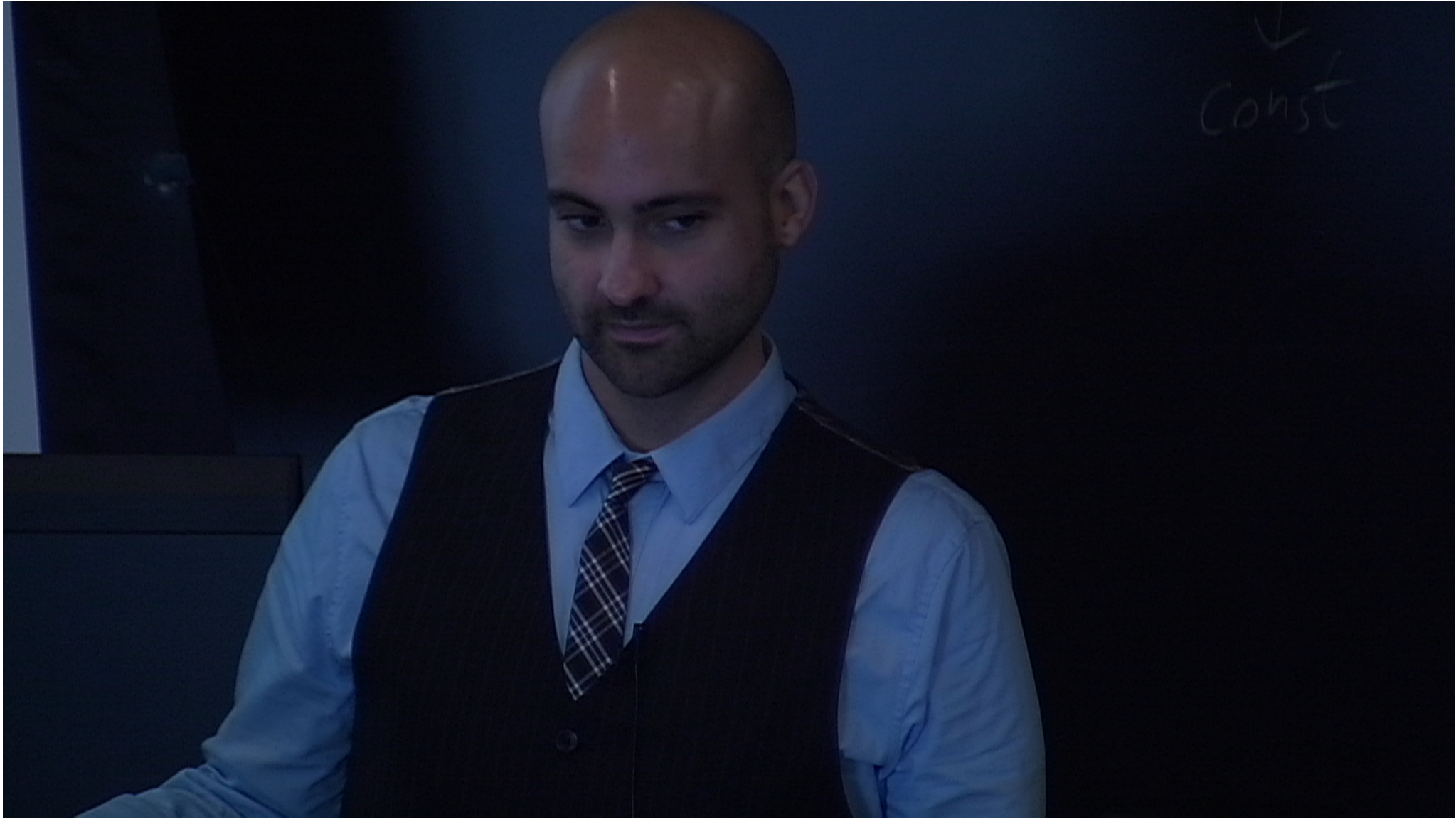


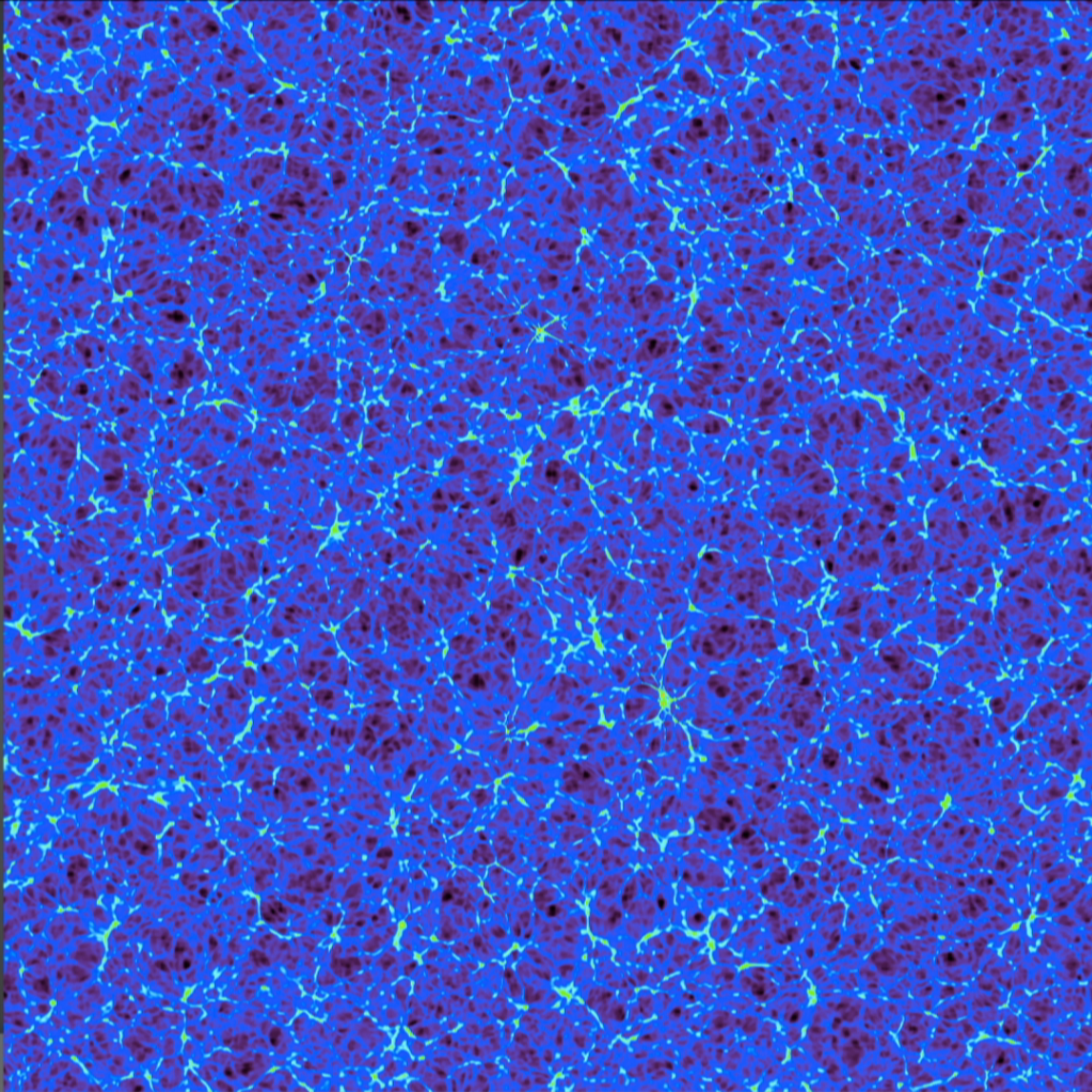
Title: Voids in the SDSS: from demography to cosmology

