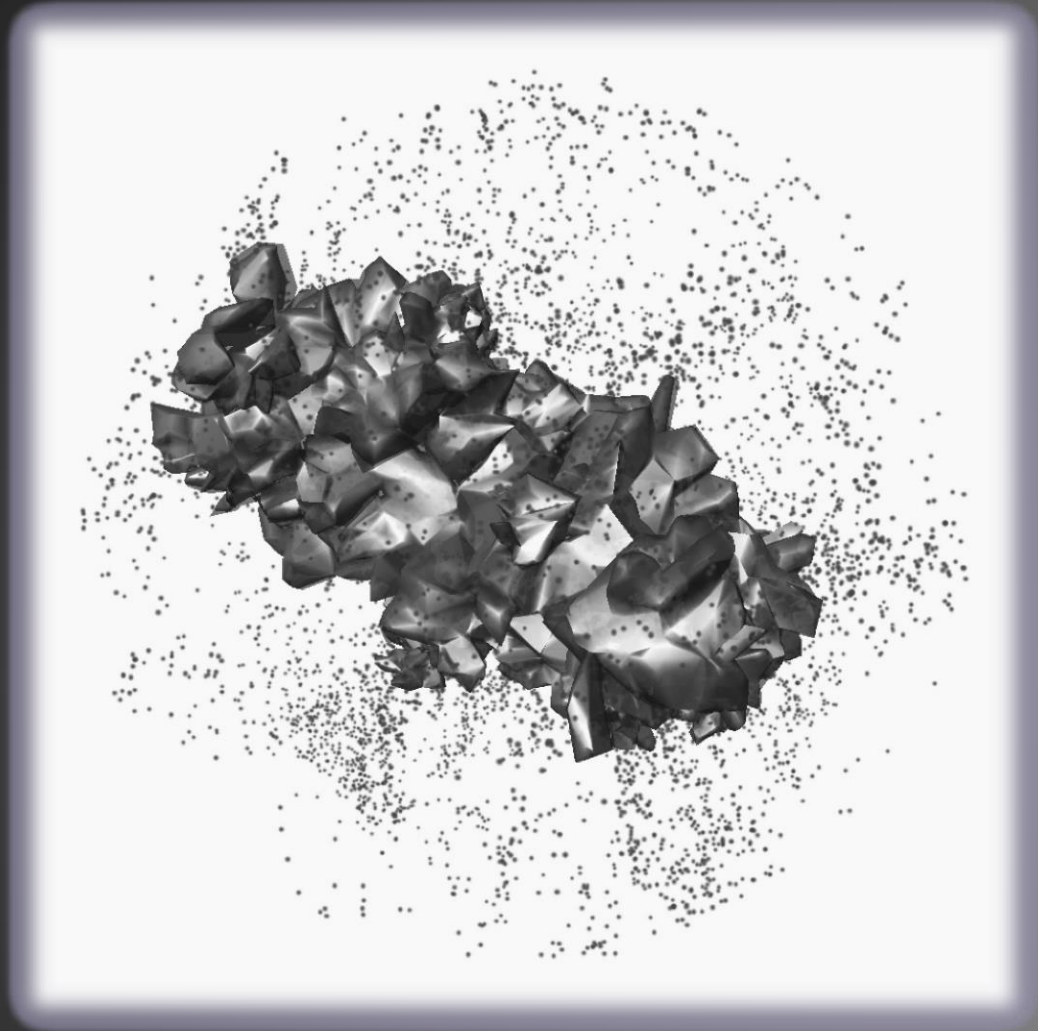


*innovative
cosmology
with
cosmic
voids*



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Nico Hamaus, Alice Pisani, and Mike Warren

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<http://www.pmsutter.com>

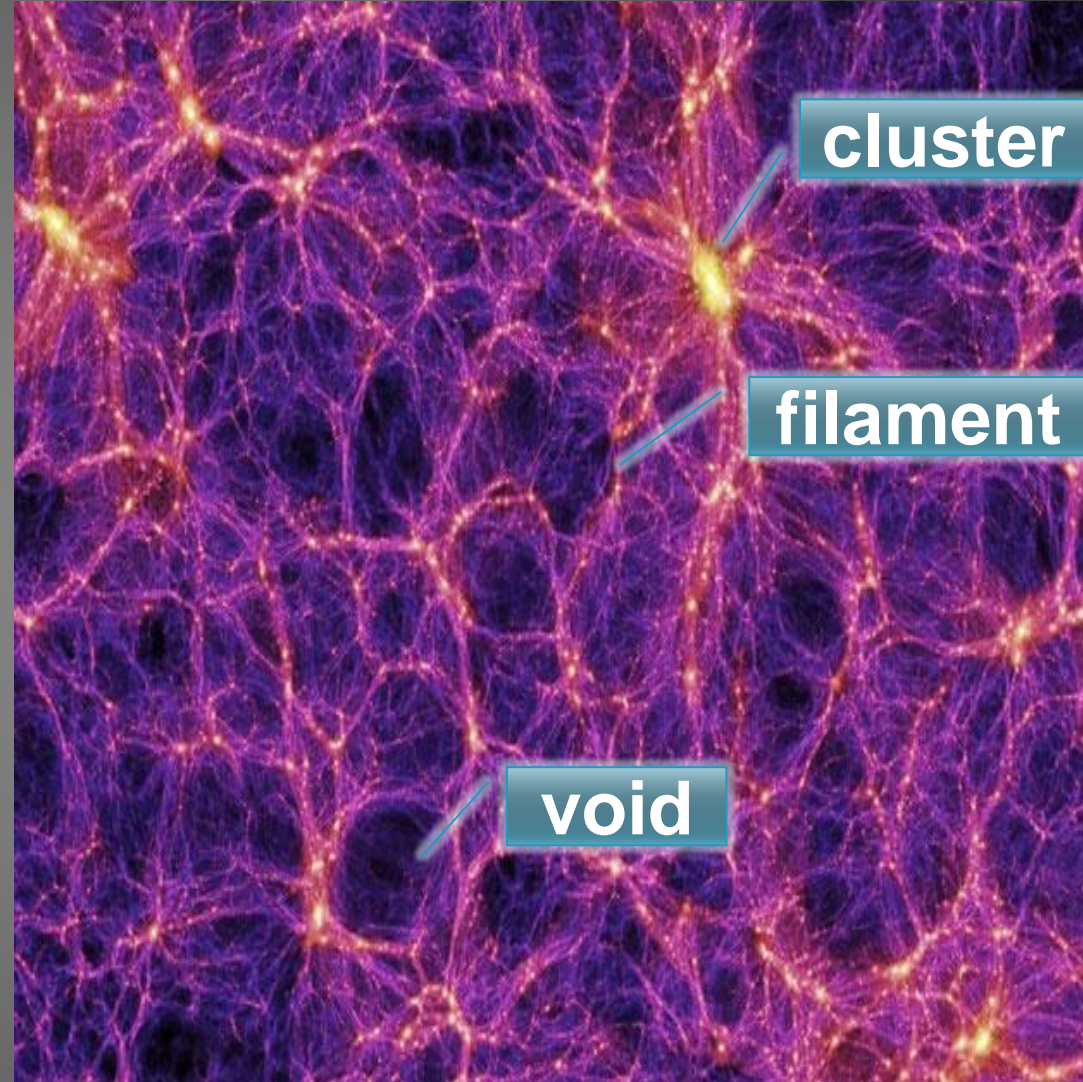
useful scales

dominated by
dark energy

closer to early
universe

fewer
systematics

abundant



<http://www.cosmicvoids.net>

Cosmic Voids

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Welcome to the Public Cosmic Void Catalog

This is the repository for the public releases of a comprehensive cosmic void catalog from galaxy redshift surveys. This catalog is the product of a collaboration of [P.M. Sutter](#) (Illinois/IAP/OSU), [Benjamin Wandelt](#) (IAP/UPMC/Illinois), [Guilhem Lavaux](#) (Perimeter), and [David Weinberg](#) (OSU). Our void finder algorithm is based on [ZOBOV](#), which uses [Voronoi tessellations](#) and the [watershed transform](#) to identify voids. See [here](#) for the journal article describing our method used for defining and cataloging voids.

