Dark Cosmology Centre

Spatially anisotropic kinematics of dark matter halos

Radek Wojtak

Lyon, 20.06.2012

Outline

- motivation/inspiration
- spatially anisotropic kinematics: velocity dispersion, anisotropy parameter, infall velocity
- testing against observations
- project in progress: measuring infall velocity around clusters
- recent result: kinematics of SDSS galaxy satellites

Halo Spin alignment

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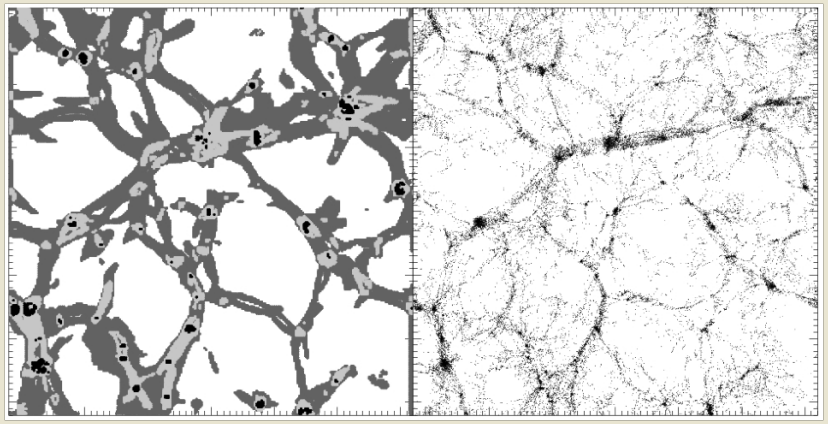
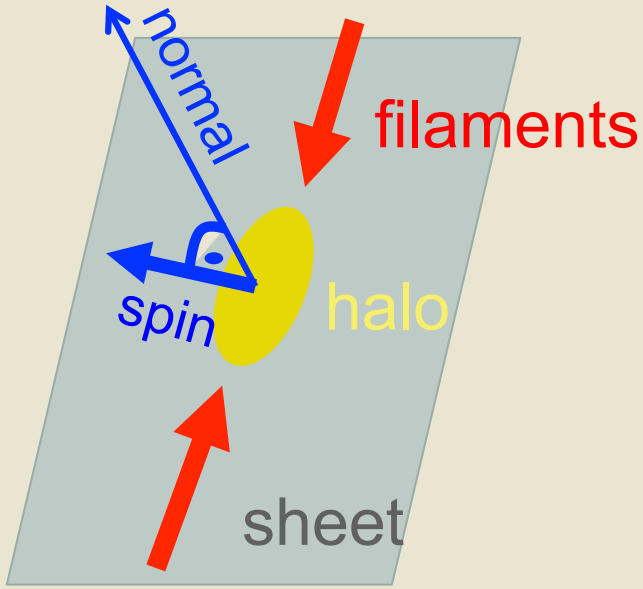
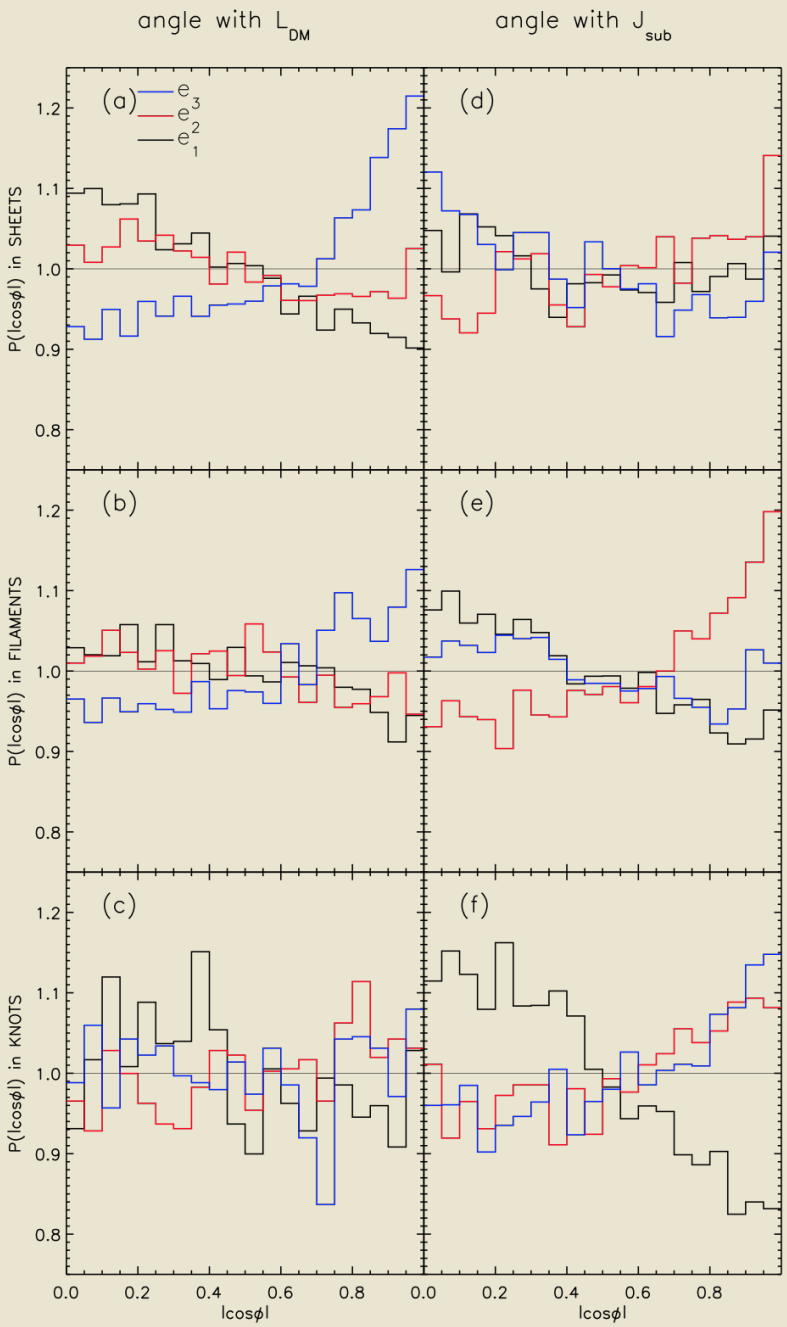
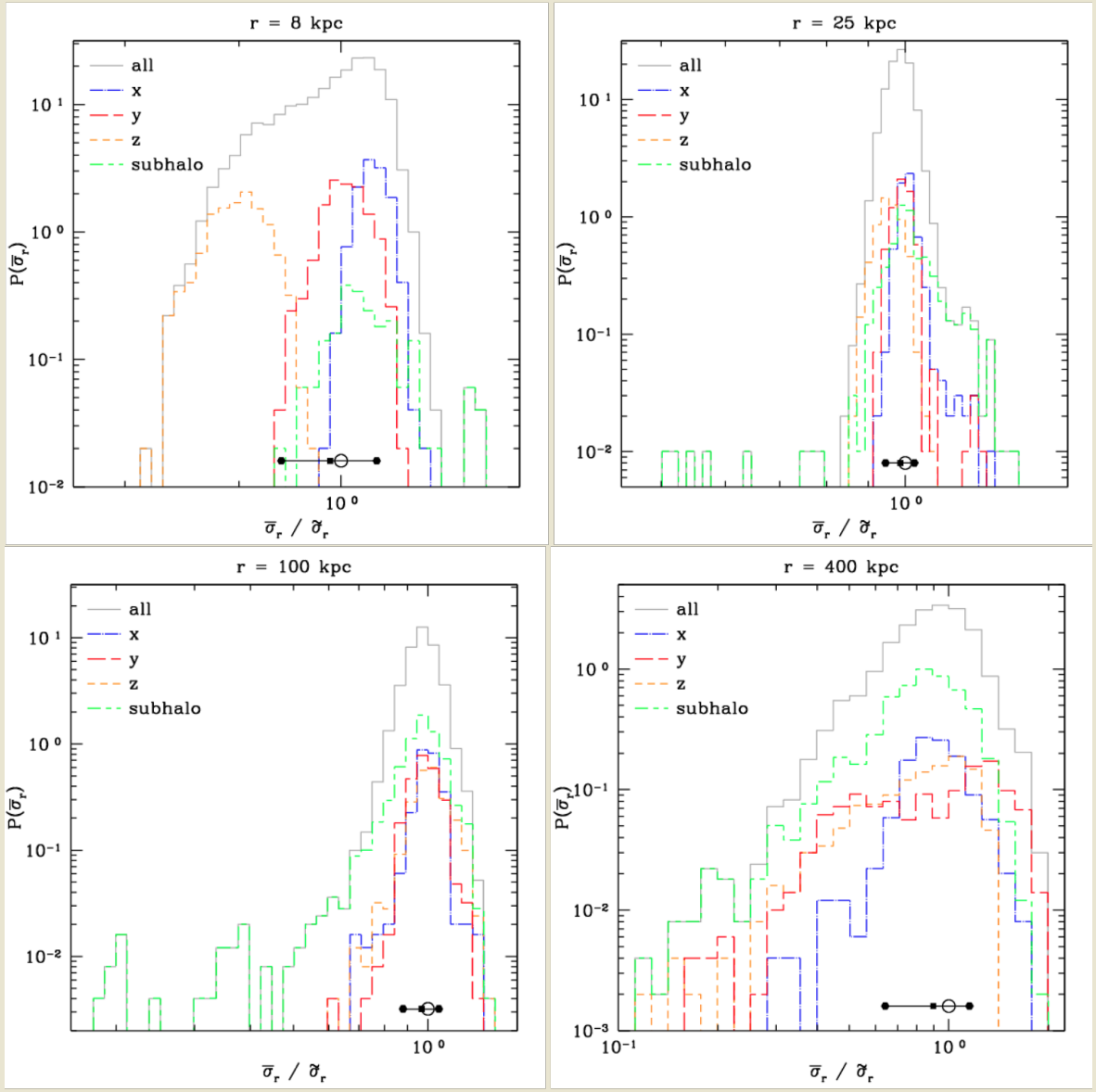






Spherical symmetry hides the details



Zemp et al (2008)

