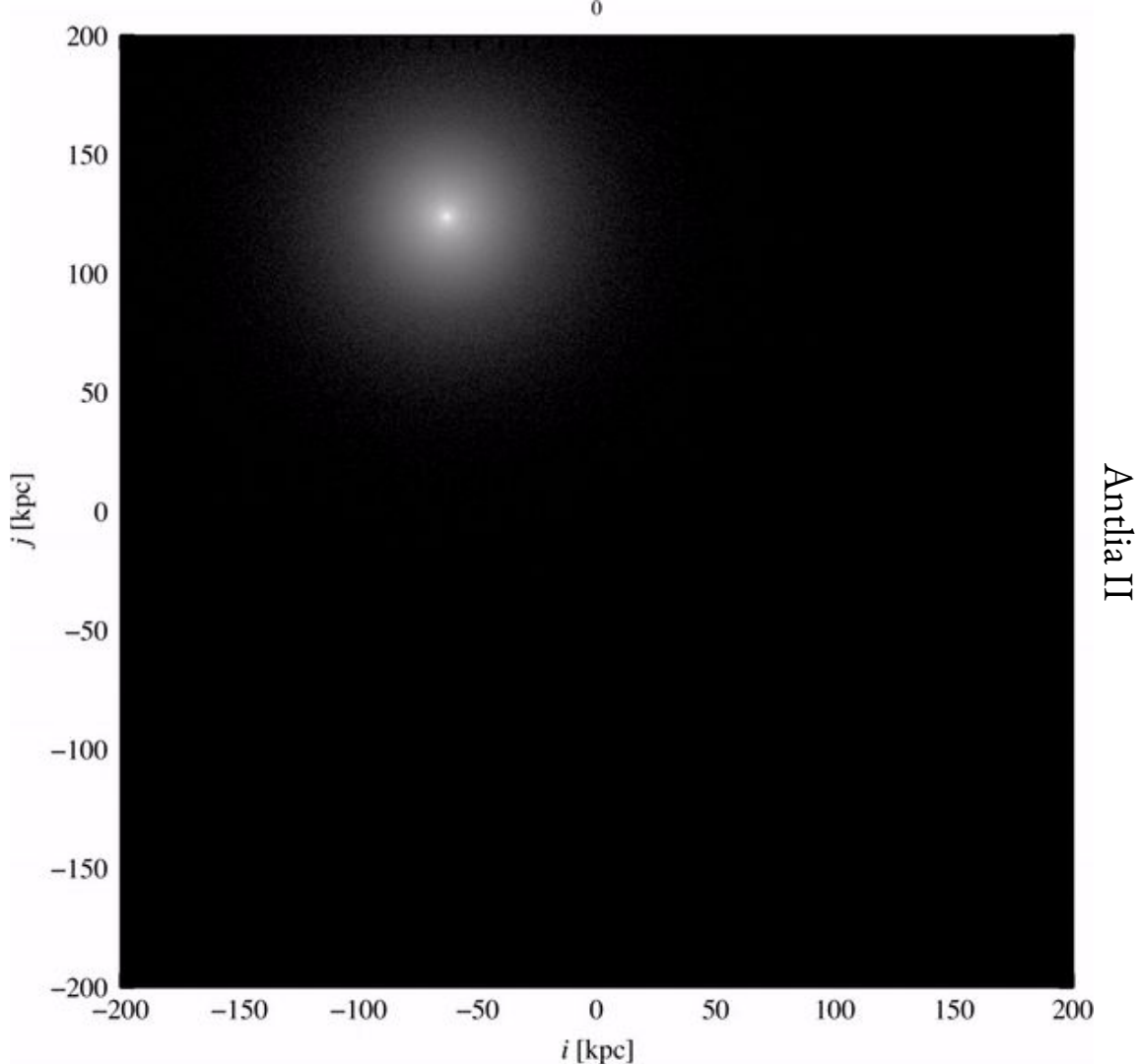
- Another way of estimating a galaxy's DM content is with $R_{1/2}$ & σ measurements and mass estimators (i.e. Walker et al 2009 or Wolf et al 2010)
- But the masses predicted from APOSTLE and the masses estimated from observed σ differ greatly:
- V_{max} from σ measurements is **<u>much lower</u>** than V_{max} from $M_\star$ and APOSTLE!



Why do Cra II and Ant II have so little DM?