Catalog at a Glance:

The catalog contains all the information required to reproduce the journal article. This means that the catalog contains the raw ZOBOV-generated catalog and all derived data products, such as:

- Void barycenters, redshifts, effective radii, and redshifts
- Locations of member galaxies
- One-dimensional radial profiles of stacked voids
- Two-dimensional projections of stacked voids
- Redshift-dependent void number counts
- Void size distributions

Catalog Objectives

The primary purpose of this catalog is to promote collaborative void science. This includes research into the nature of voids and their use as astrophysical and cosmological probes. Potential topics include:

- The Alcock-Paczynski test
- Size distributions
- Ellipticity distributions
- Integrated Sachs-Wolfe effect
- Fifth forces and $f(R)$ gravity
- Large-scale anisotropies
- Weak lensing anti-shear
- Cosmological magnetic fields
- Environmental dependence of galaxy metallicities

size distributions (*Lee & Park 2006*)

ellipticity distributions (*Bos et al. 2012*)

Alcock-Paczynski test (*Sutter et al. 2012*)

integrated Sachs-Wolfe effect (*Planck Collaboration 2013*)

fifth forces and $f(R)$ gravity (*Li et al. 2012*)

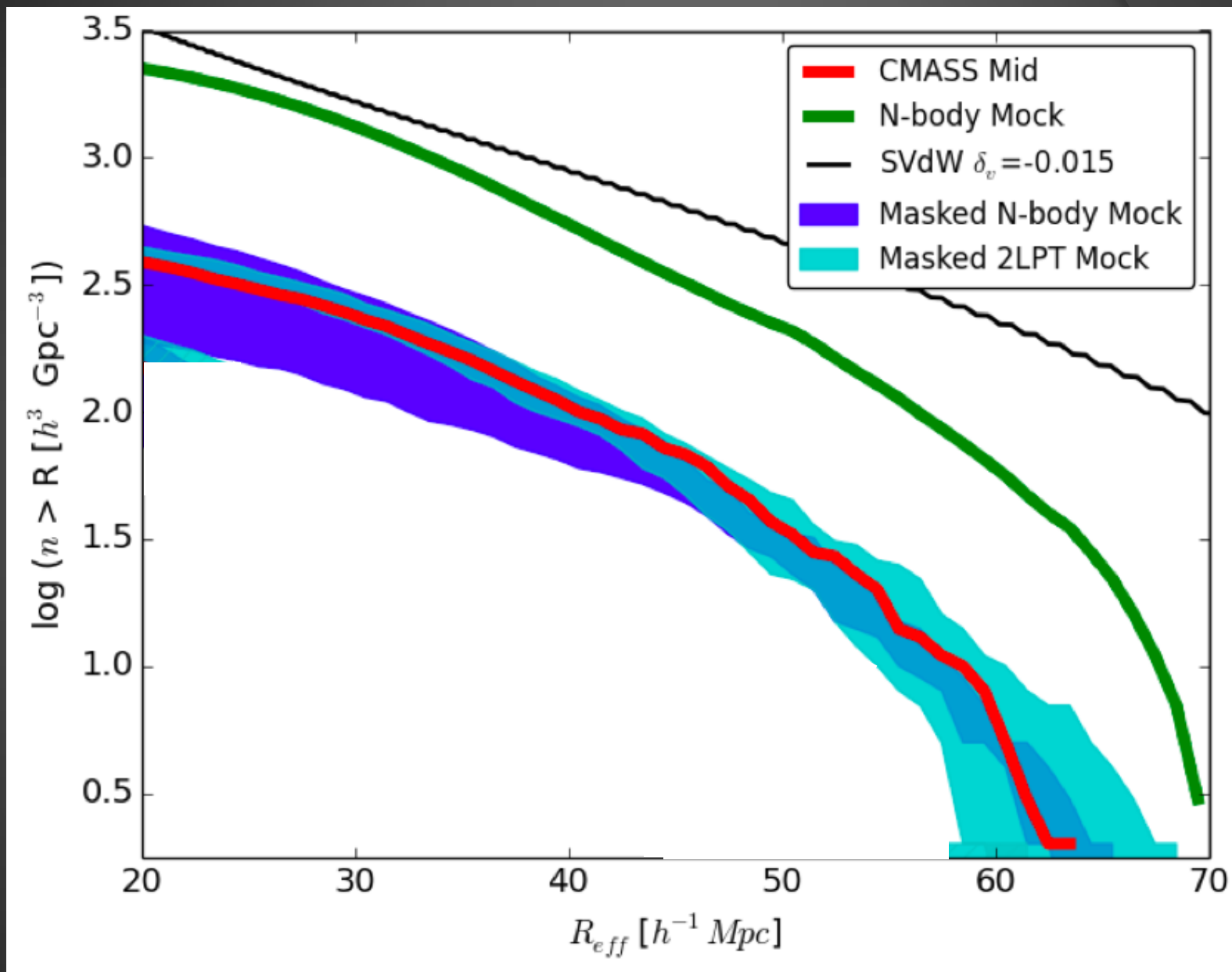
weak anti-lensing (*Melchior et al. 2013*)

standard rulers (*Hamaus et al. 2013*)