Controlled numerical experiments

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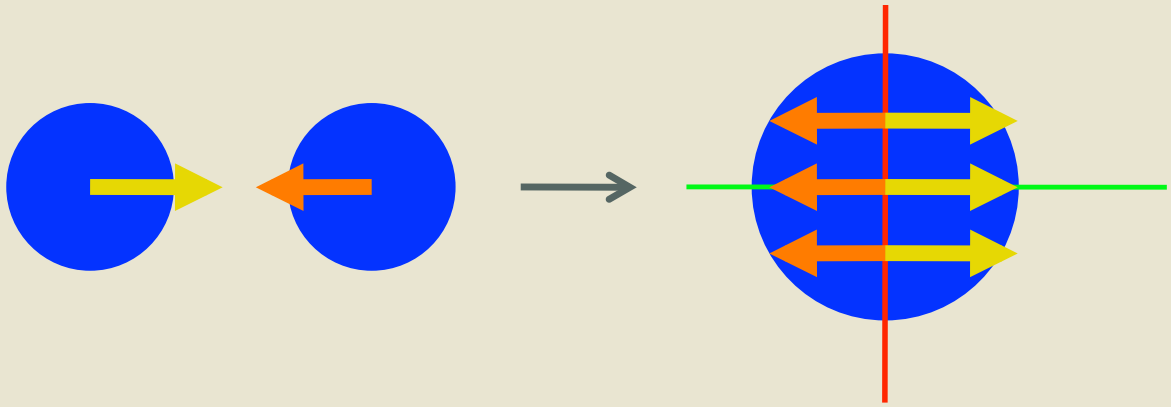
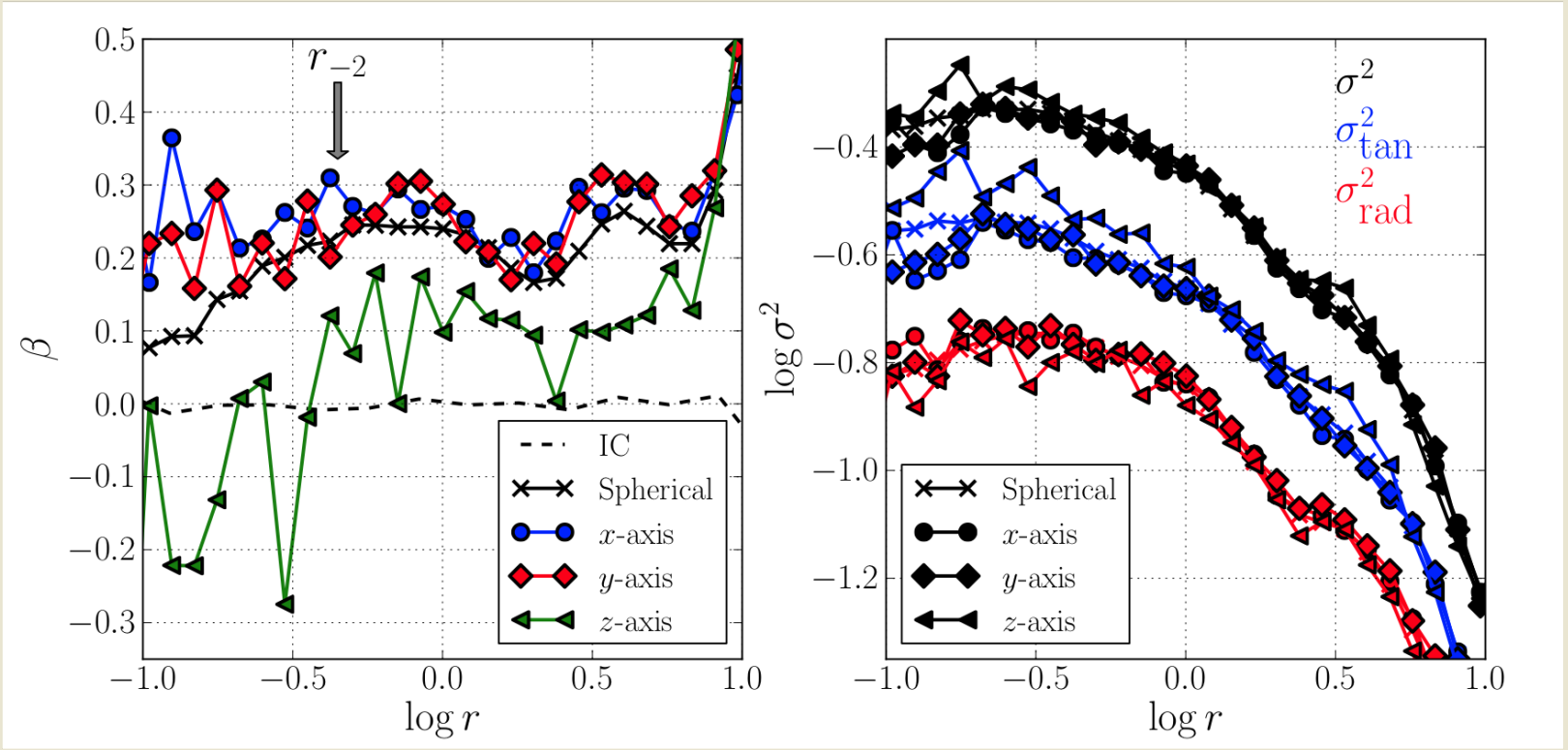
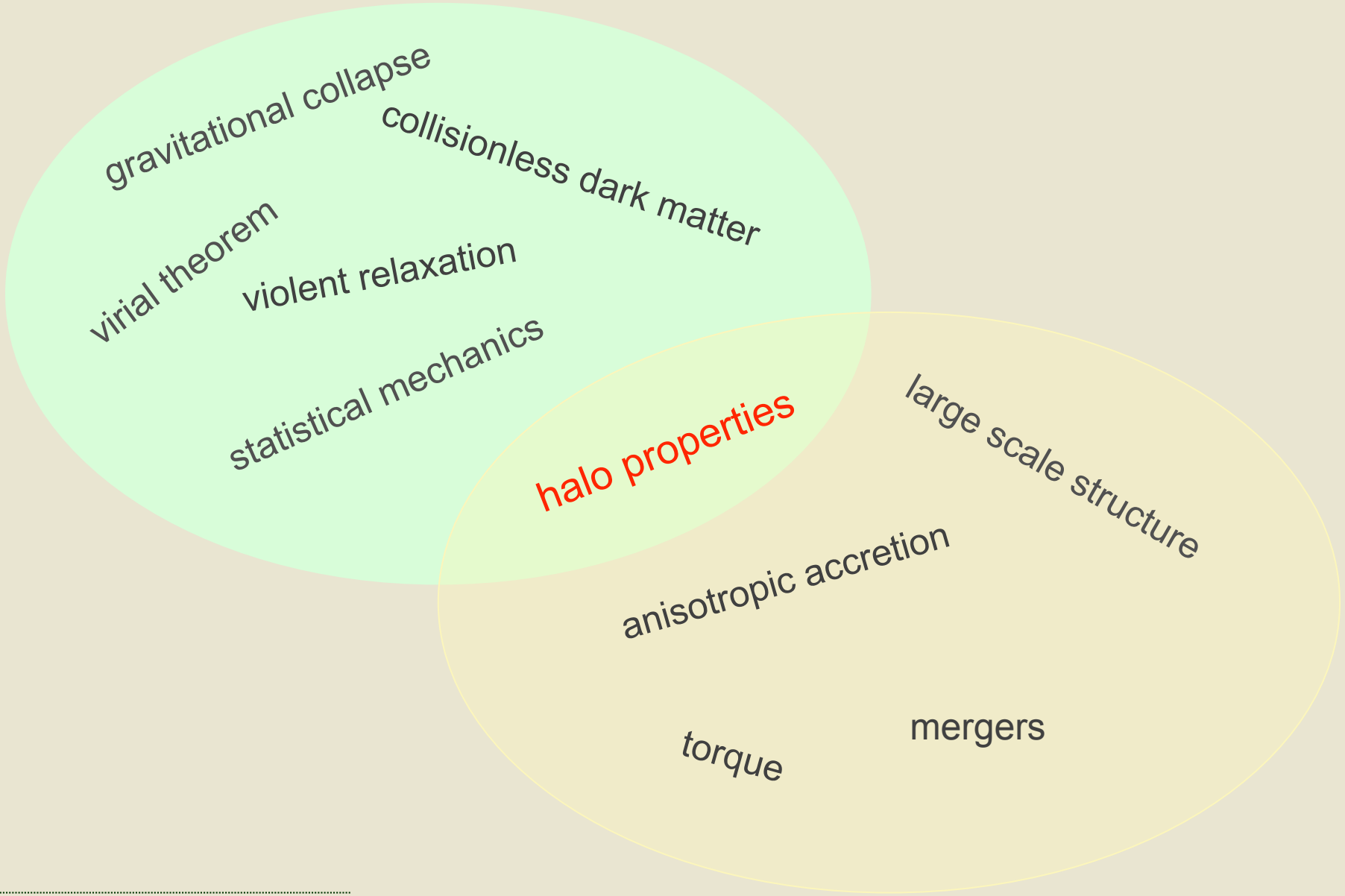