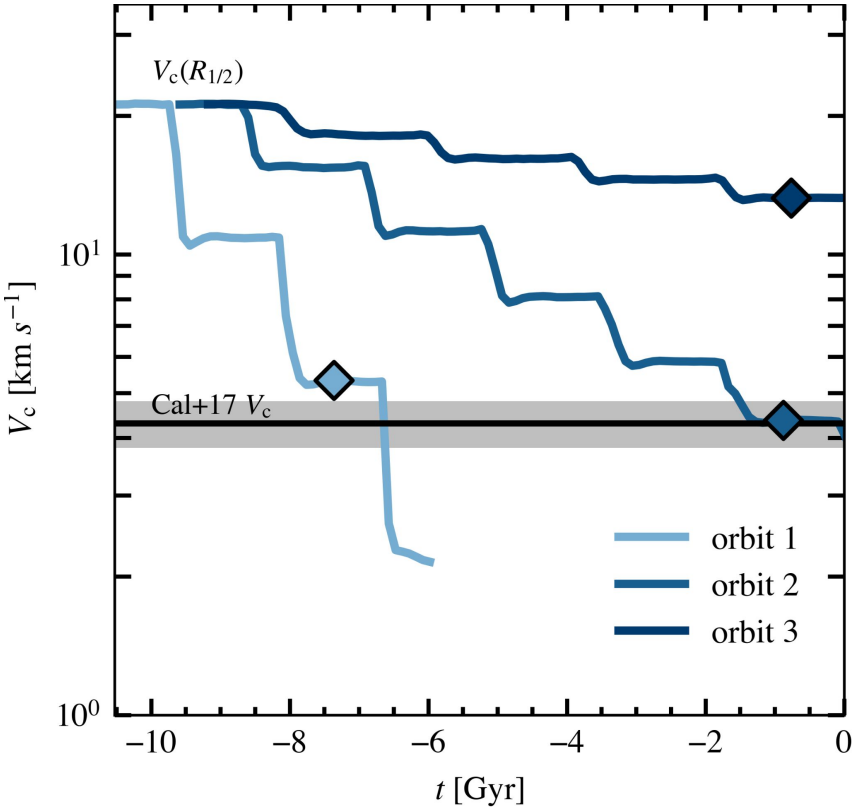
Tidal Stripping

Can **tidal stripping** account for the Crater II/Antlia II mass discrepancy?



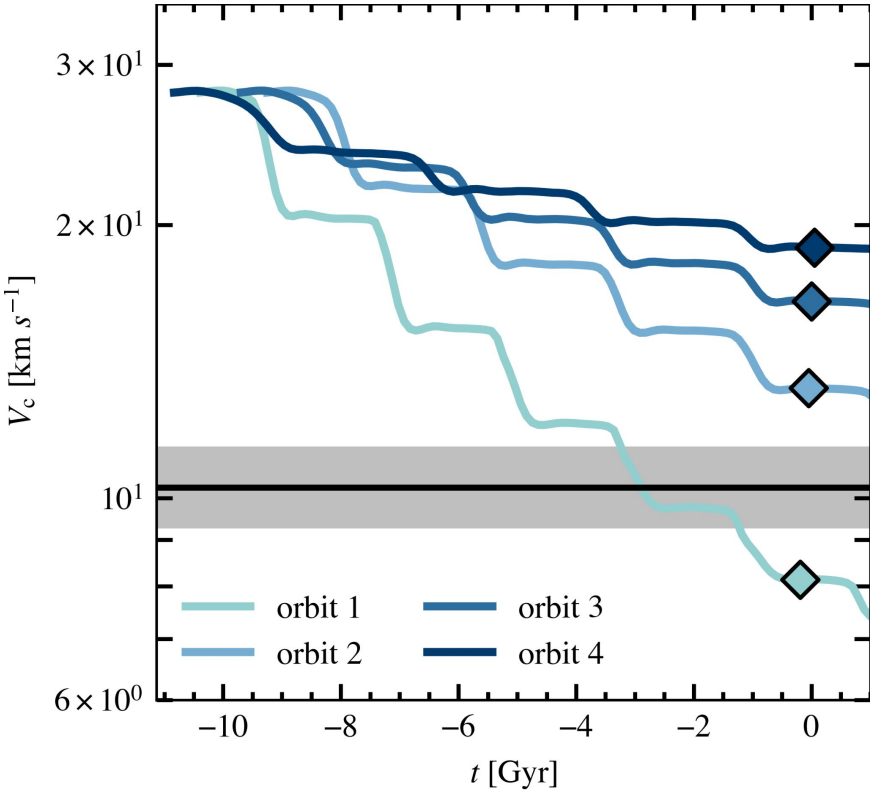
Stripping of the Dark Matter Halo: Crater II