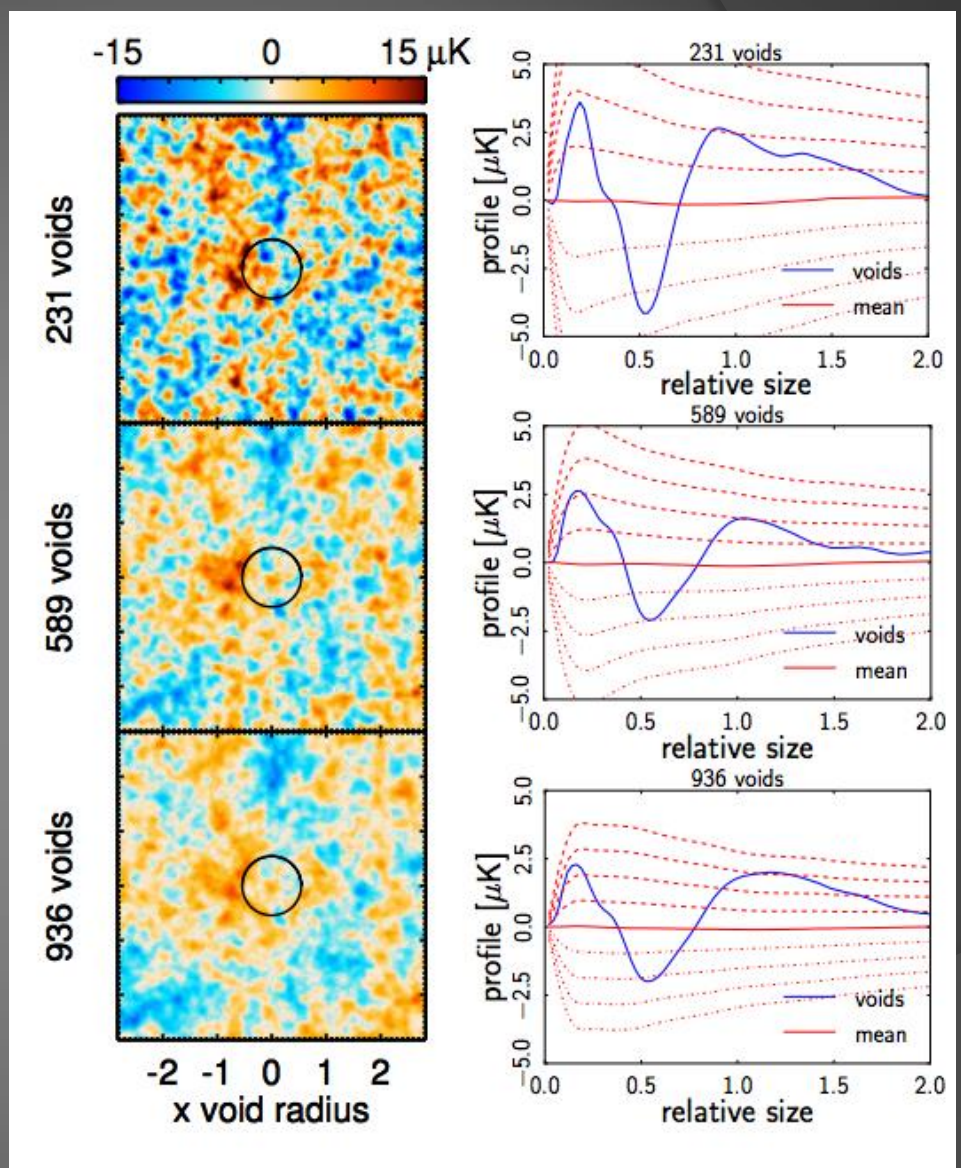
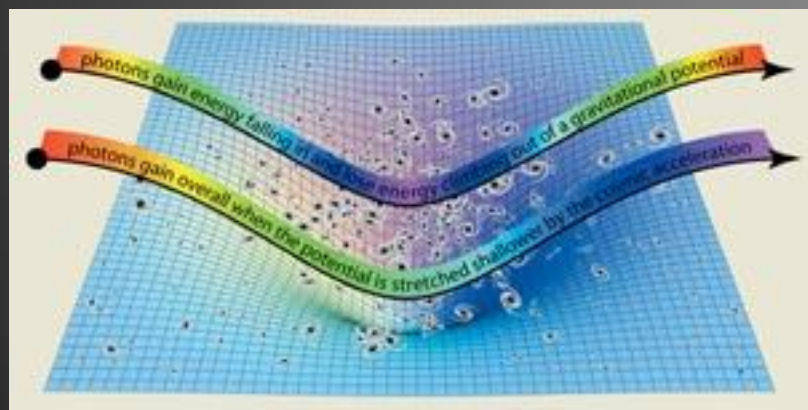
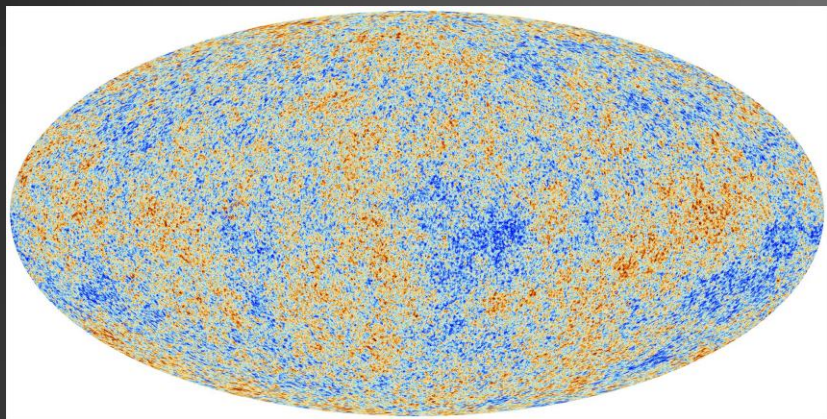
environmental dependence of galaxy metallicities (*Hoefl et al. 2006*)

origins of large-scale magnetic fields (*Neronov & Vovk 2010*)

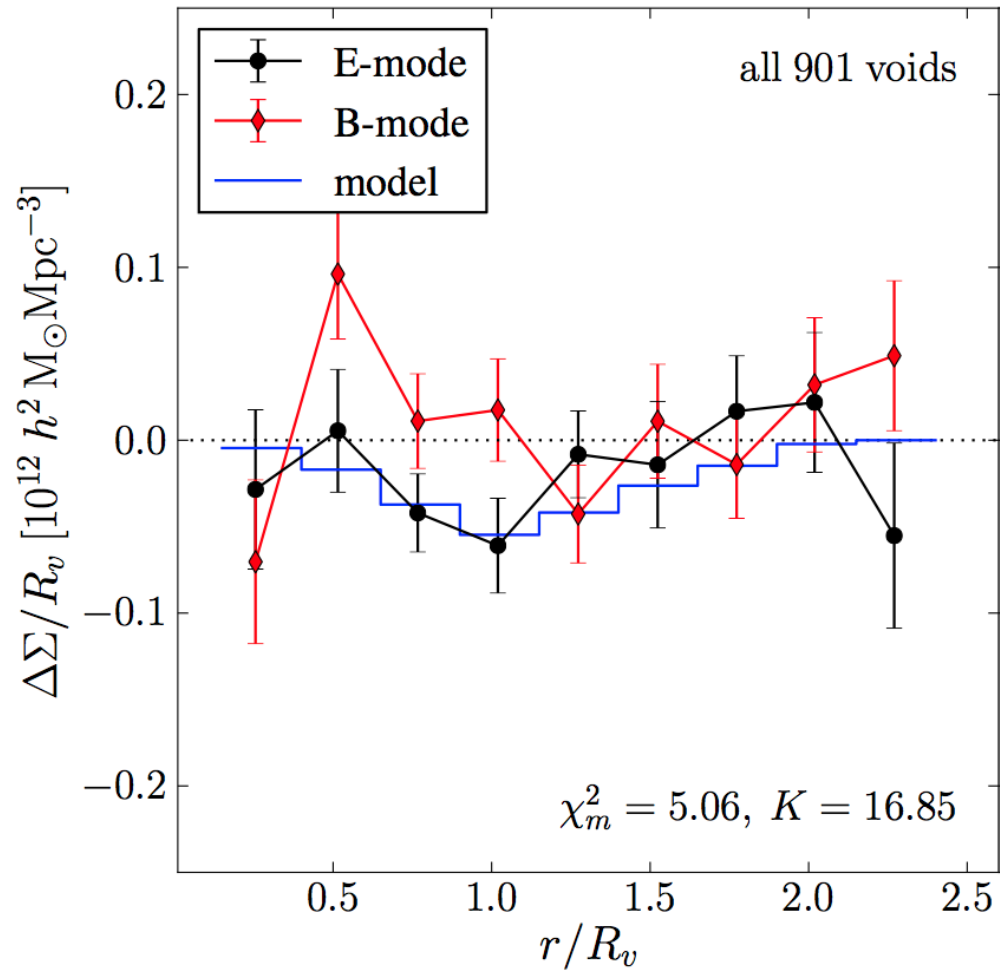
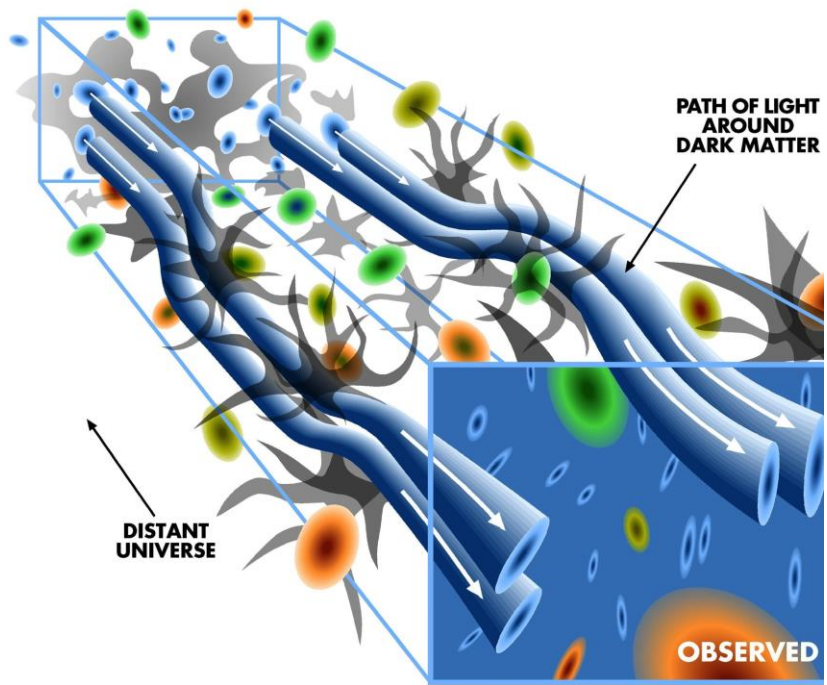
$\text{Ly}\alpha$ (*Tejos et al. 2012*)