Sparre & Hansen 2012

Nature versus nurture



Phase-space diagnostics

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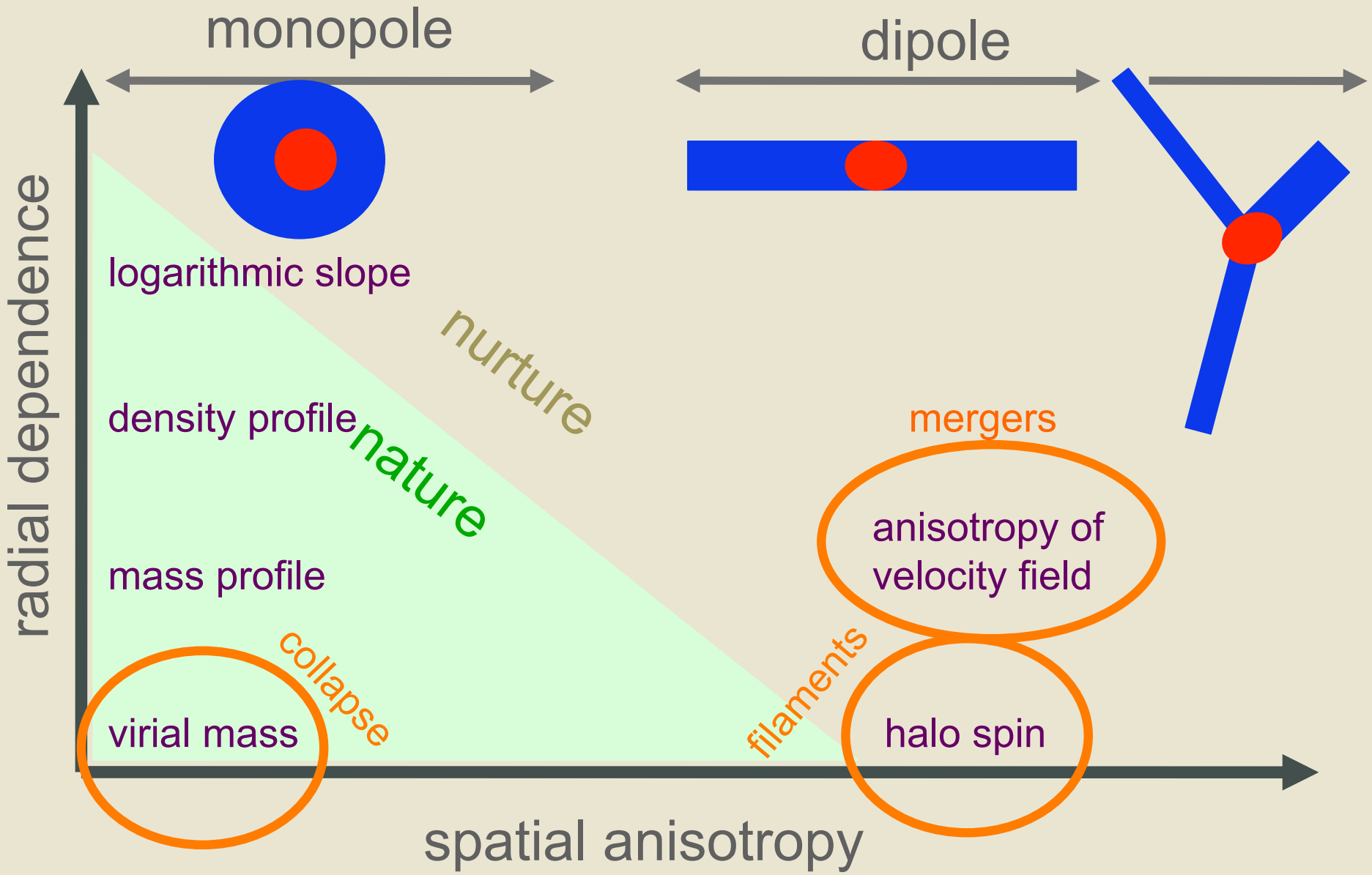

Density and anisotropy

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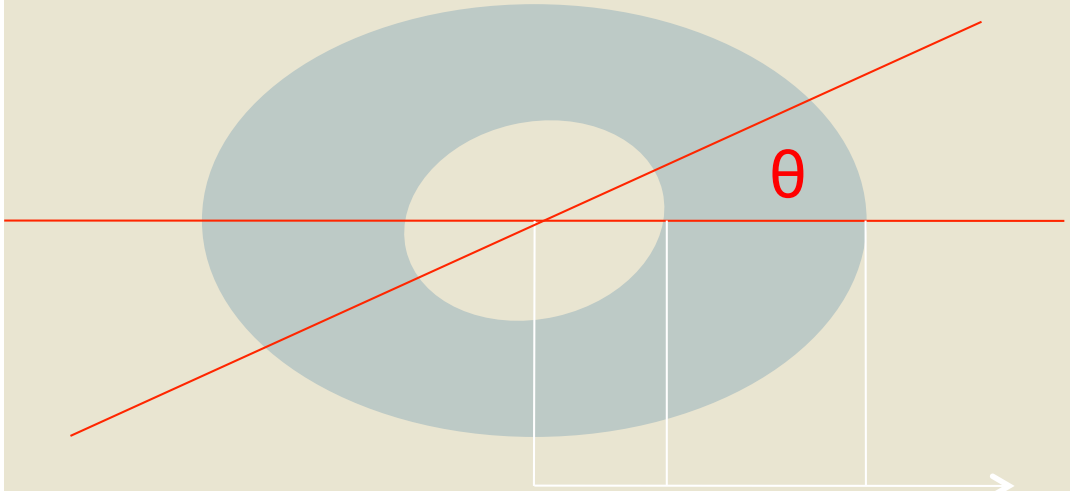

