University of St Andrews

DYNAMICAL MODELLING IN THE COSMIC WEB

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WITH:
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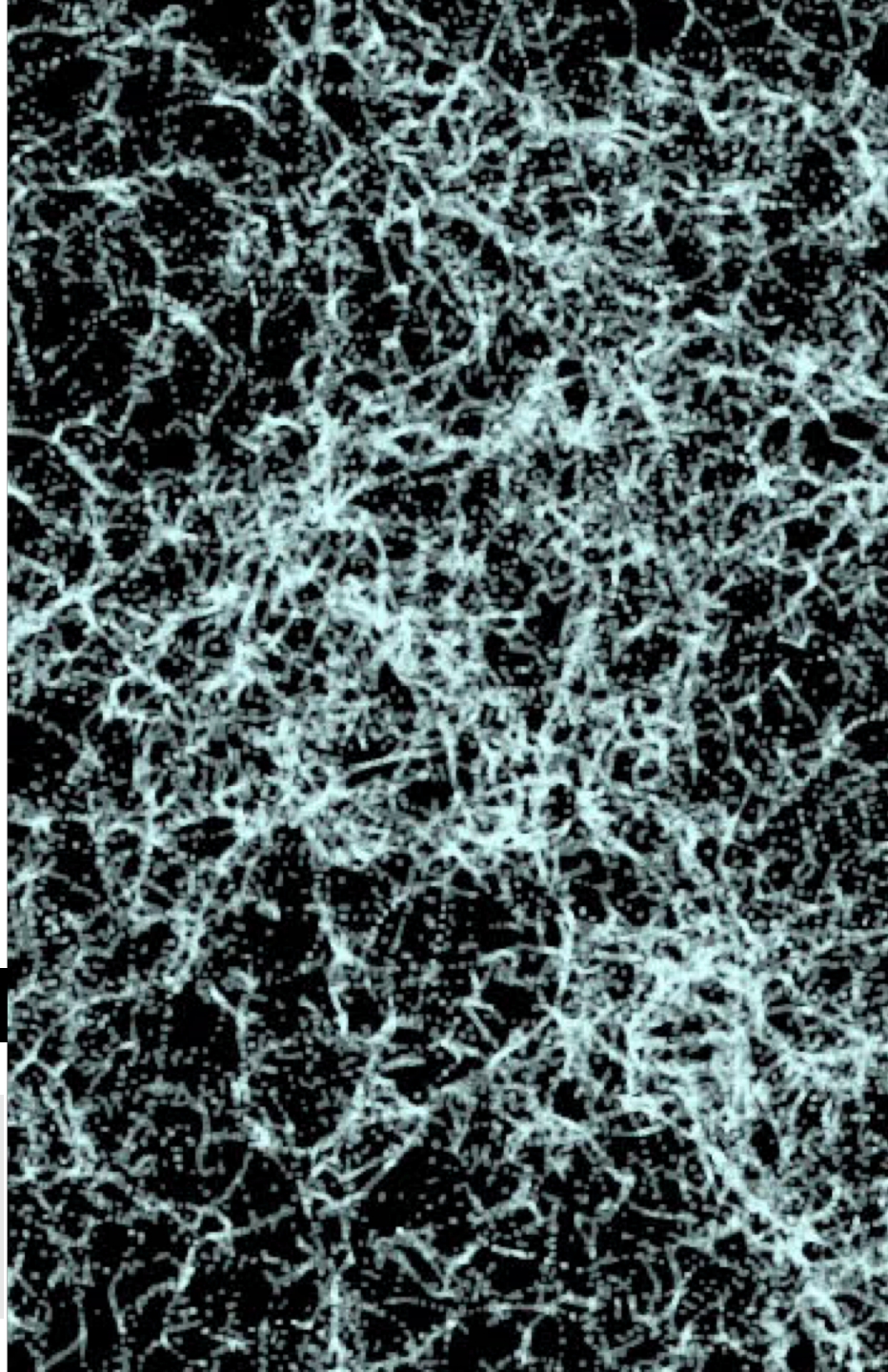