- Can **tidal stripping** account for the Crater II mass discrepancy?
- *N*-body run with 10^7 particles
- Wide distribution in r_{peri} → halo placed on 3 orbits with 3 different pericentres.
- **Masses are reconciled!** (provided Cra II has been orbiting the Milky Way for ~9 Gyr and $r_{peri} \approx 15$ kpc)



Stripping of the Dark Matter Halo: Antlia II

- Can **tidal stripping** account for the Antlia II mass discrepancy?
- *N*-body run with 10^7 particles
- Like Cra II, wide distribution in r_{peri} → halo placed on 4 orbits with 4 different pericentres.
- **Masses are reconciled!** (provided Ant II has been orbiting the Milky Way for ~8 Gyr and $r_{peri} \approx 30$ kpc)



Stripping of Stars

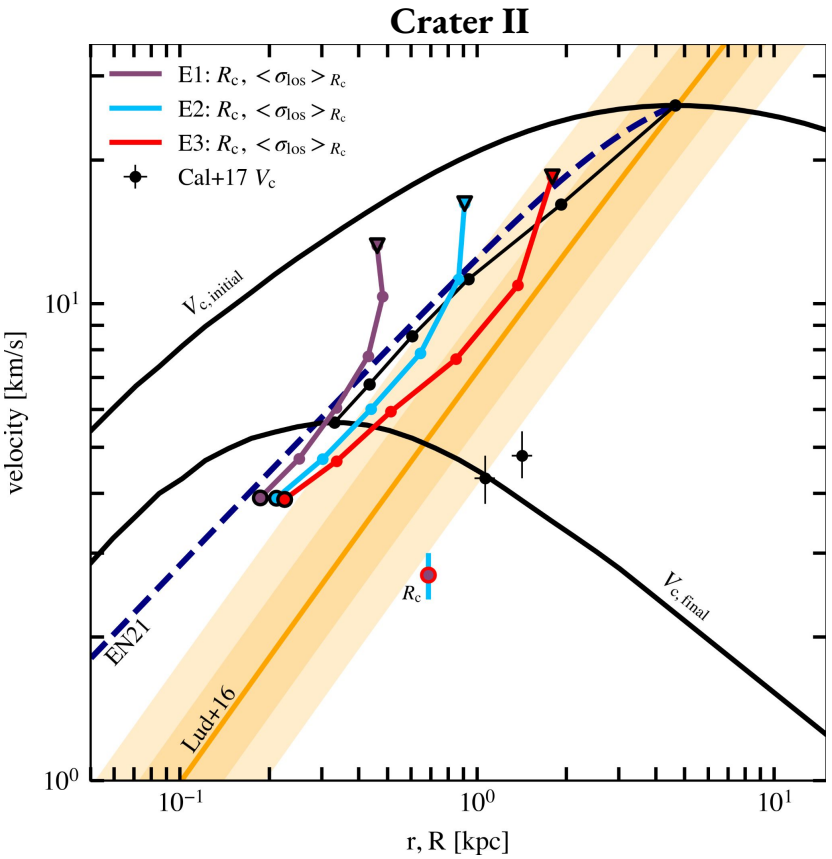
How do the stars respond to such intense tidal stripping?