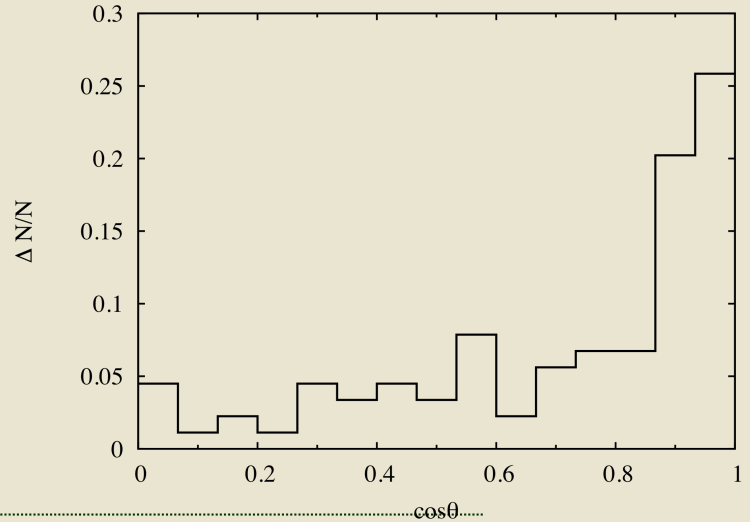

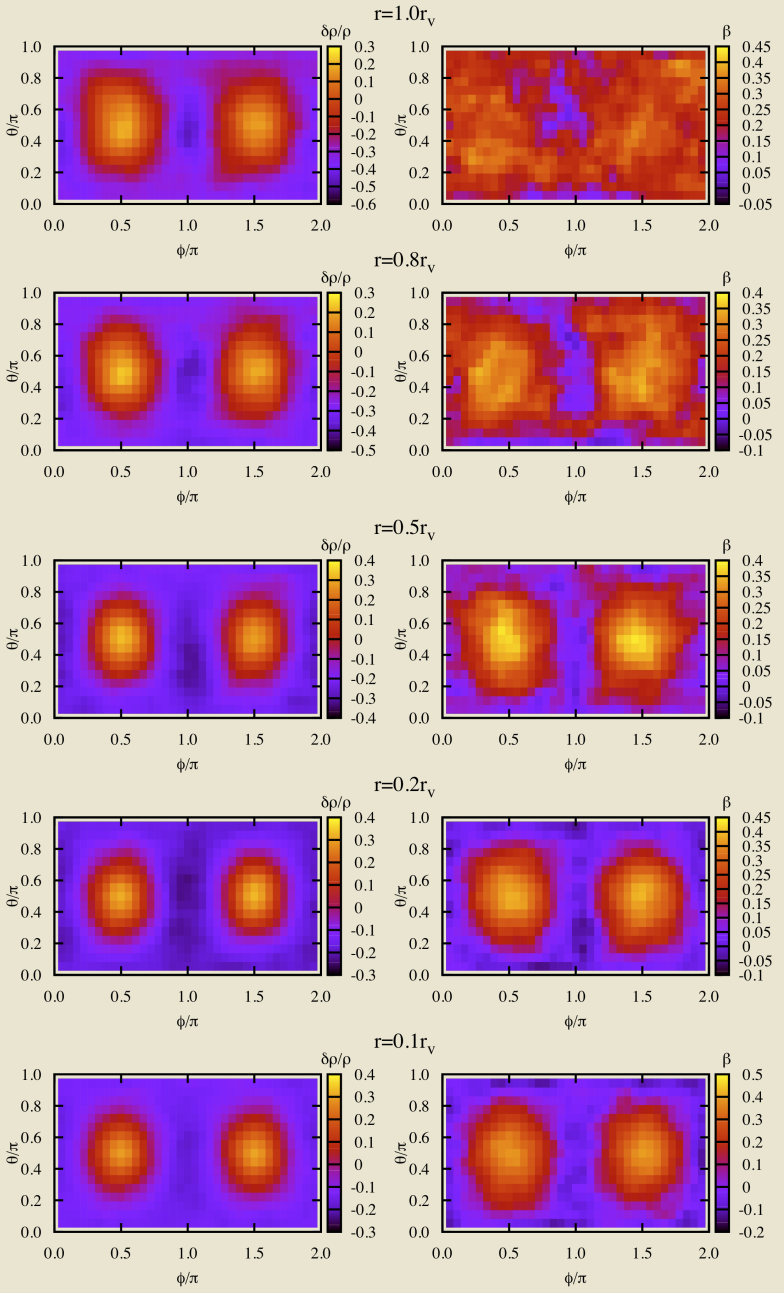

Further up to

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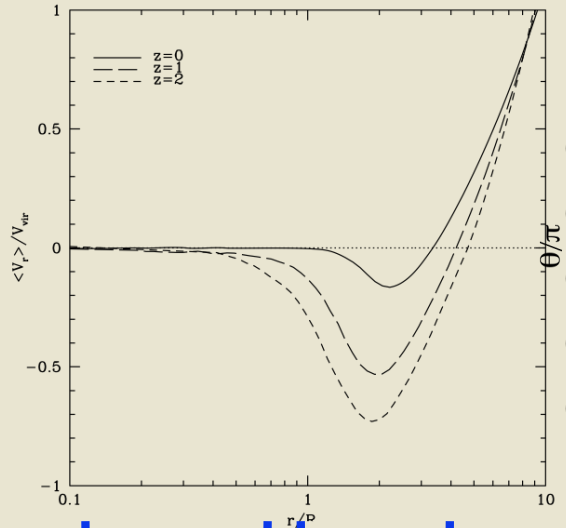
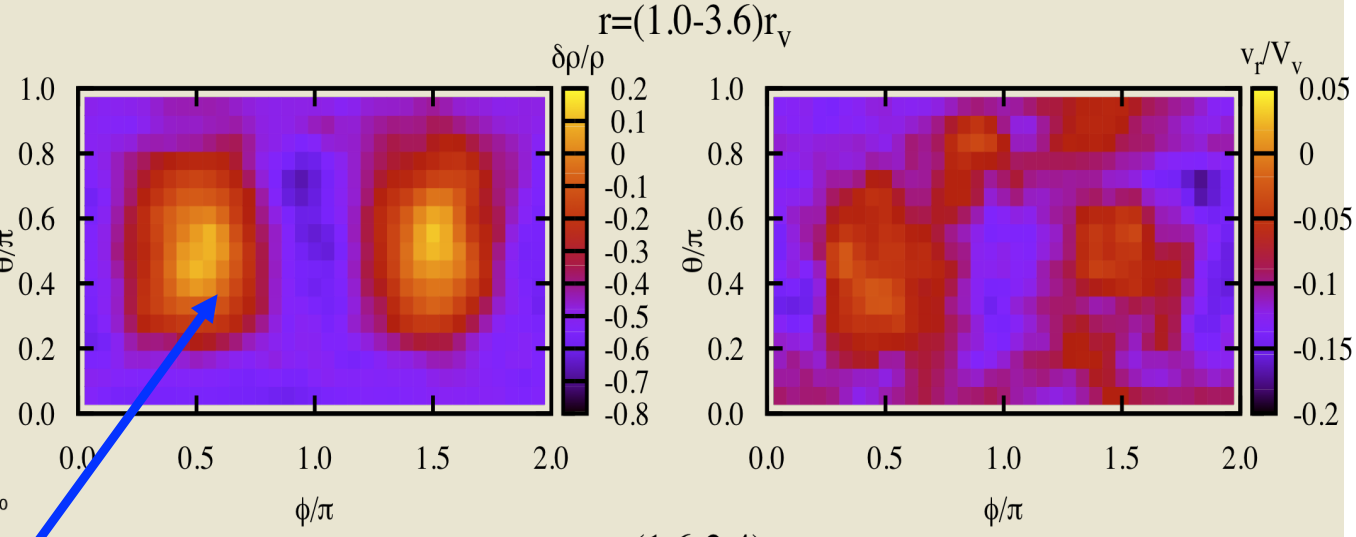
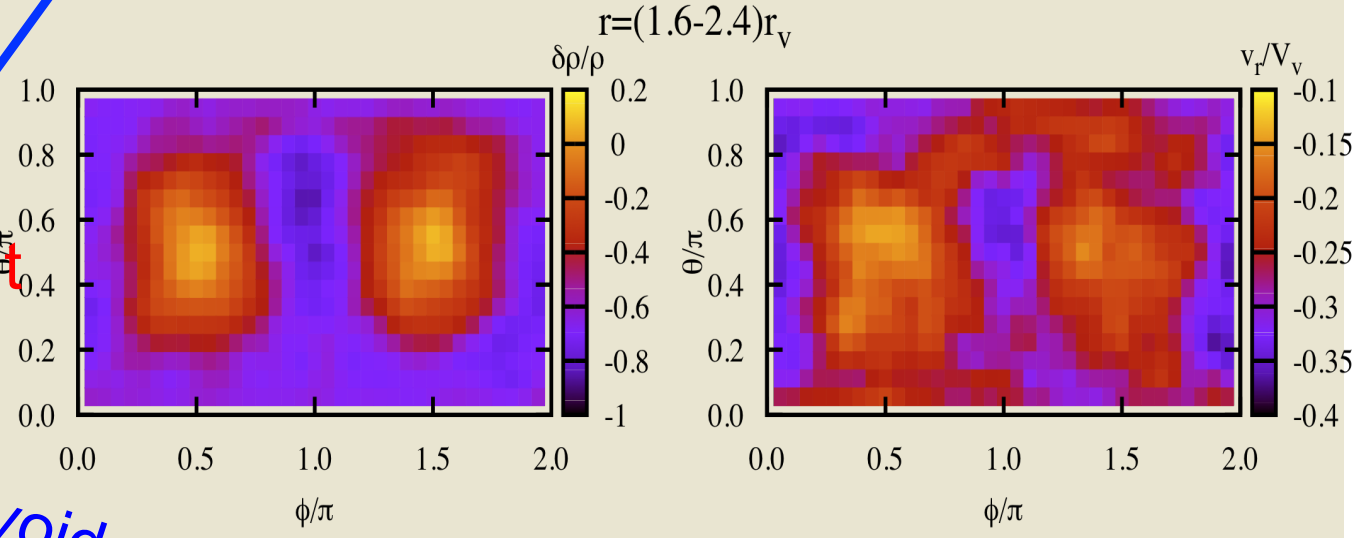
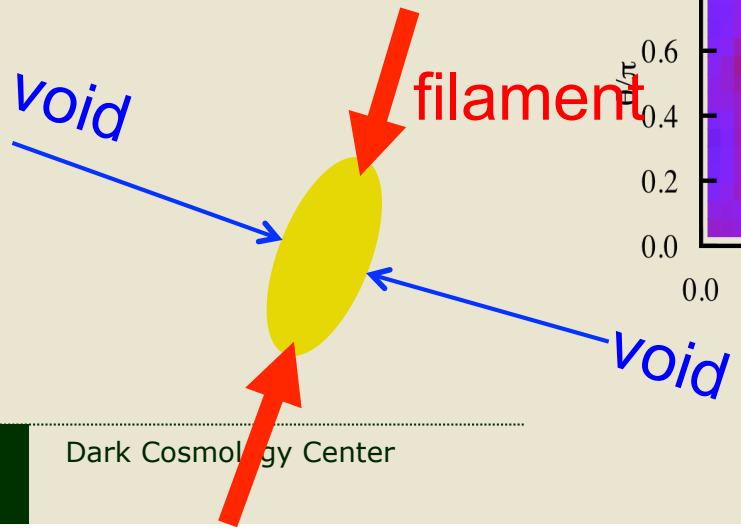
Cuesta et al. 2008









Dropping spherical symmetry

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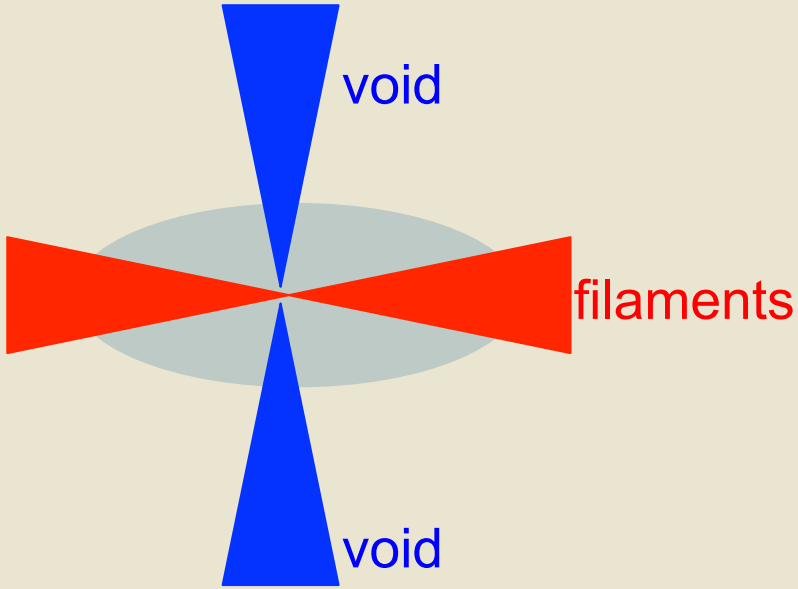
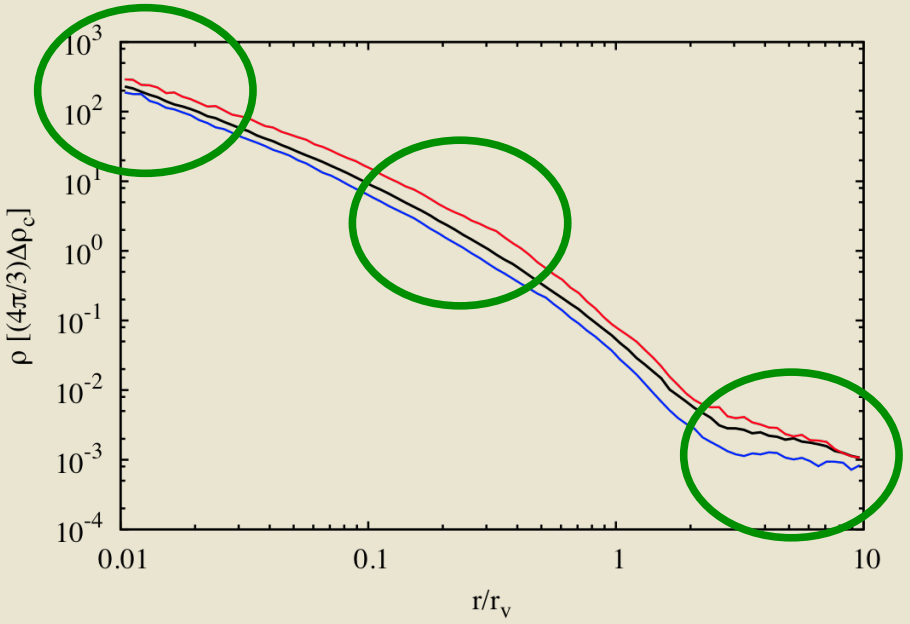
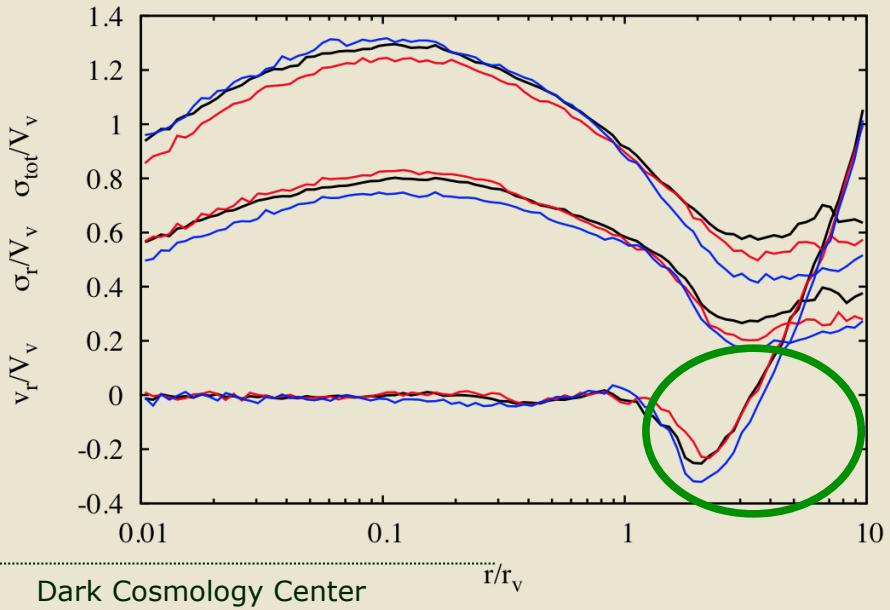
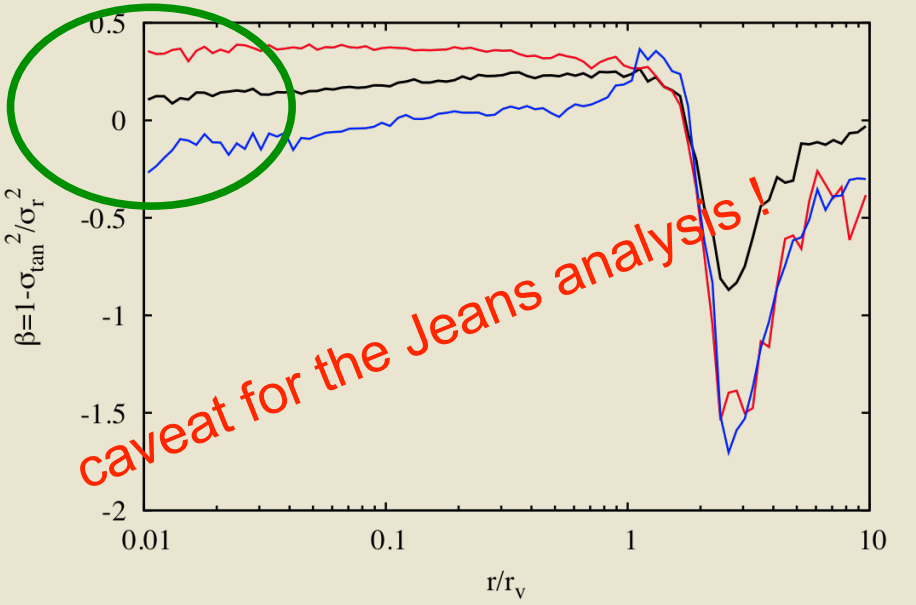
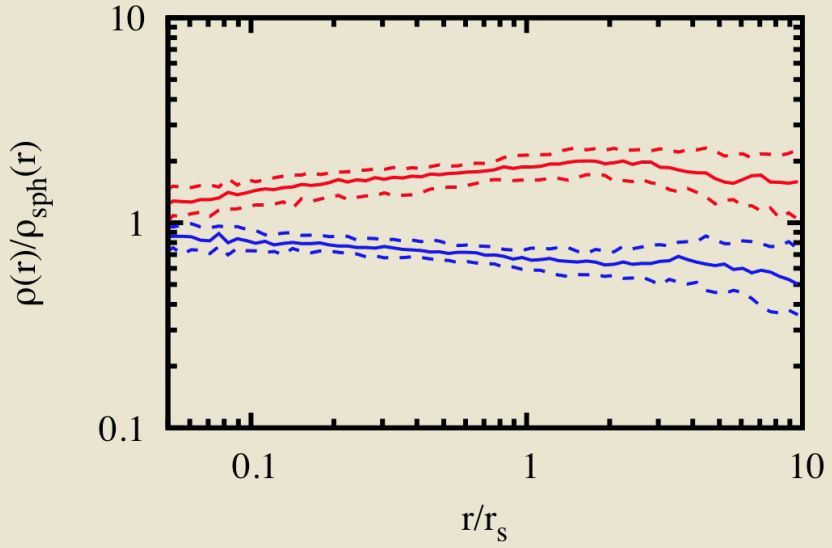