Date: Oct 09, 2012 01:00 PM

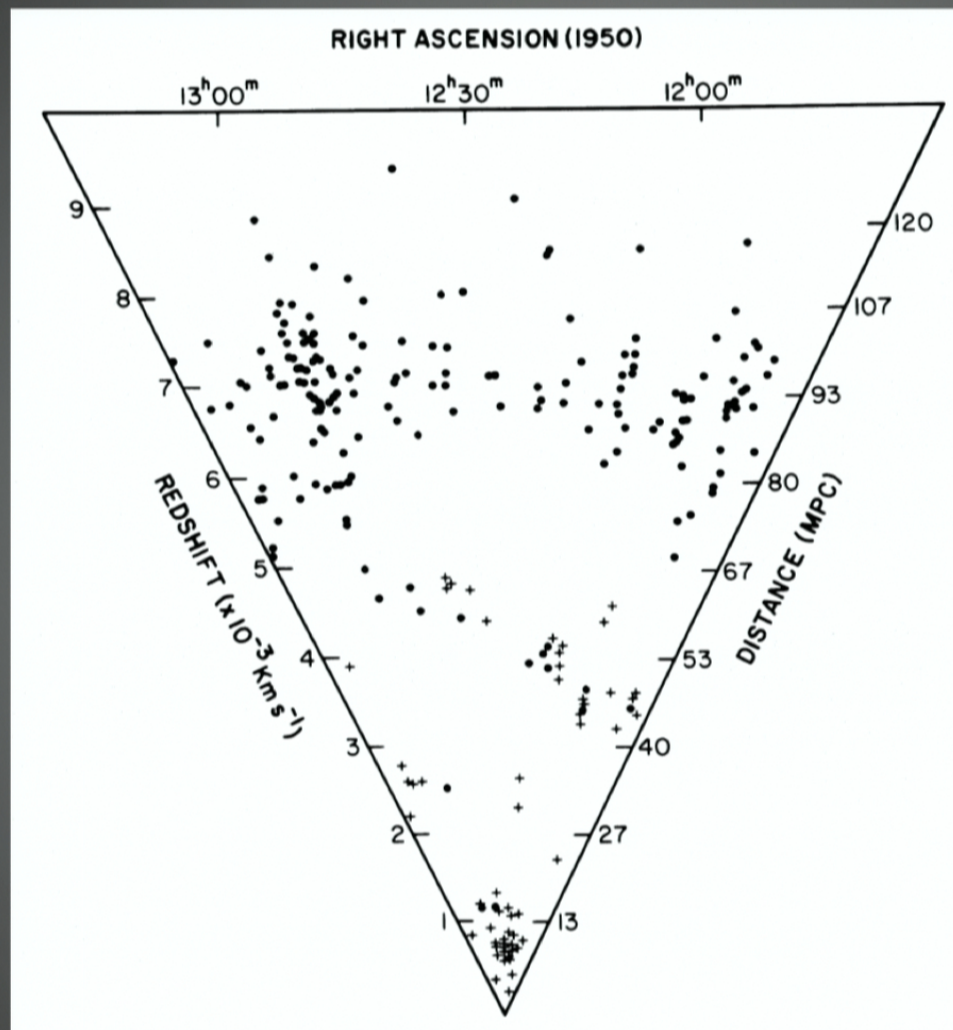
URL: <http://pirsa.org/12100041>

Abstract: Cosmic voids are potentially a rich source of information for both astrophysics and cosmology. To enable such science, we produce the most comprehensive void catalog to date using the Sloan Digital Sky Survey Data Release 7 main sample out to redshift $z = 0.2$ and the Luminous Red Galaxy sample out to $z = 0.44$. Using a modified version of the parameter-free void finder ZOBOV, we fully take into account the presence of survey boundary and masks. We discuss basic catalog statistics such as number counts and redshift distributions, as well as describe some example data products derived from our catalog, such as radial density profiles and projected density maps. Using this catalog, we report on the first application of the Alcock-Paczynski test to stacked voids in spectroscopic redshift surveys by applying the shape-fitting procedure presented in Lavaux & Wandelt (2011) to ten void stacks out to redshift $z = 0.36$. Our results are consistent with WMAP 7-year cosmological constraints. We compare our results to alternate methods of constructing void stacks and comment on future observational prospects.