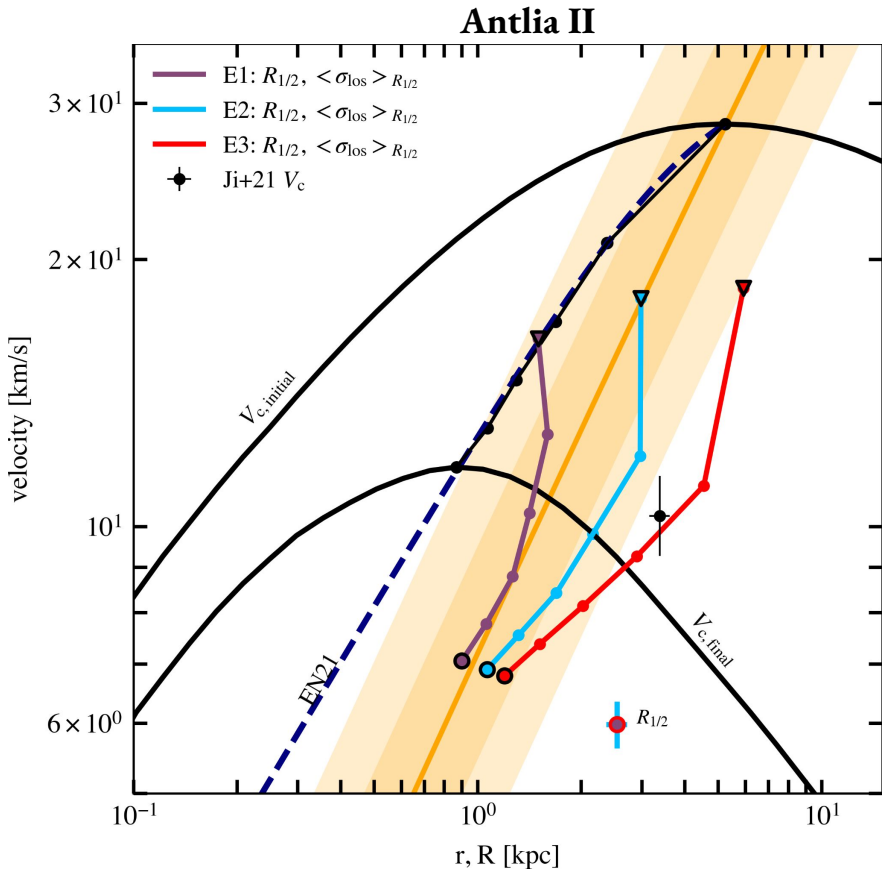
Are we able to reproduce current stellar properties?

3 exponential stellar models, with varying $R_{1/2}$:

- **E1**: $R_{1/2,\,initial} = 0.5\ R_{1/2,\,observed}$
- **E2**: $R_{1/2,\,initial} = 1\ R_{1/2,\,observed}$
- **E3**: $R_{1/2,\,initial} = 2\ R_{1/2,\,observed}$