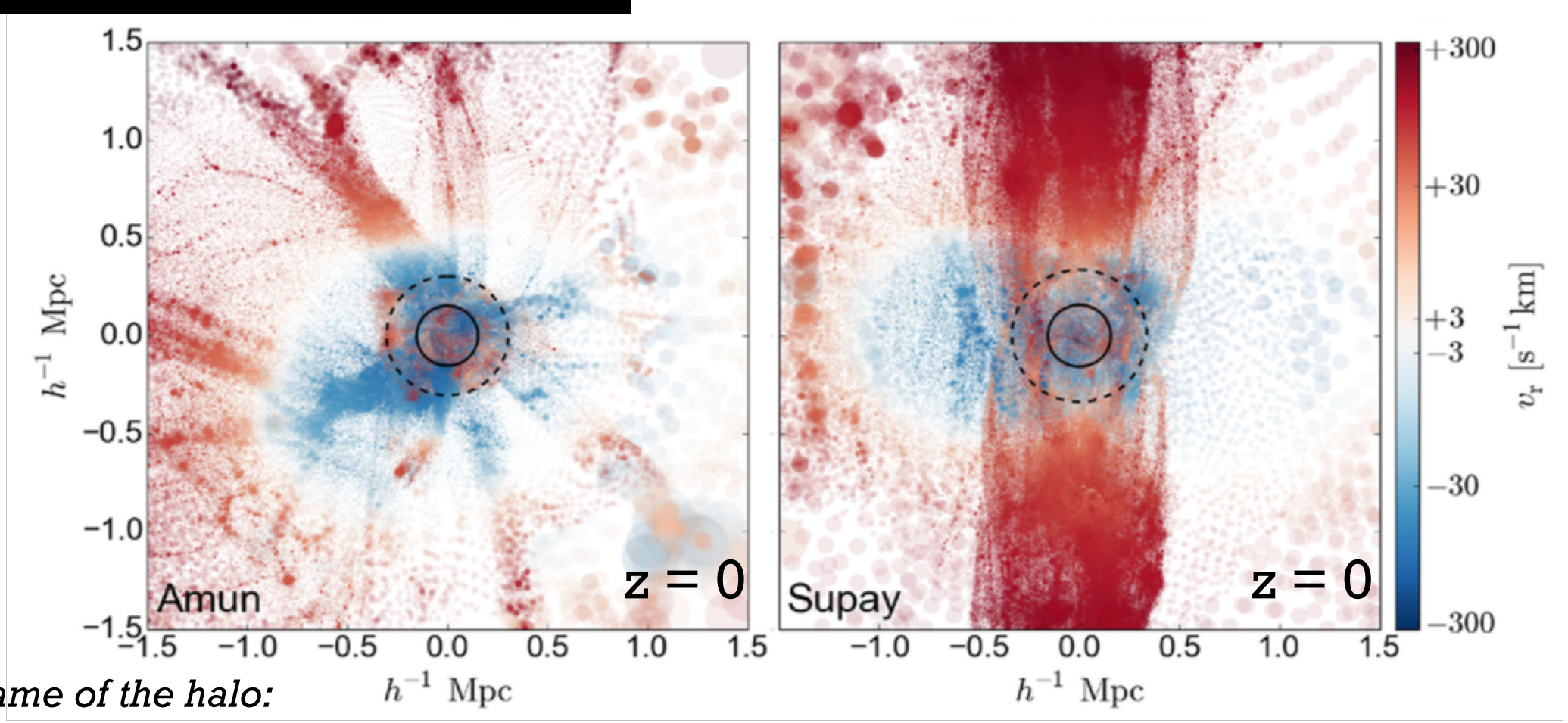
MOTIVATION

- *Halo assembly bias:*
  - the dependence of the clustering of dark matter halos on physical parameters outside of halo mass. (e.g. halo age, shape, spin)
  - E.g. Sheth & Tormen04, Gao+05, Wechsler+06, Dalal+08