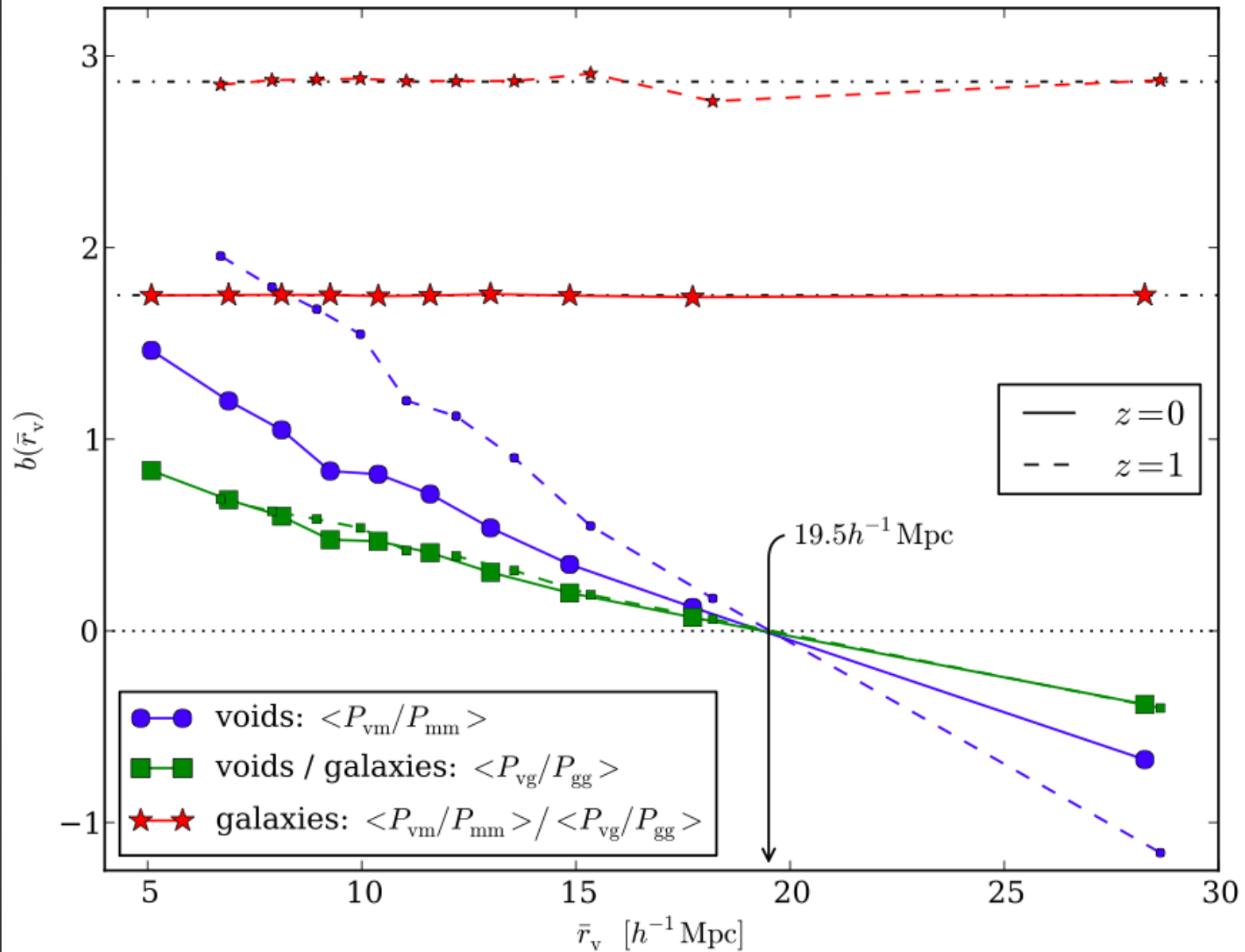
(Sutter et al. 2013)



(Planck Collaboration 2013)

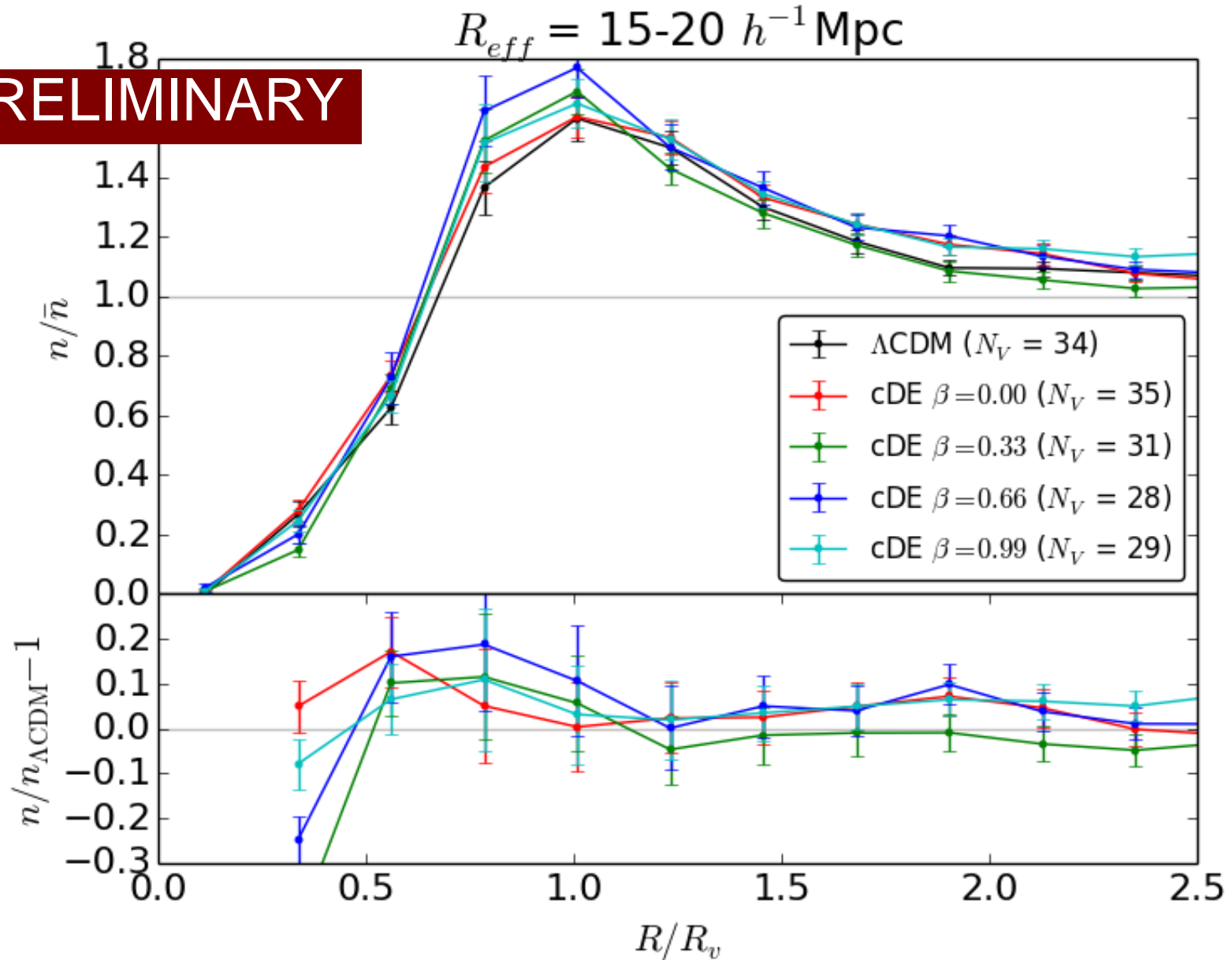


(Melchior et al. 2013)