'painted' over existing DM *N*-body distributions

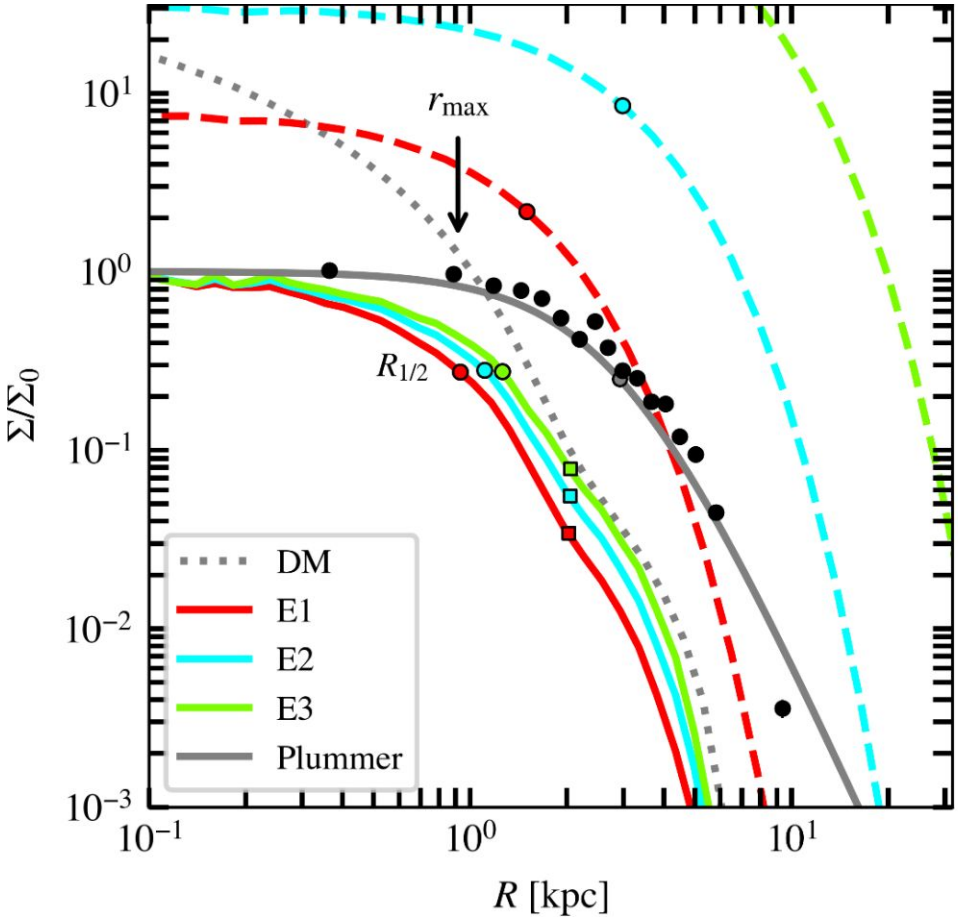




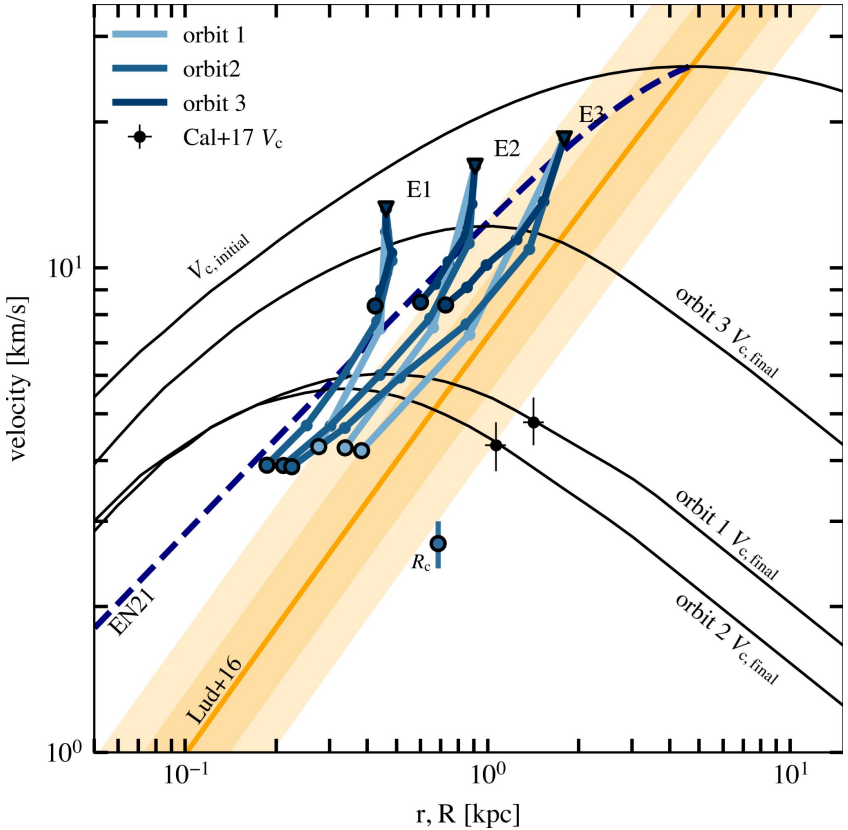
regardless of chosen initial extent , σ-$R_{1/2}$ tracks become parallel to the tidal track (Errani+21) and