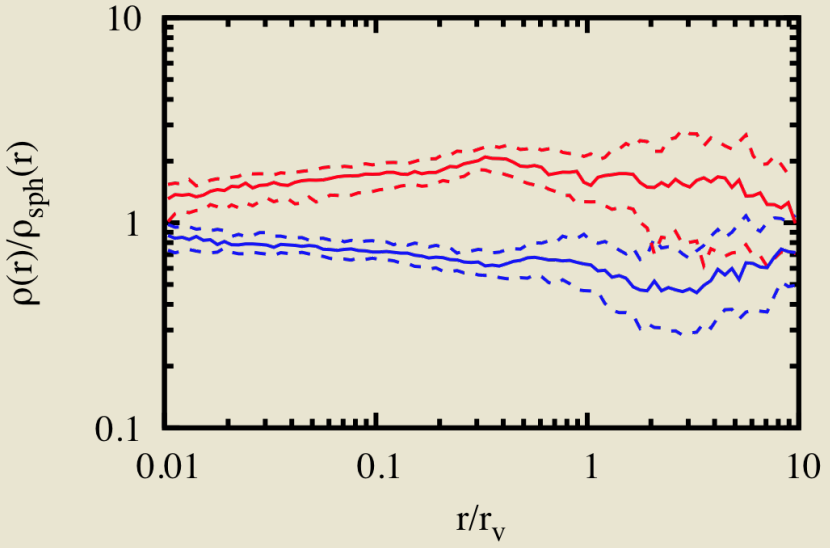


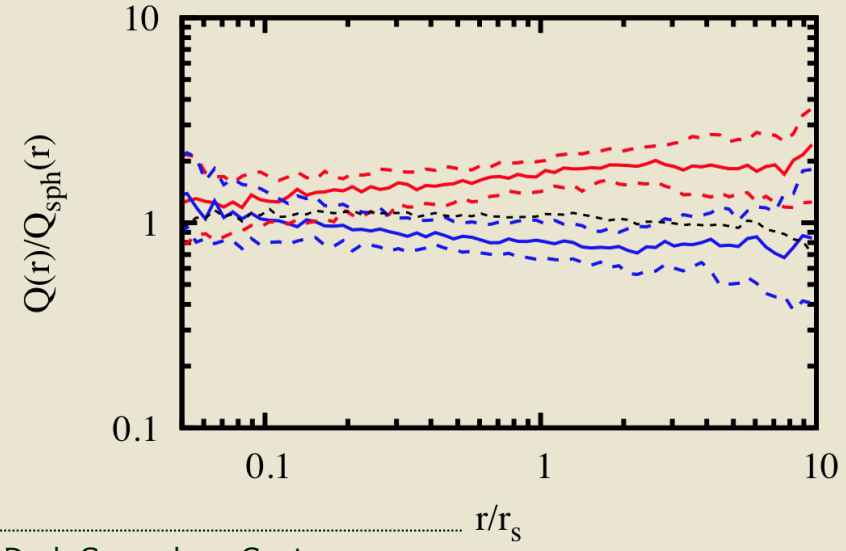


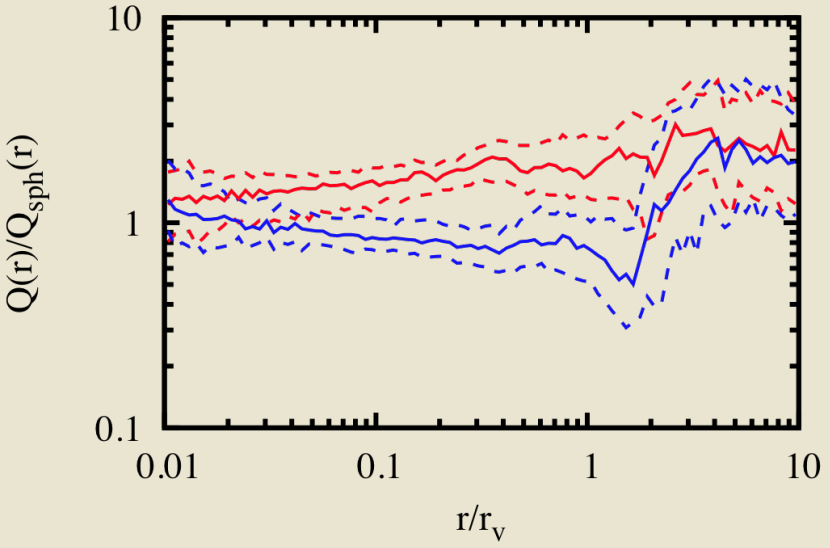


Density and pseudo phase-space density









Dispersion at $r<r_v$ and $r>r_v$

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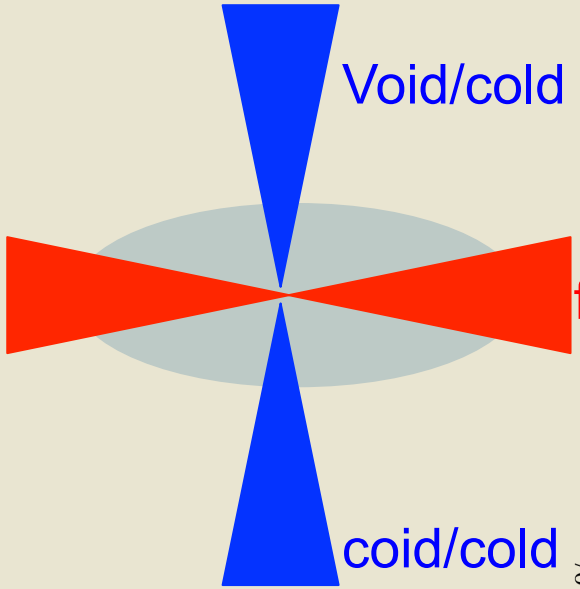
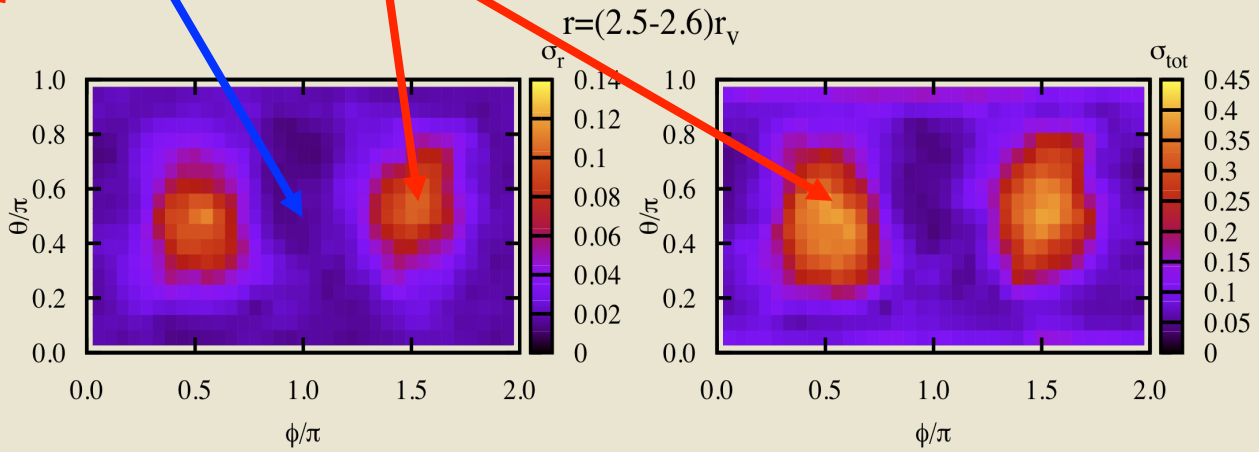
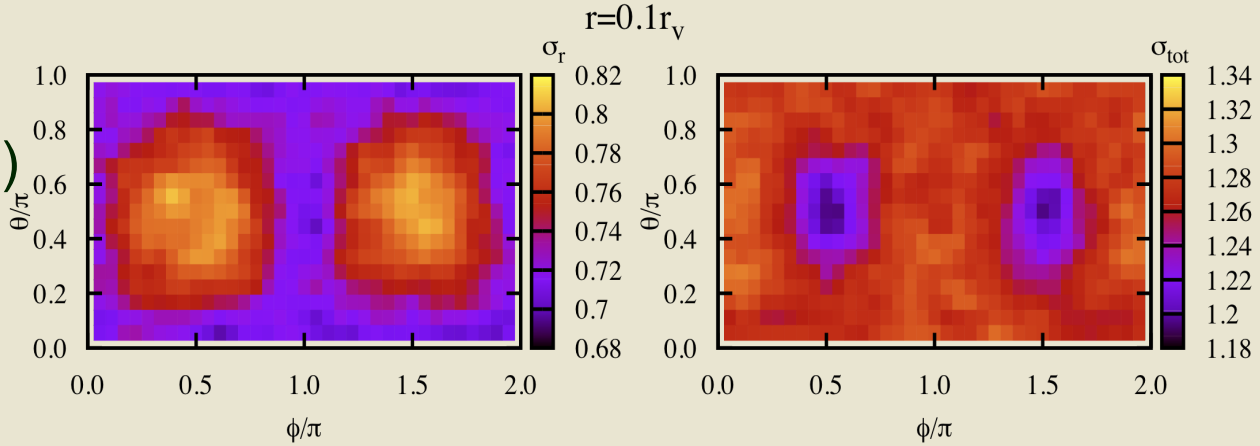
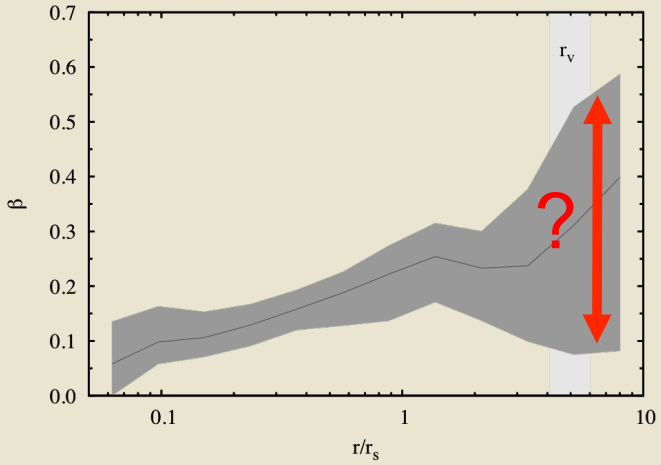