(Hamaus et al. 2013)

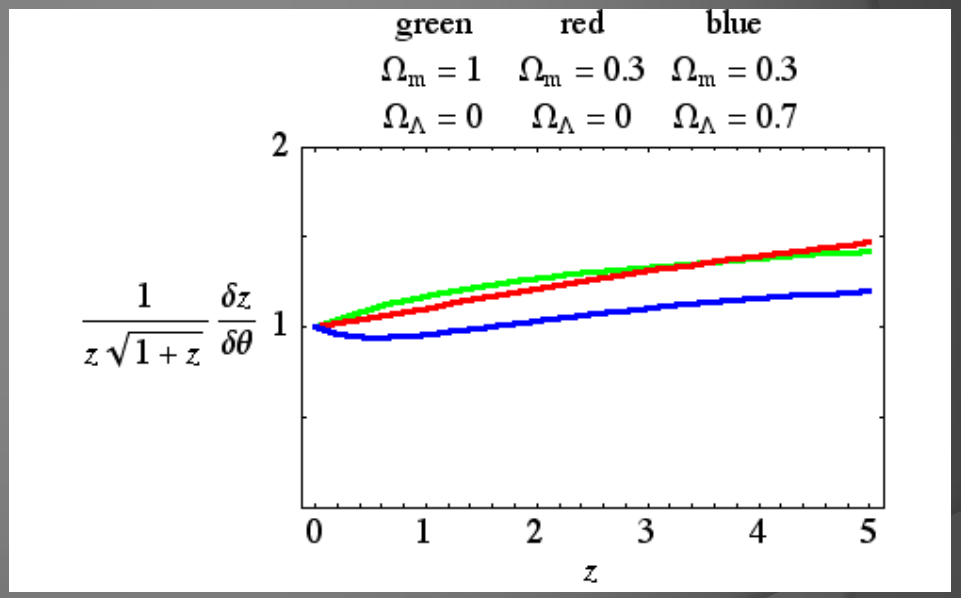
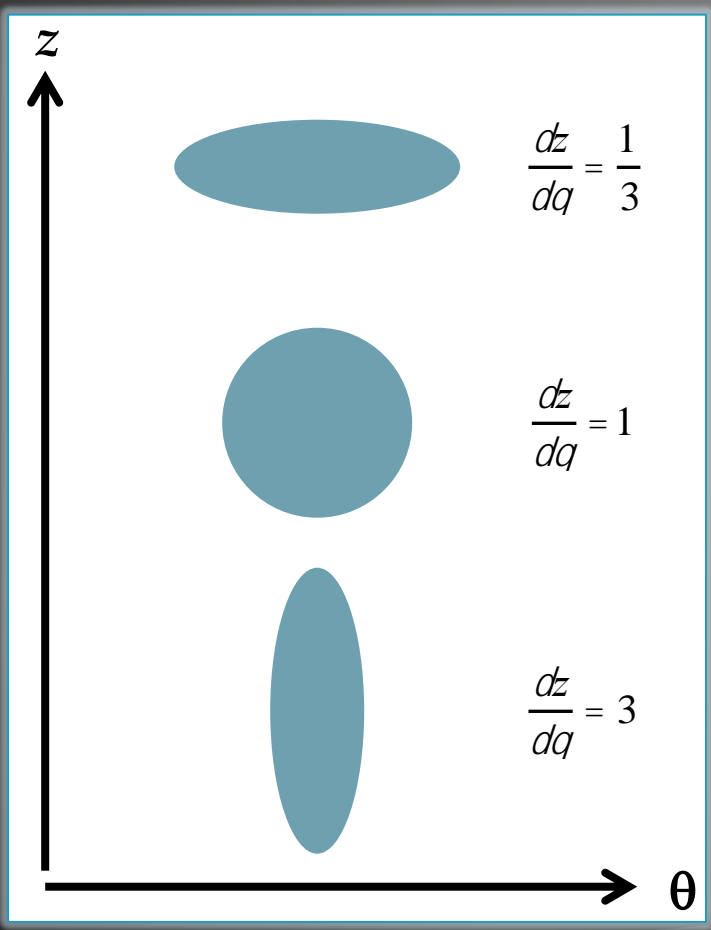
PRELIMINARY

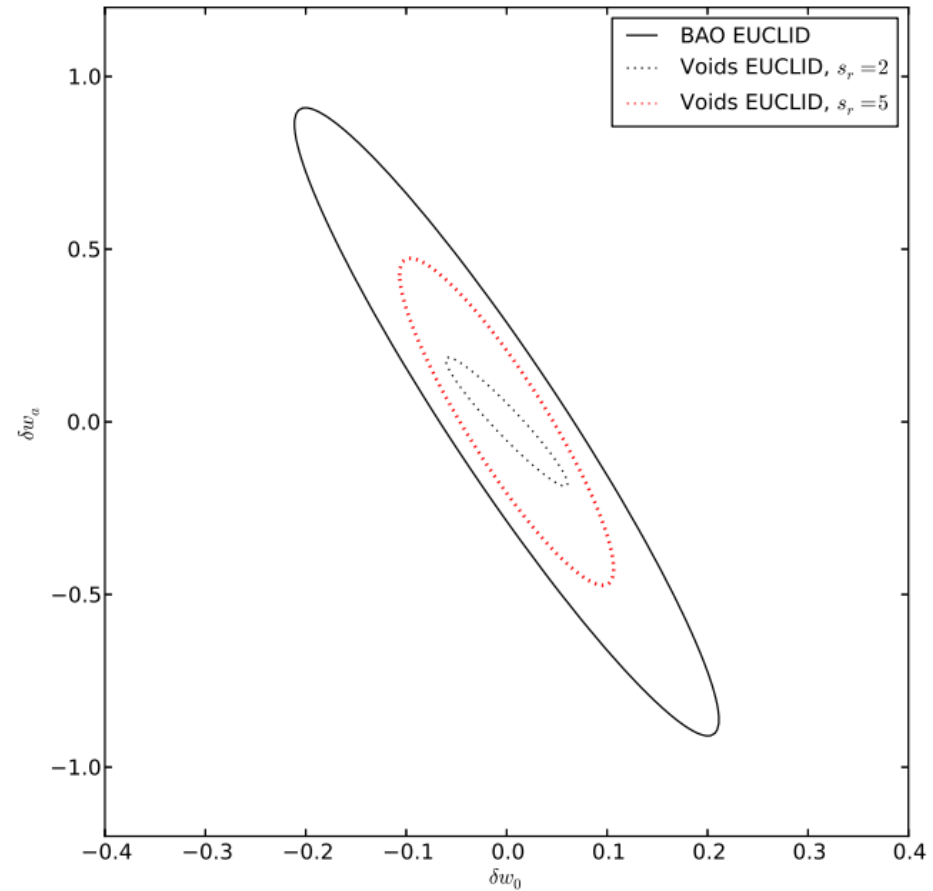
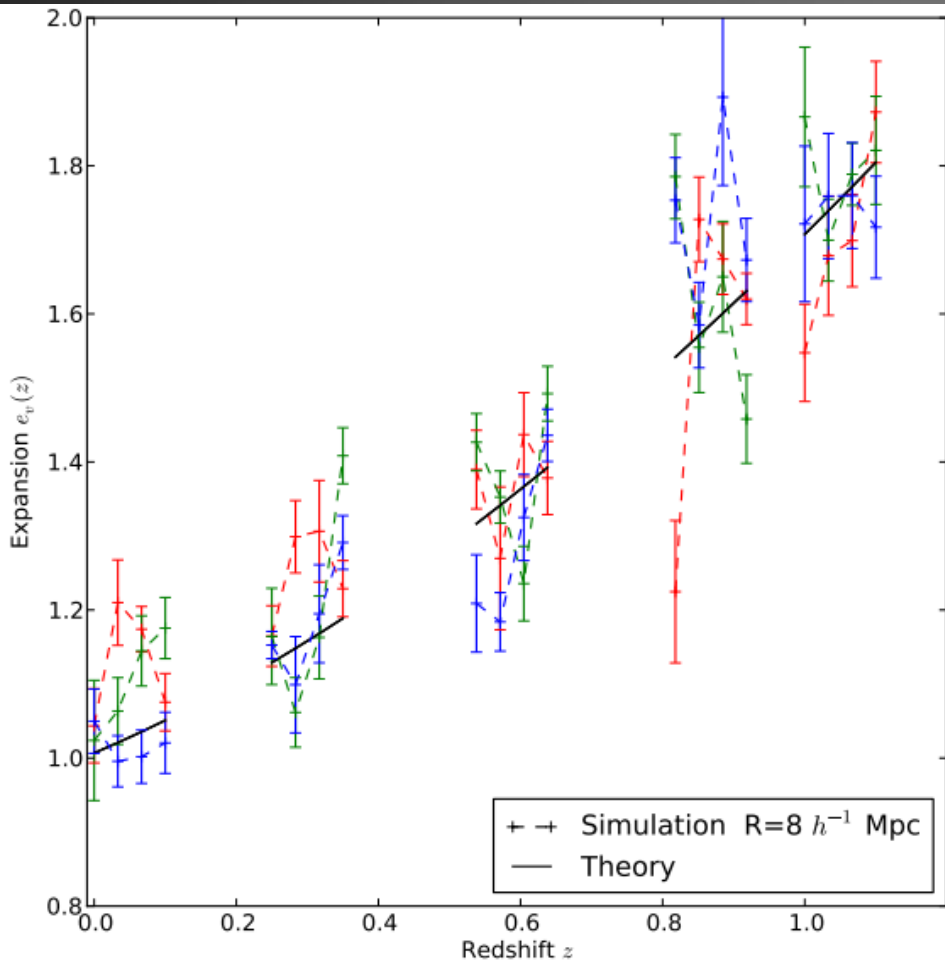