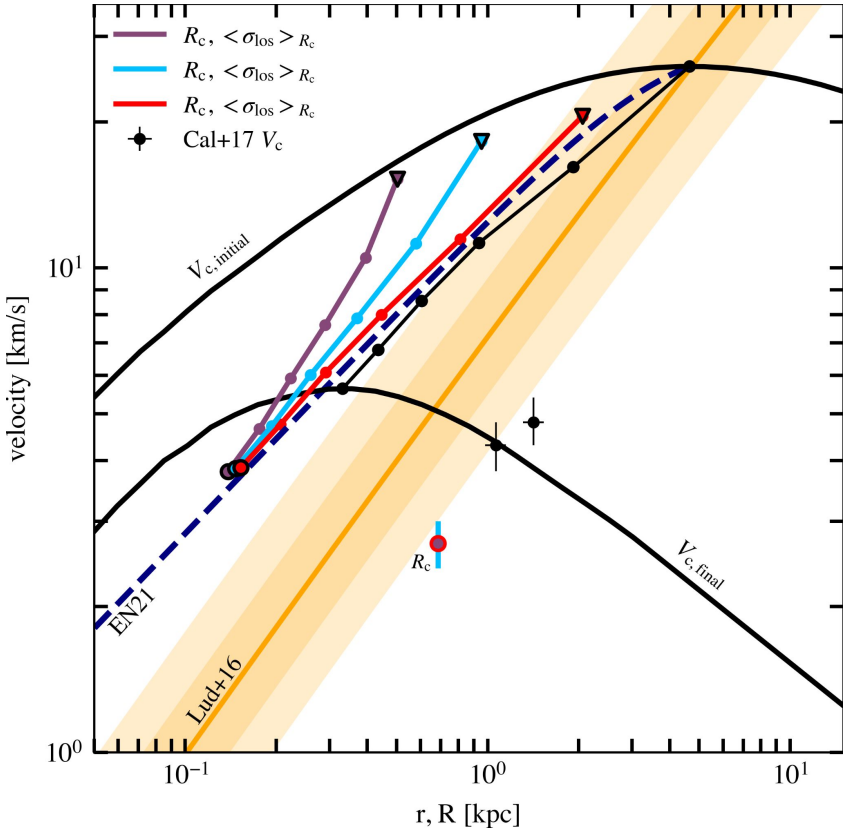
final $R_{1/2}$ is inevitably too small

Antlia II


r_{max}
$R_{1/2}$
DM
E1
E2
E3
Plummer
Σ/Σ_0
R [kpc]
10^{1}
10^{0}
10^{-1}
10^{-2}
10^{-3}
10^{-1}
10^{0}
10^{1}

Crater II





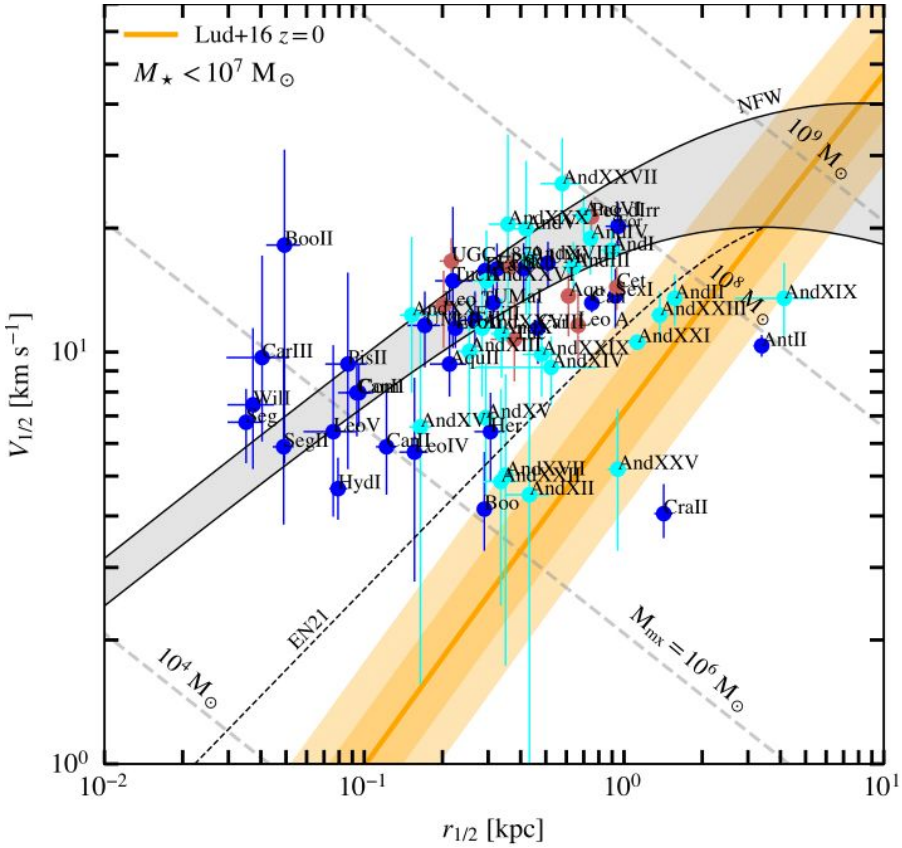
Stars are much more challenging to reconcile with observations using tidal stripping...

Other Satellites

As satellites are tidally stripped:

- σ decreases
- $R_{1/2}$ decreases

→ matching satellites that lie to the right of the mass-concentration relation is a challenge



- would need a halo that initially starts off the Ludlow m-c relation or,
- a core… or,
- a steep energy distribution + caught in perfect moment of disruption

Thank you! https://arxiv.org/abs/2112.01540