- Linked to the *large scale tidal environment* which is a direct effect of the anisotropy of the cosmic web!
  - (e.g. Hahn+09,Tojeiro+17,Kraljic+18)

- Found in various flavors of simulation but yet to converge in observations
  - ***Developing techniques to isolate assembly bias in observations is the aim here!***

ANISOTROPY



In rest-frame of the halo:

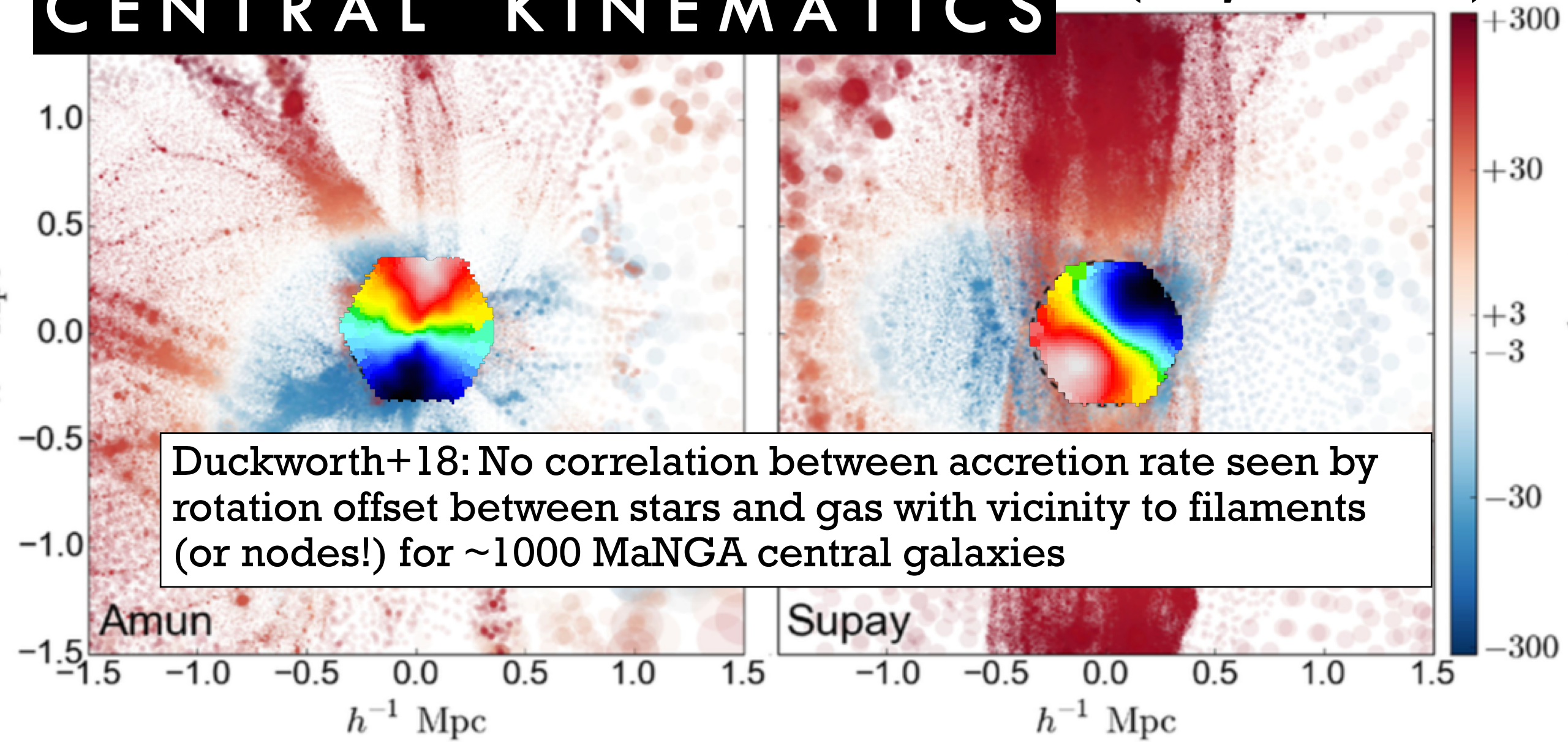
Blue = in-falling material

Red = material moving away

(Borzyszkowski+16)