(Sutter et al. in prep)

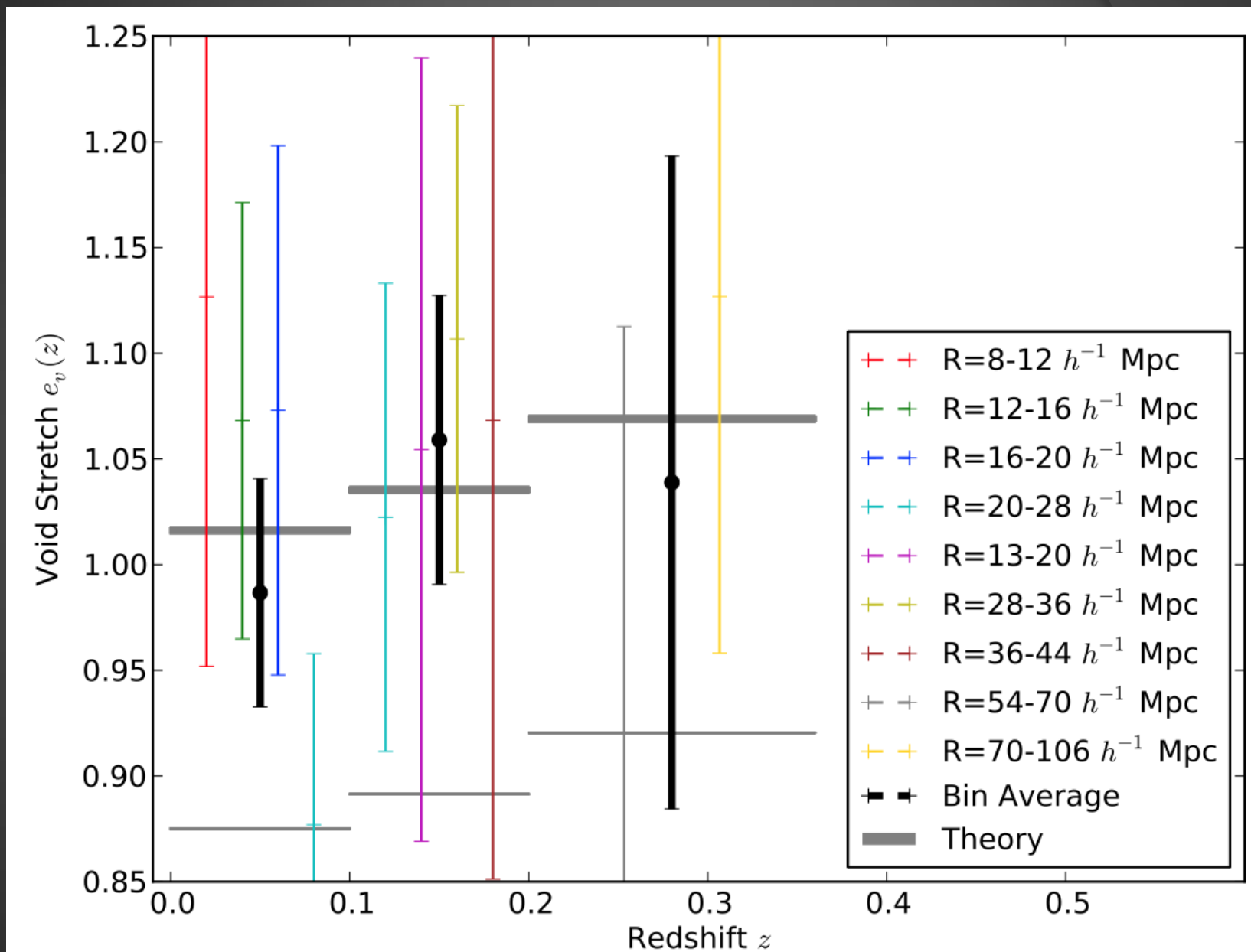
$$\frac{\Delta z}{\Delta d} = \frac{H_0}{c} \frac{\ddot{a}}{\dot{a}} \frac{D_A(z)}{z f'_k(C(z))} E(z) = \frac{H_0}{c} \frac{\ddot{a}}{\dot{a}} \frac{D_A(z) E(z)}{z}$$

(Alcock & Paczynski 1979)