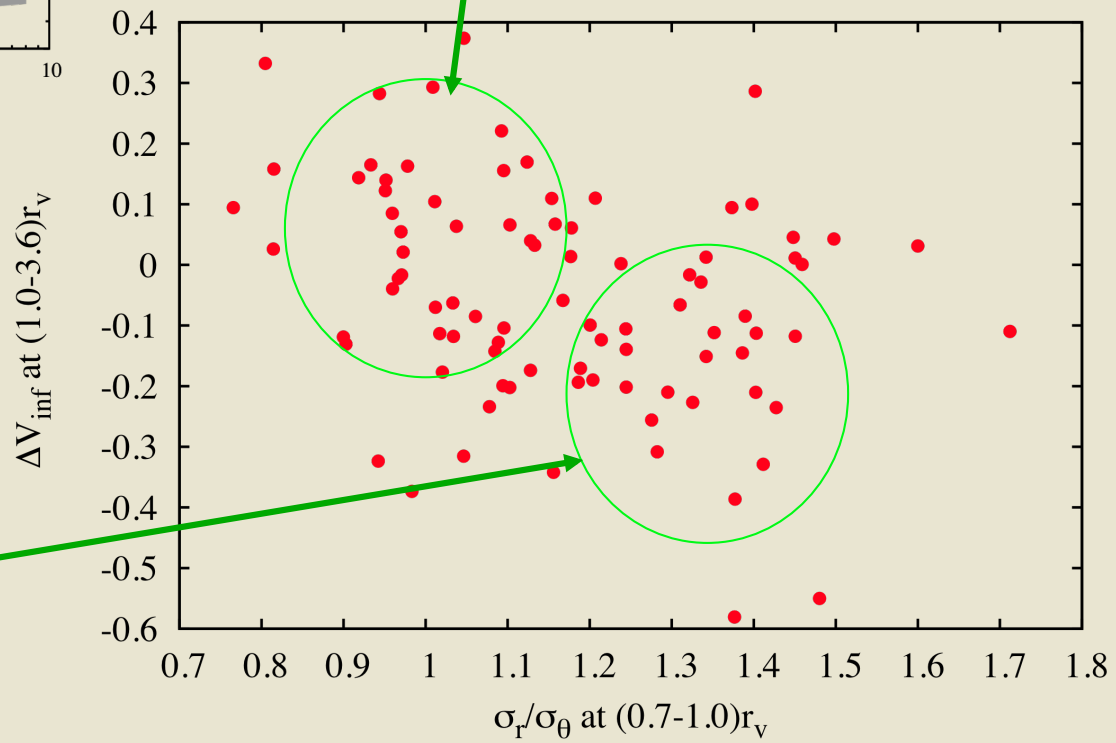
remnant of major merger (?)

Scatter in anisotropy at r_v



isotropic infall

anisotropic infall



Confronting with observations

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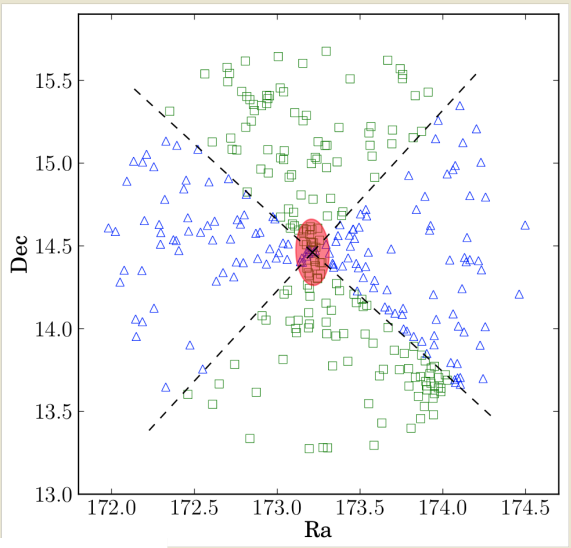

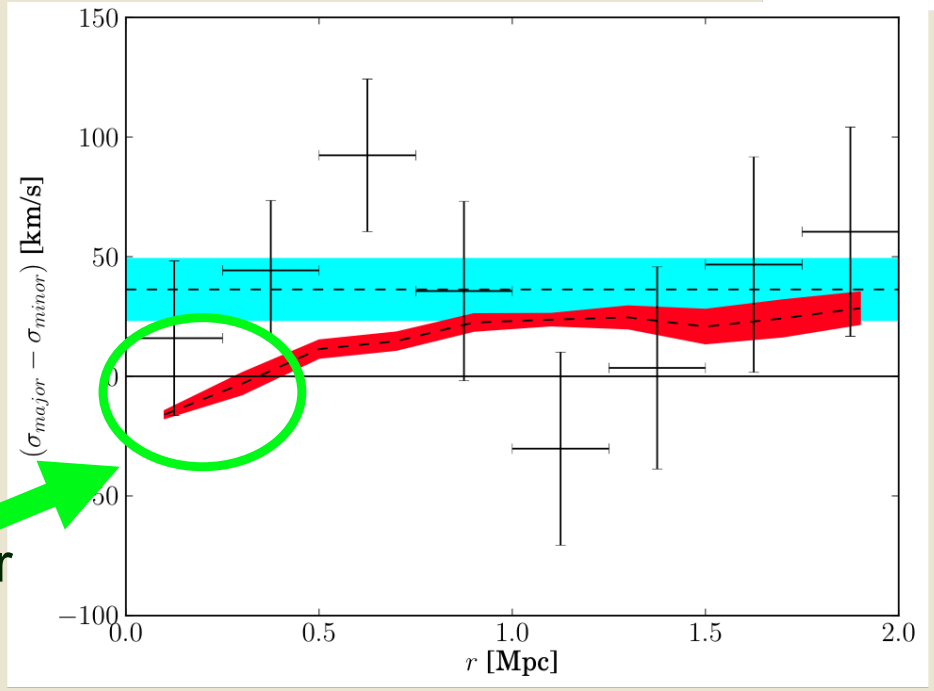

affected by BCG-cluster offset

Skielboe et al 2012, in prep.

