Quenching and ram pressure stripping of simulated Milky Way satellite galaxies

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Many substructure puzzles in the Local Group

- ‘Missing satellites’
- ‘Too big to fail’
- cores vs. cusps
- planes of satellites

**Solution(s)?**

Dark matter?  
Gravity?  
Baryons?  
All of the above?
What do we know about baryons in LG dwarfs?

**Environment**

Few systems with measured H I within ~270 kpc of host

**Mass**

Fraction of quenched systems increases with decreasing luminosity

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Grecevich & Putman 2009

Weisz et al. 2015
The Set-up & Physics

- Thirty cosmological zoom simulations of $10^{12} \, M_\odot$ halos
- DM particle mass $\sim 3 \times 10^5 \, M_\odot$; baryon cell/particle mass $\sim 5 \times 10^4 \, M_\odot$
- Second-order hydrodynamics on a moving mesh (AREPO)
- MHD, SF & stellar feedback, AGN feedback, UV background, atomic & metal line cooling
Satellites & Dwarfs in Auriga

- Cumulative number of luminous satellites match the MW and M31

- Luminosity of systems lie above predictions for central galaxies from abundance matching extrapolations

Simpson et al. 1705.03018
Quenching of Satellites

- All distance bins show more quenching at lower masses
- The most isolated systems only quench strongly at $M_{\text{star}} < 10^7 \, M_\odot$
- Above $M_{\text{star}} > 10^8 \, M_\odot$ almost all systems are star-forming

Simpson et al. 1705.03018
Mechanisms?

Ram Pressure?

Simpson et al. 1705.03018
Ram pressure is the dominant quenching mechanism

- This system is $\sim 6.3 \times 10^6 \, M_\odot$ in stellar mass
- The half-stellar mass radius expands by $\sim 45\%$ during this ram pressure stripping event

Safarzadeh & Scannapieco 2017

Simpson et al. 1705.03018
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Safarzadeh & Scannapieco 2017
Observed quenching times

$\tau_{90}$ is the time by which 90% of a system's stellar mass formed (data: Weisz et al. 2015)

Simpson et al. 1705.03018
‘Backsplash’ galaxies: systems that have been within $R_{200}$ in the past but not at $z = 0$
Conclusions

- Satellites in Auriga match general trends found in the Local Group (numbers, quenched fractions, distance trends)
- 50% of quenched systems do so within 1 Gyr of first infall
- Ram pressure stripping appears to be the dominant quenching mechanism of satellites in Auriga

Weisz et al. 2015