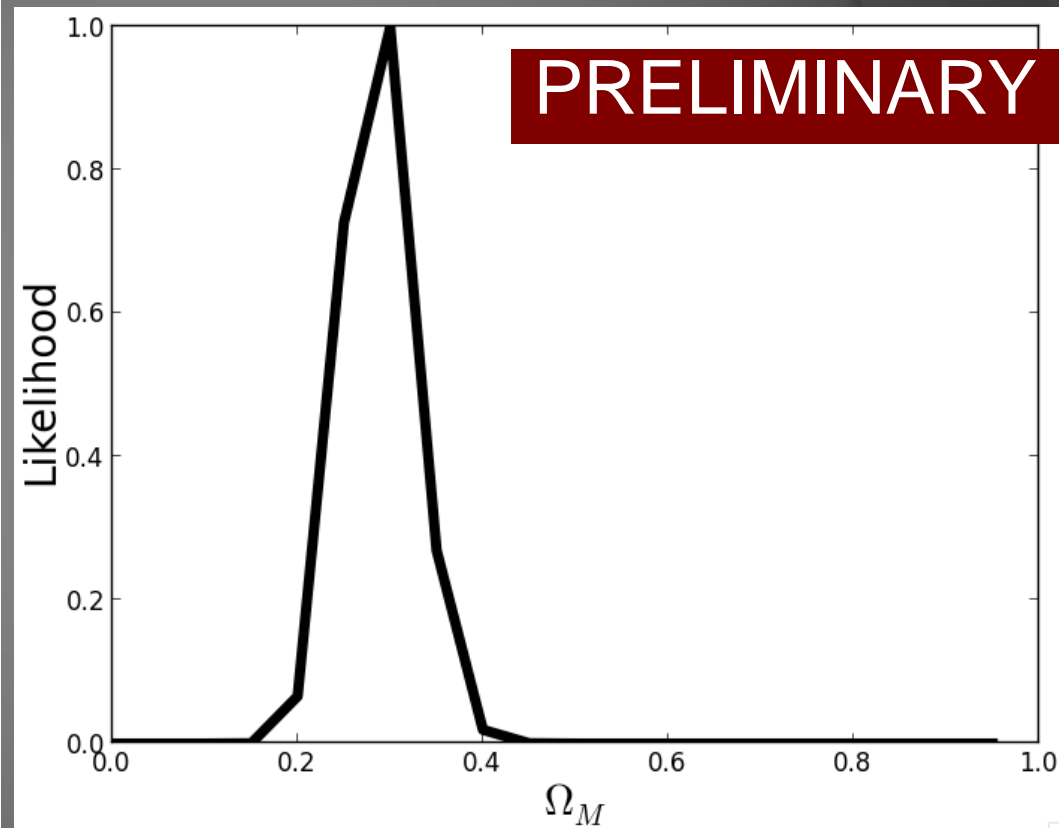
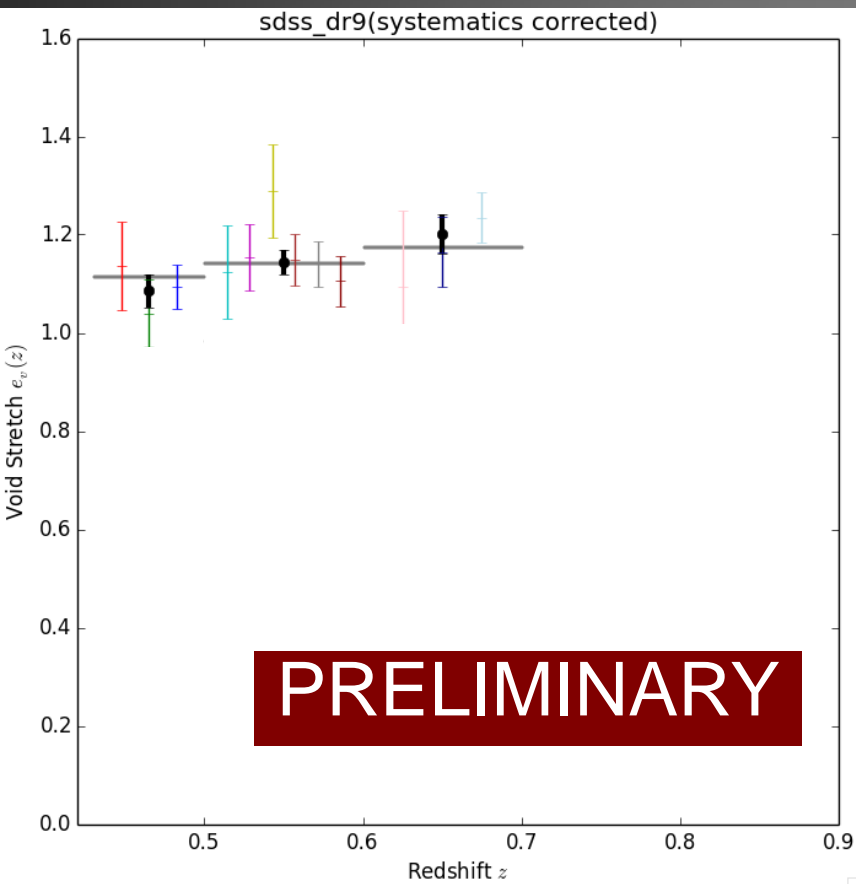




(Lavaux & Wandelt 2012)



(Sutter et al. 2012)



(Sutter et al. in prep)

public catalog keep
growing:
cosmicvoids.net

many void applications

building links between
theory and observations

first detections of
cosmological results

theory/methods

- 1110:0345
- 1306:3052
- 1307:2571

linking theory
to observations

- 1306:3052
- 1309:5087
- 1310:7155
- 1311:3301

catalogs

- 1207:2524
- 1309:5087
- 1310:7155

cosmology
results

- 1208:1058
- 1303:5079
- 1309:2045

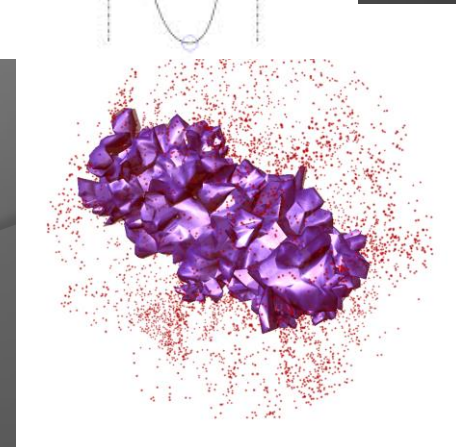
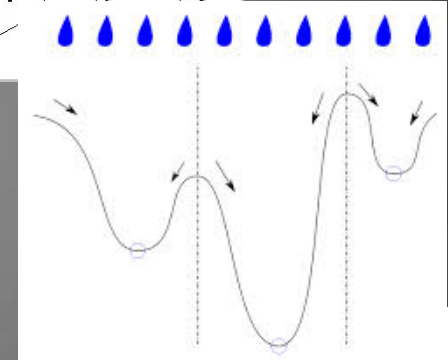
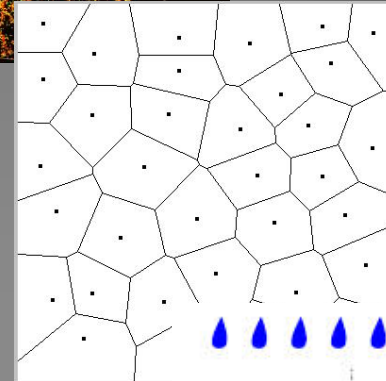
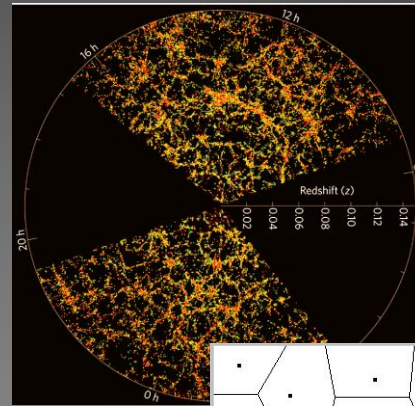
how to find voids?