CENTRAL KINEMATICS

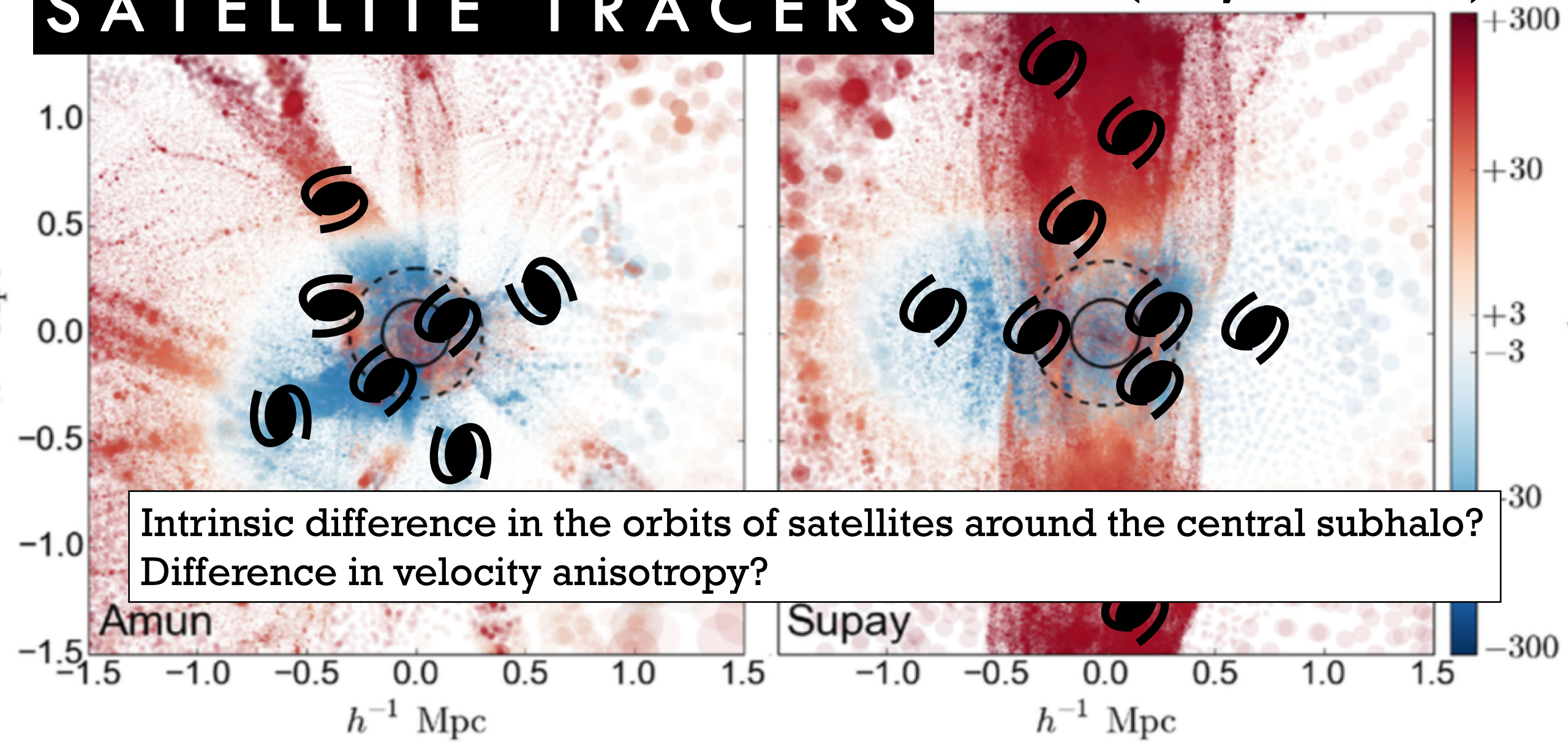
(Borzyszkowski+16)