Infall: 3D and projection

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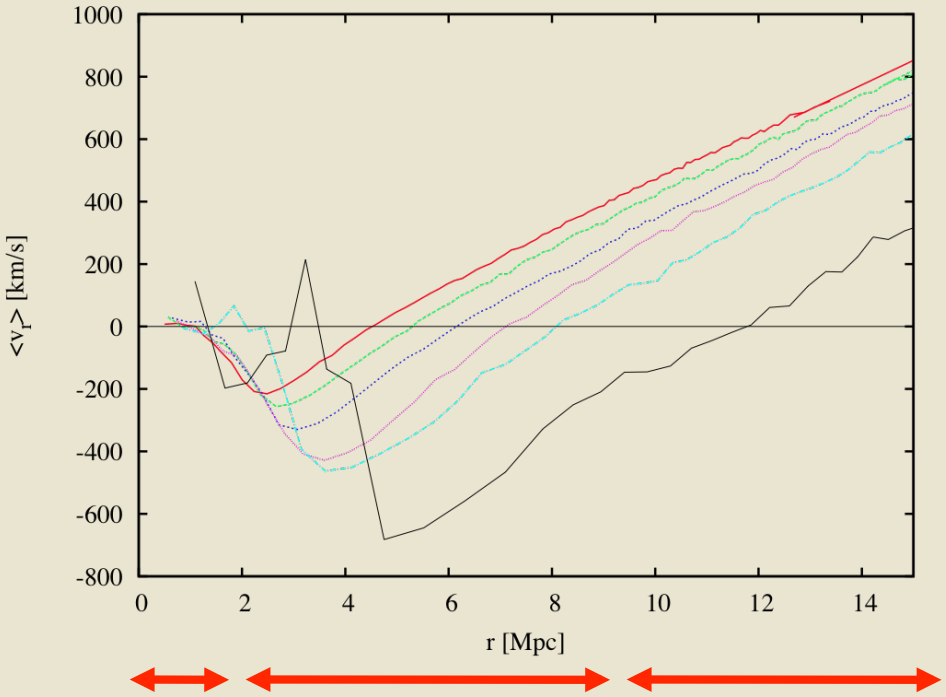
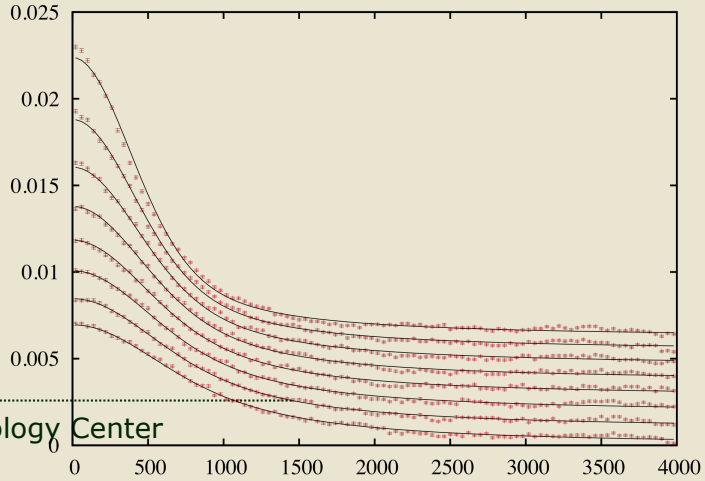
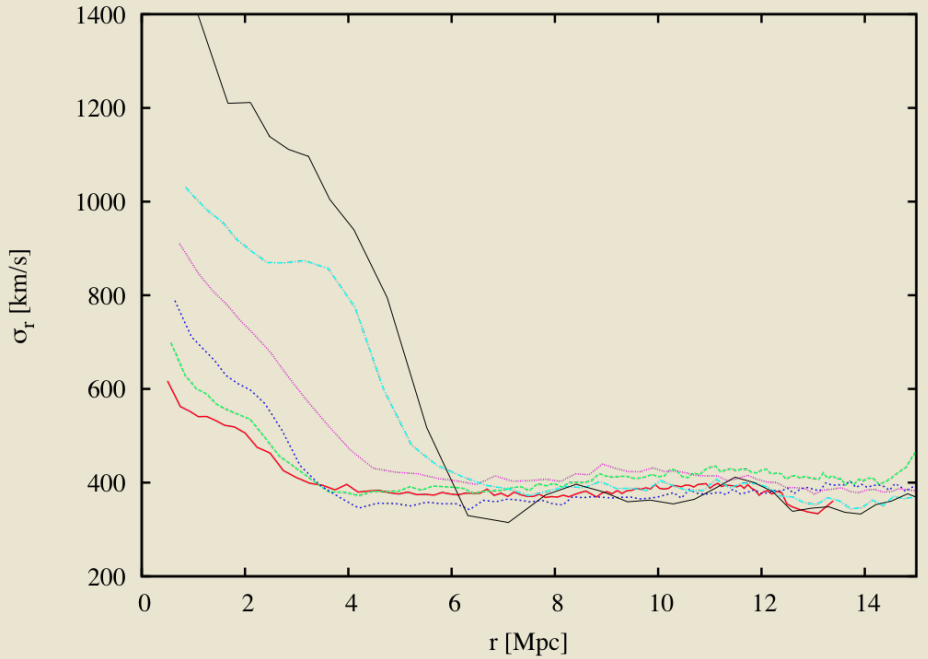


virialisation infall Hubble flow





Bolshoi simulation

- 3D density
- infall velocity profile
- local Gaussianity

Infall velocity: observational perspective

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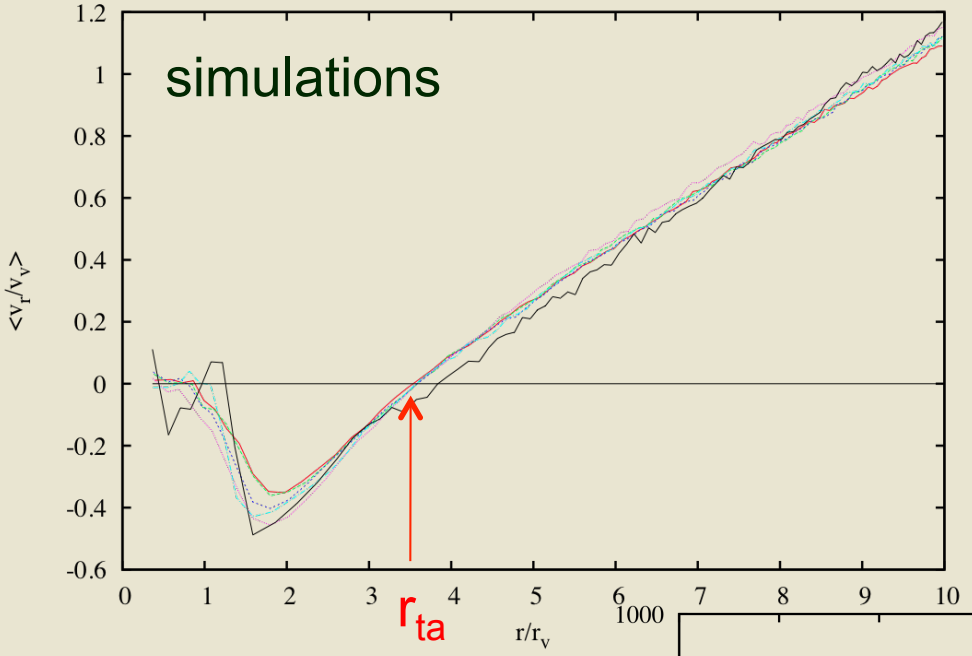