galaxy
survey/simulation

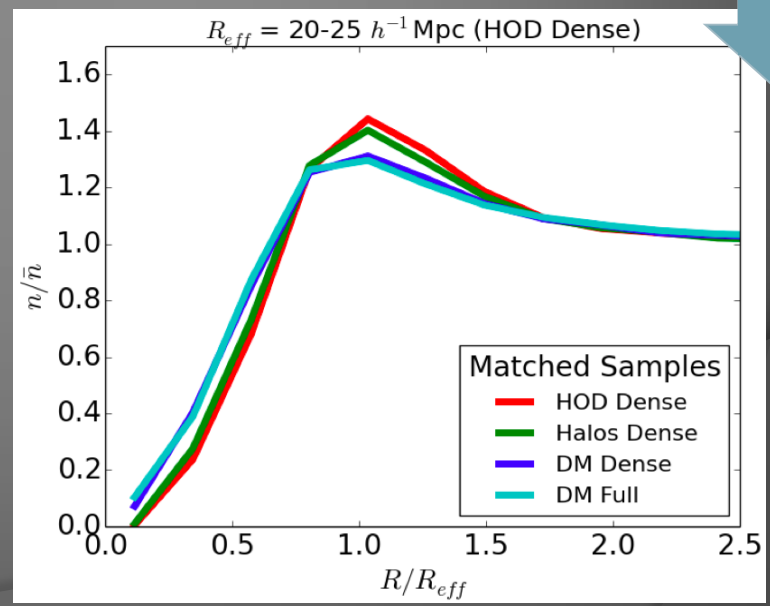
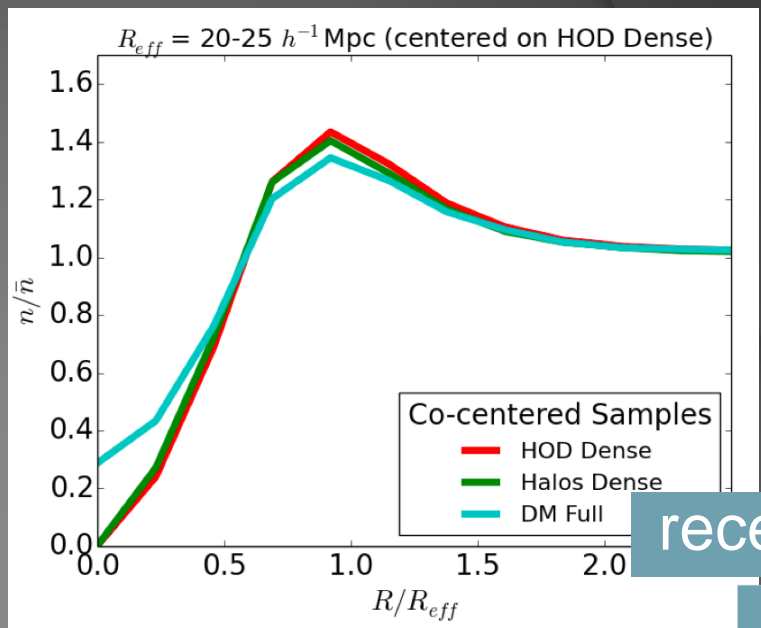
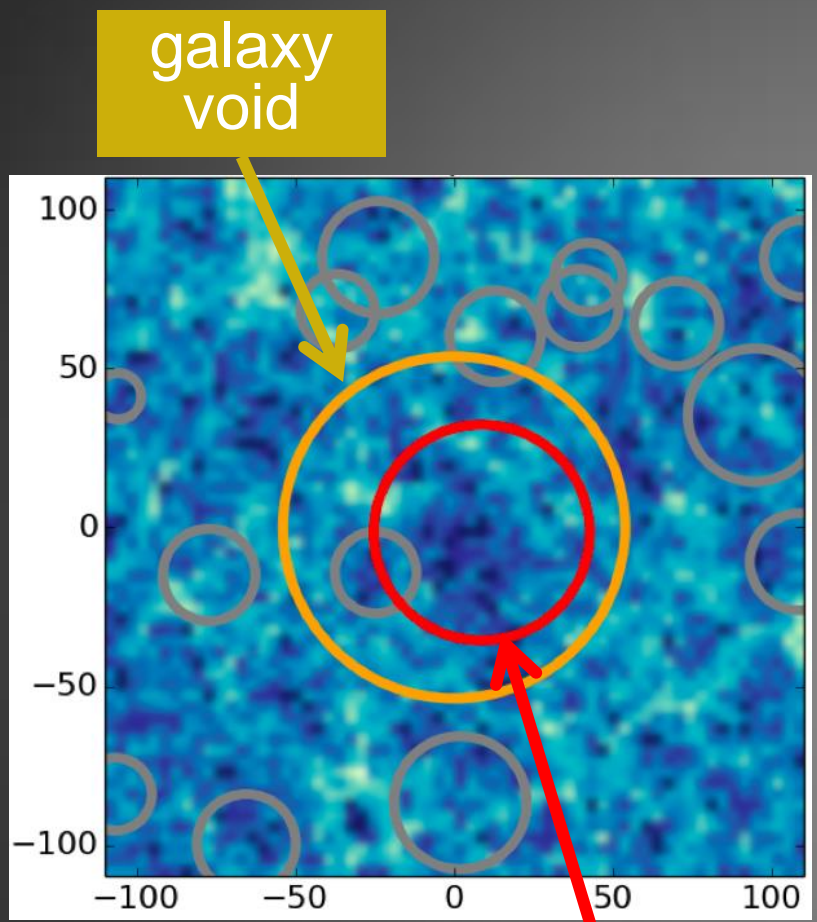
Voronoi
tessellation

watershed
transform

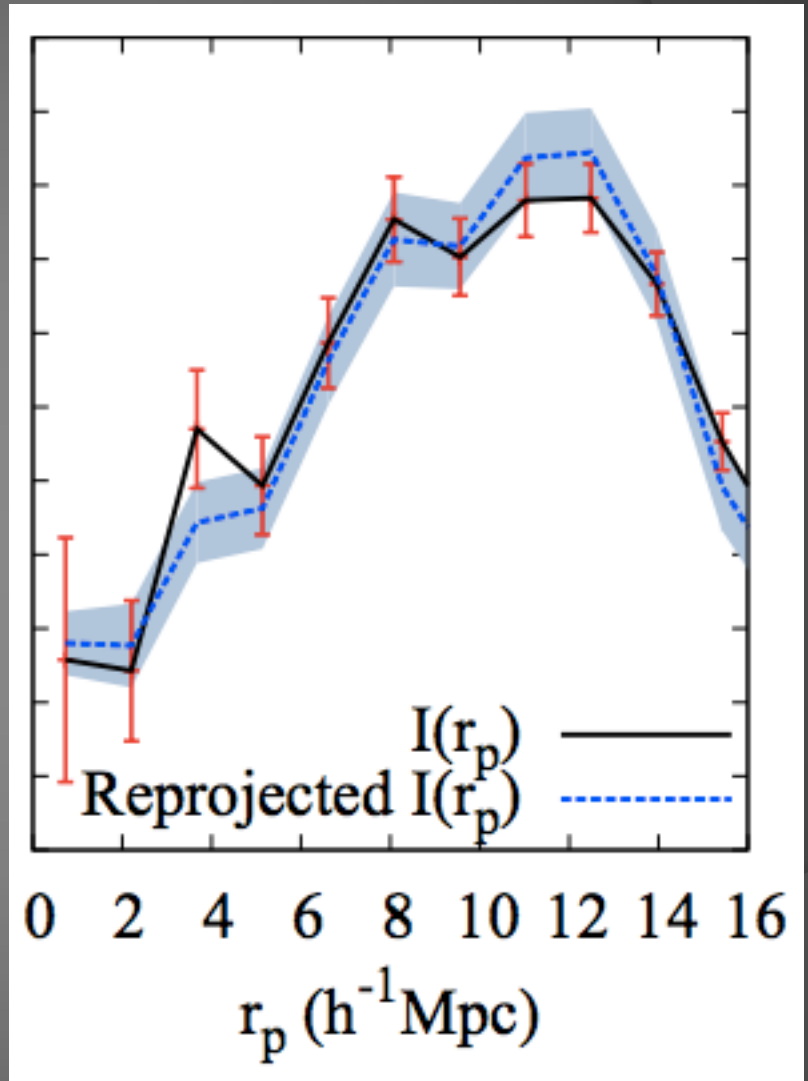
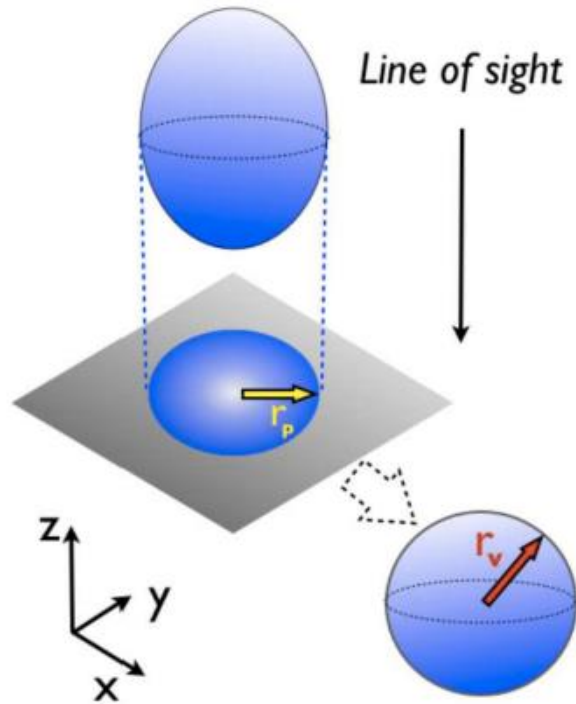
voids!



galaxy void = dark matter underdensity



(Sutter et al. 2013)



(Pisani et al. 2013)