Duckworth+18: No correlation between accretion rate seen by rotation offset between stars and gas with vicinity to filaments (or nodes!) for ~1000 MaNGA central galaxies

SATELLITE TRACERS

(Borzyszkowski+16)

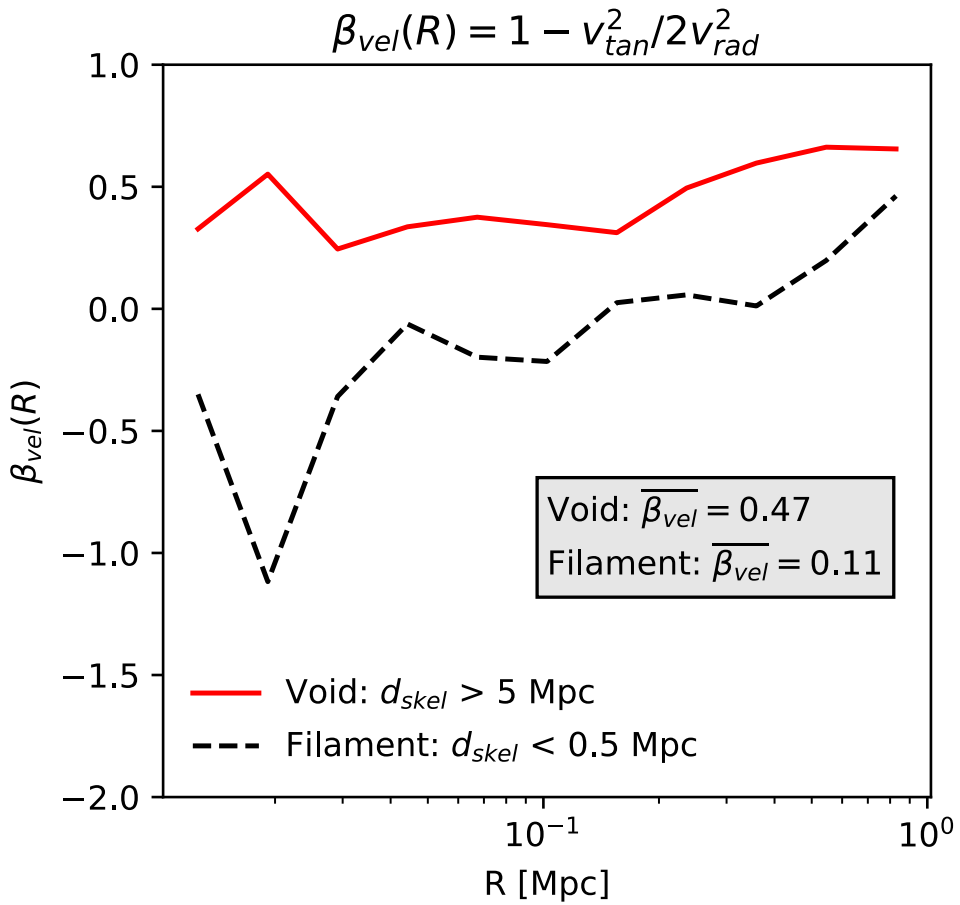


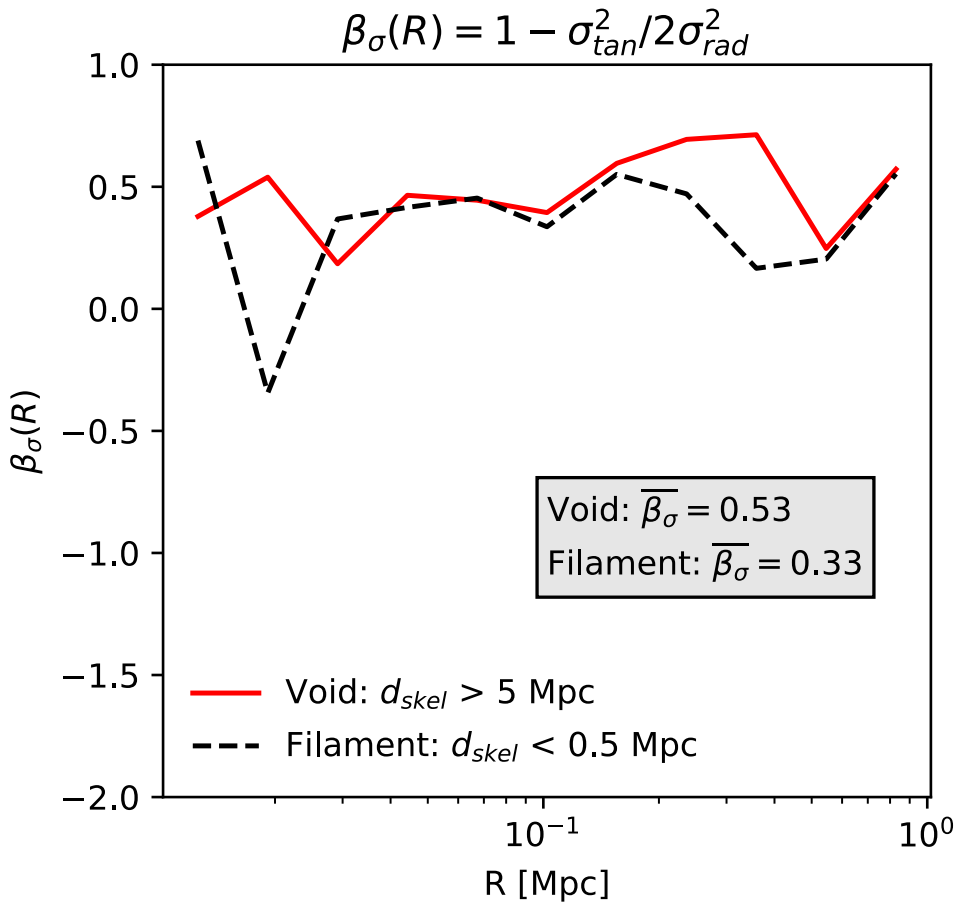
Intrinsic difference in the orbits of satellites around the central subhalo?
Difference in velocity anisotropy?

VELOCITY ANISOTROPY

PRELIMINARY

Stacking TNG300 haloes: $10^{11.8}$-$10^{12.5}$ $M_\odot$





DISCRETE JEANS

CJAM : Jeans Anisotropic MGE modelling code written in C
Watkins+13, https://github.com/lauralwatkins/cjam
Adaptation to include chemical properties: Zhu+16

1) Construct MGEs of tracer population + gravitational potential (or functional form)

2) Solve Jeans' equations taking *each* tracer position as a prior and compare model velocity to the observed (line-of-sight)

3) Use maximum likelihoods to find best fit free parameters + prediction for 3D velocities for all tracers!

SUMMARY

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- Duckworth+18: No correlation between accretion rate seen by rotation offset between stars and gas with vicinity to filaments (or nodes!) for ~1000 MaNGA central galaxies

In progress:

- DisPerSE: Cosmic web identification in IllustrisTNG – public catalogue to be released
- Discrete dynamical modelling applied to TNG stacked haloes
- Discrete dynamical modelling applied to large cluster in TNG
- Kinematic offsets as measures of merger rate