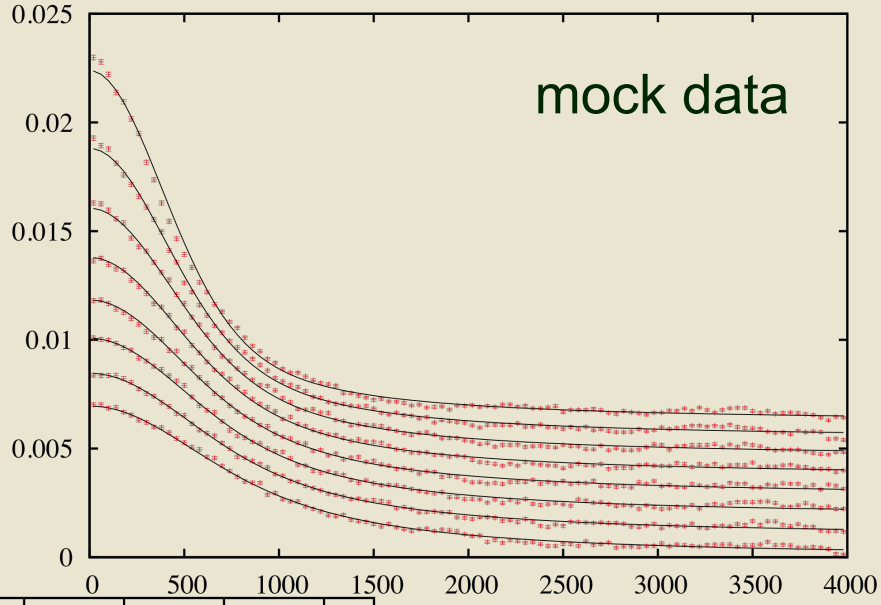

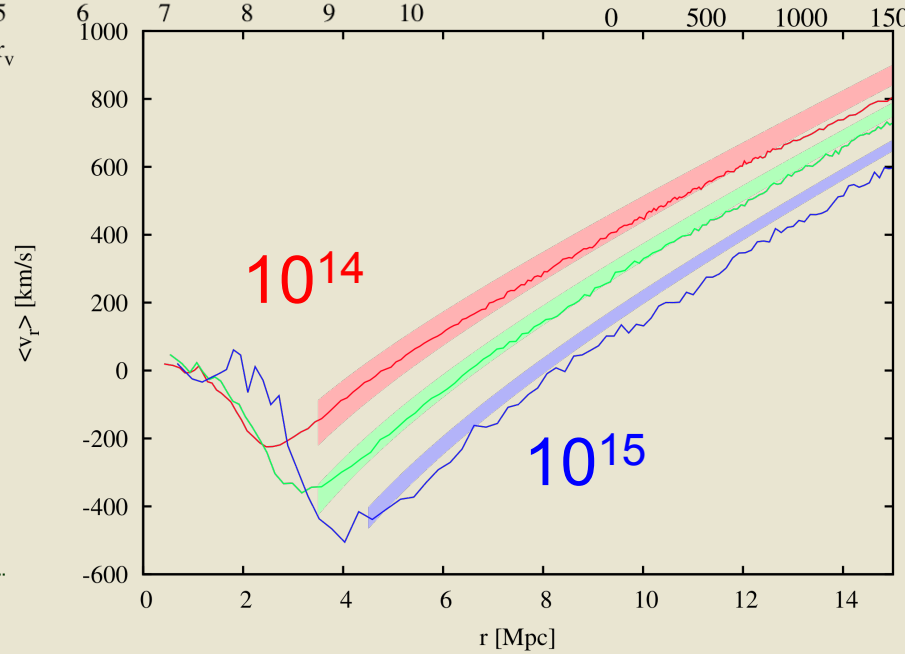

α=3 for GR

$M_v \sim r_{ta}^{\alpha}$

Kinematics of SDSS satellites

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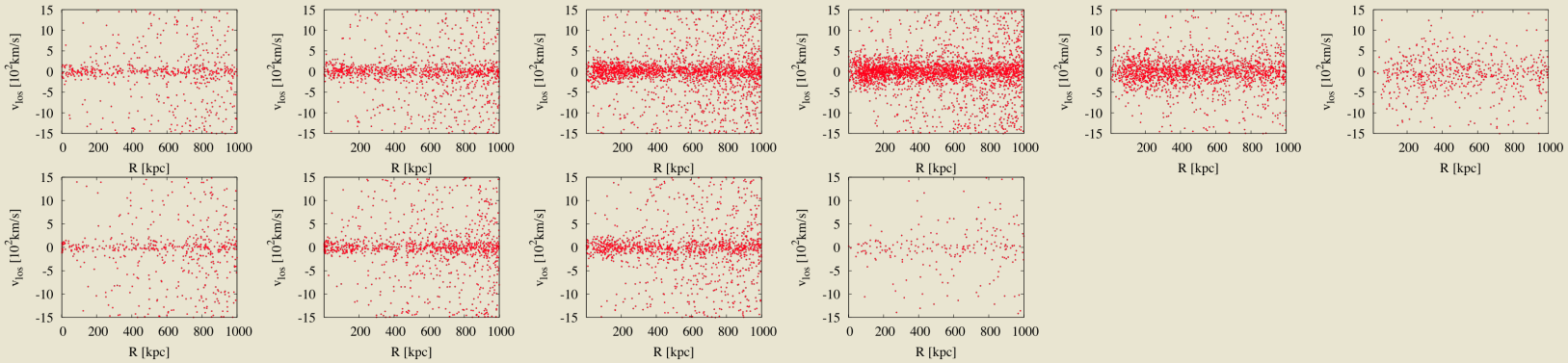
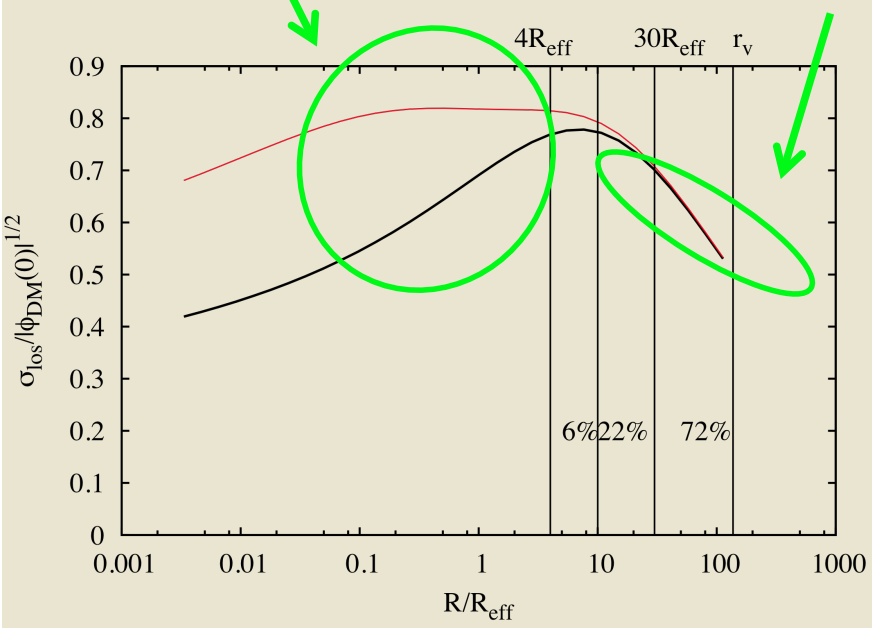
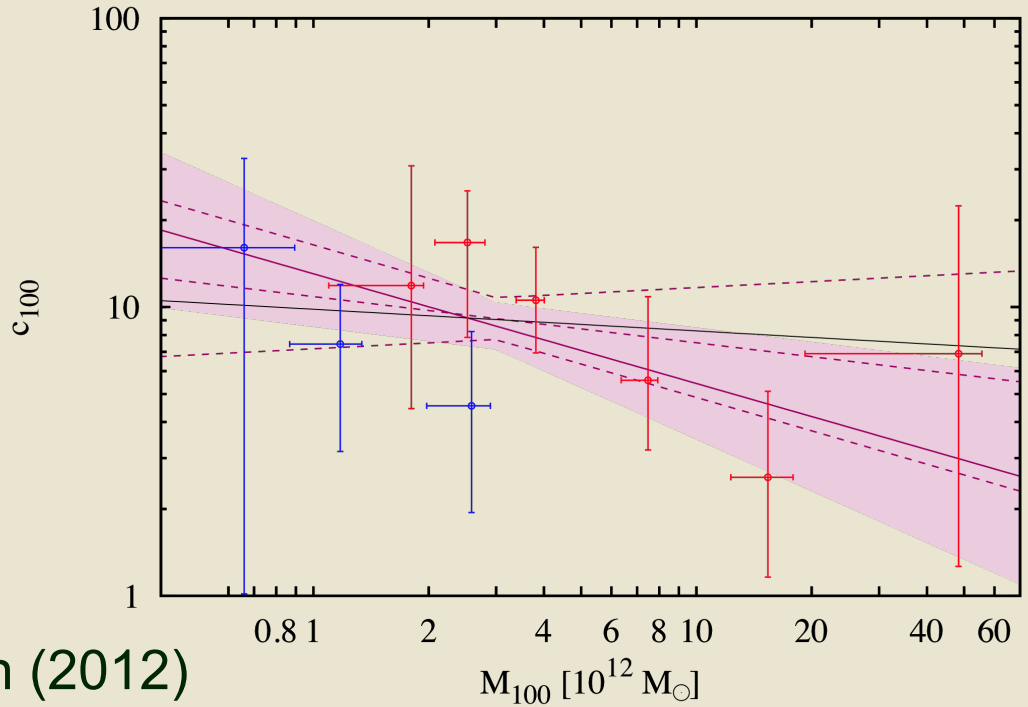


stars, nebulae, gas,SL

satellites



DM concentration



Wojtak & Mamon (2012)

Selected results

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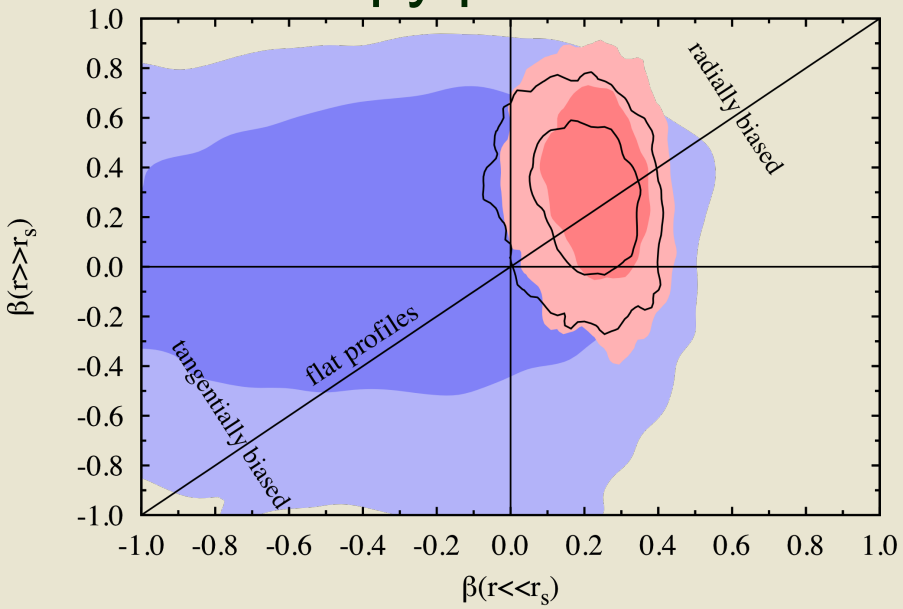
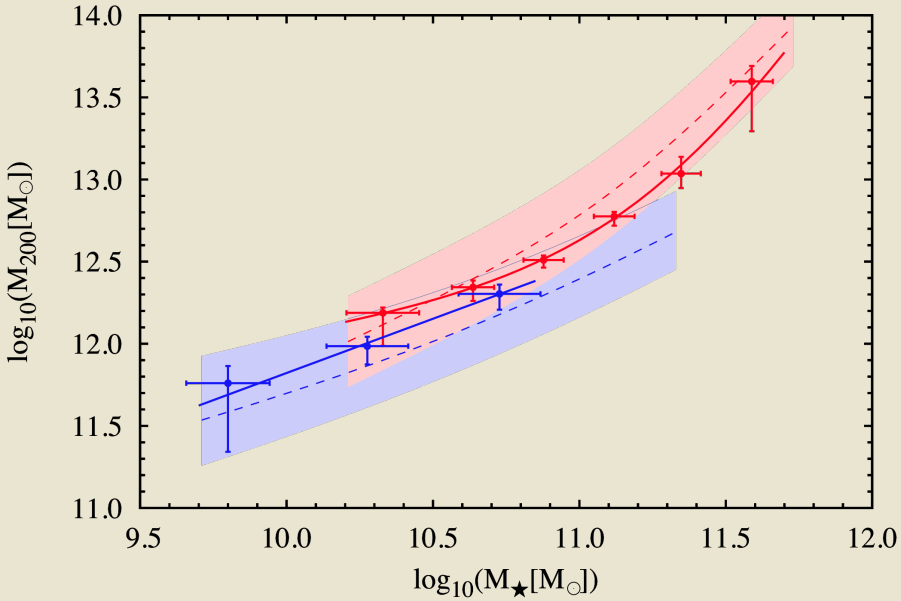
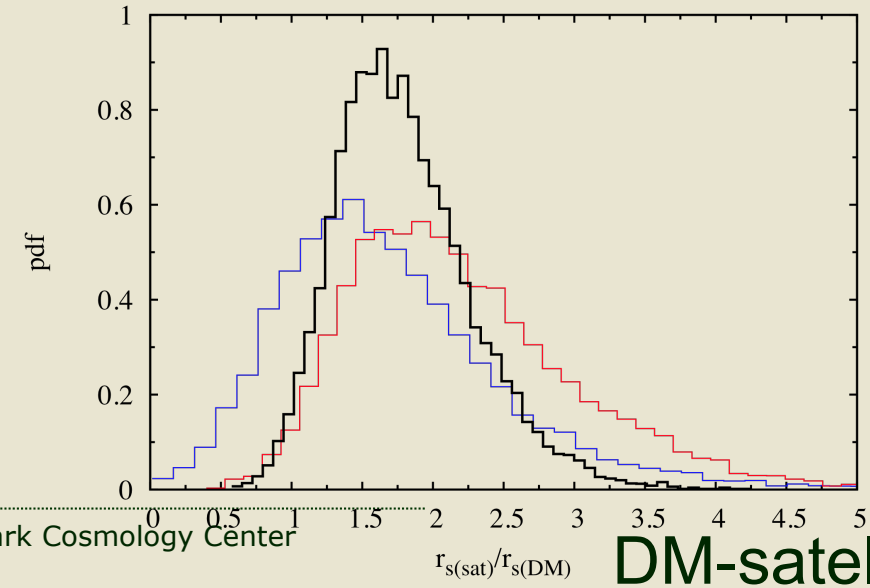
anisotropy parameter



halo-stellar mass





DM-satellites bias

Plan: Bayesian model selection
- NFW
- gNFW
- isothermal
- MOND