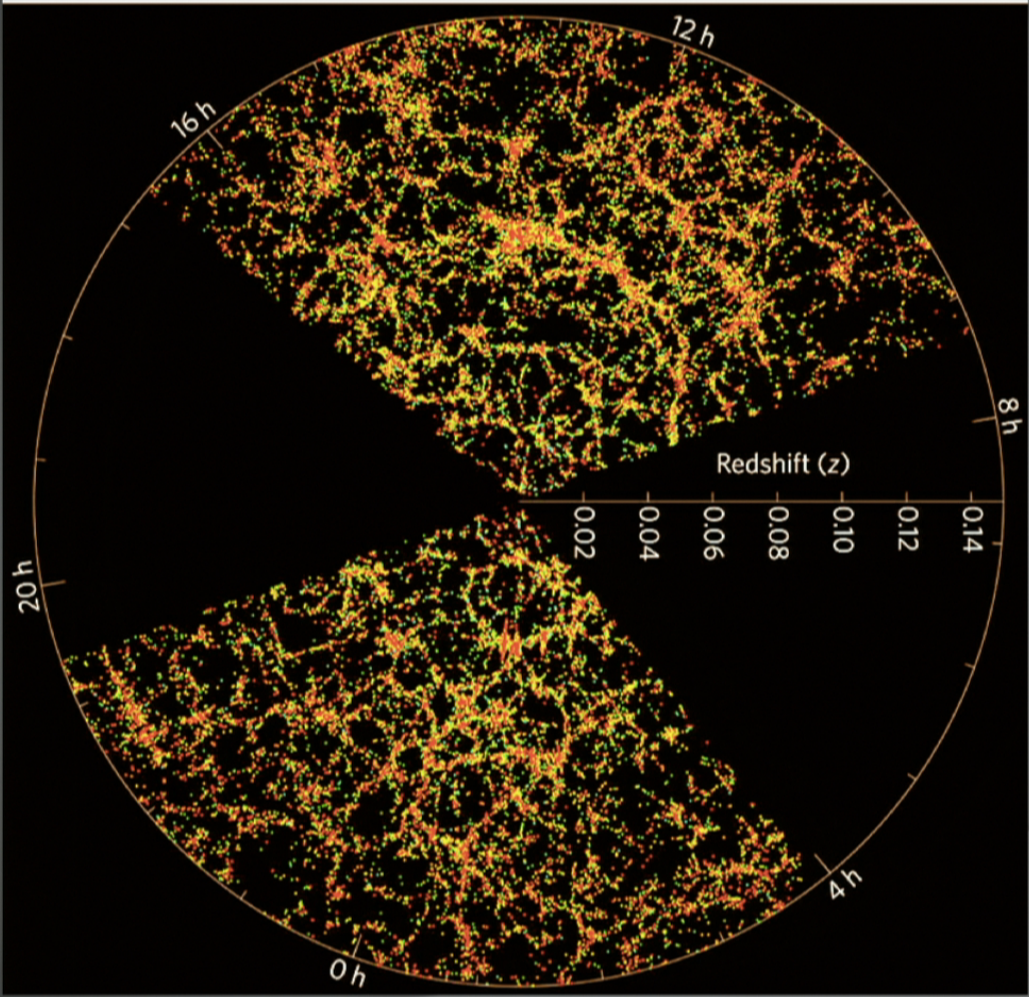


what is a void

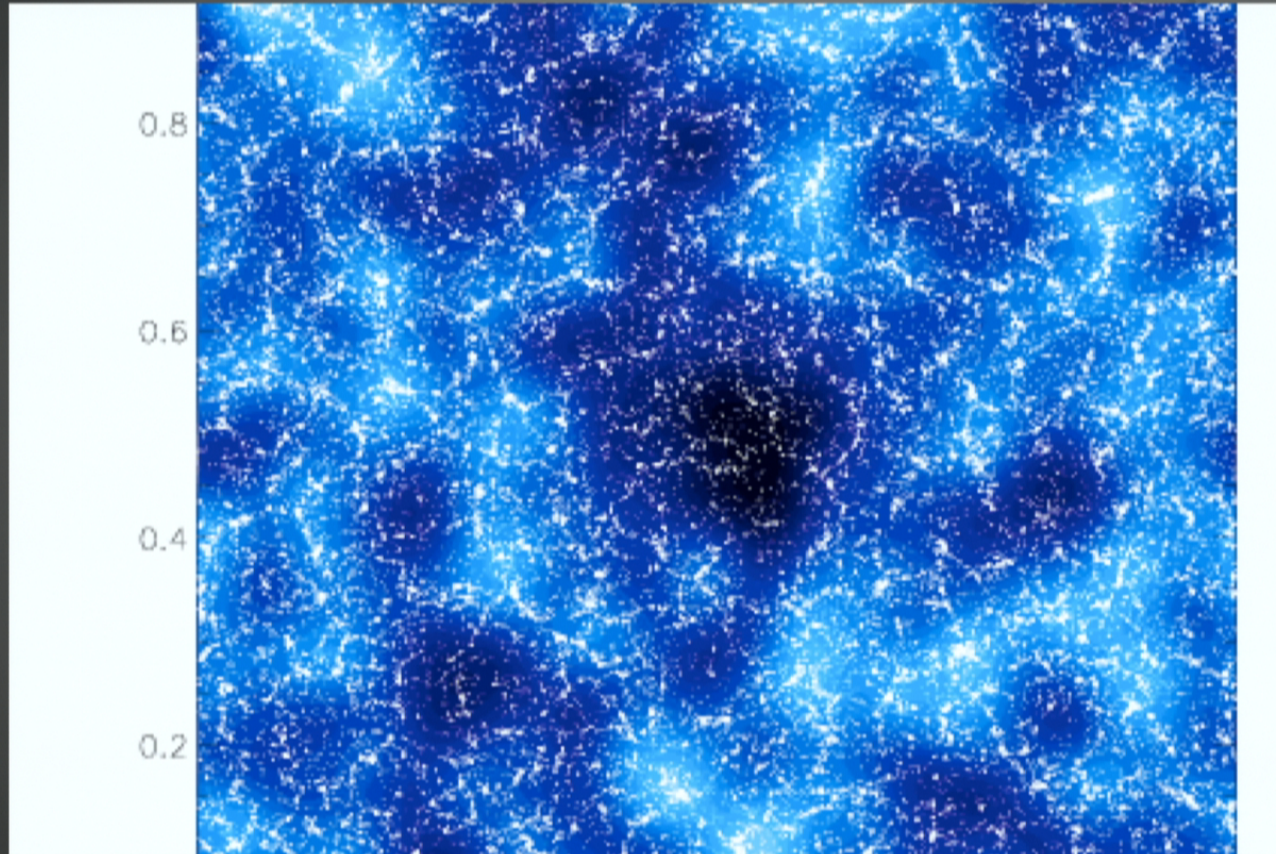


(Gregory and Thompson 1978)

what is a void?

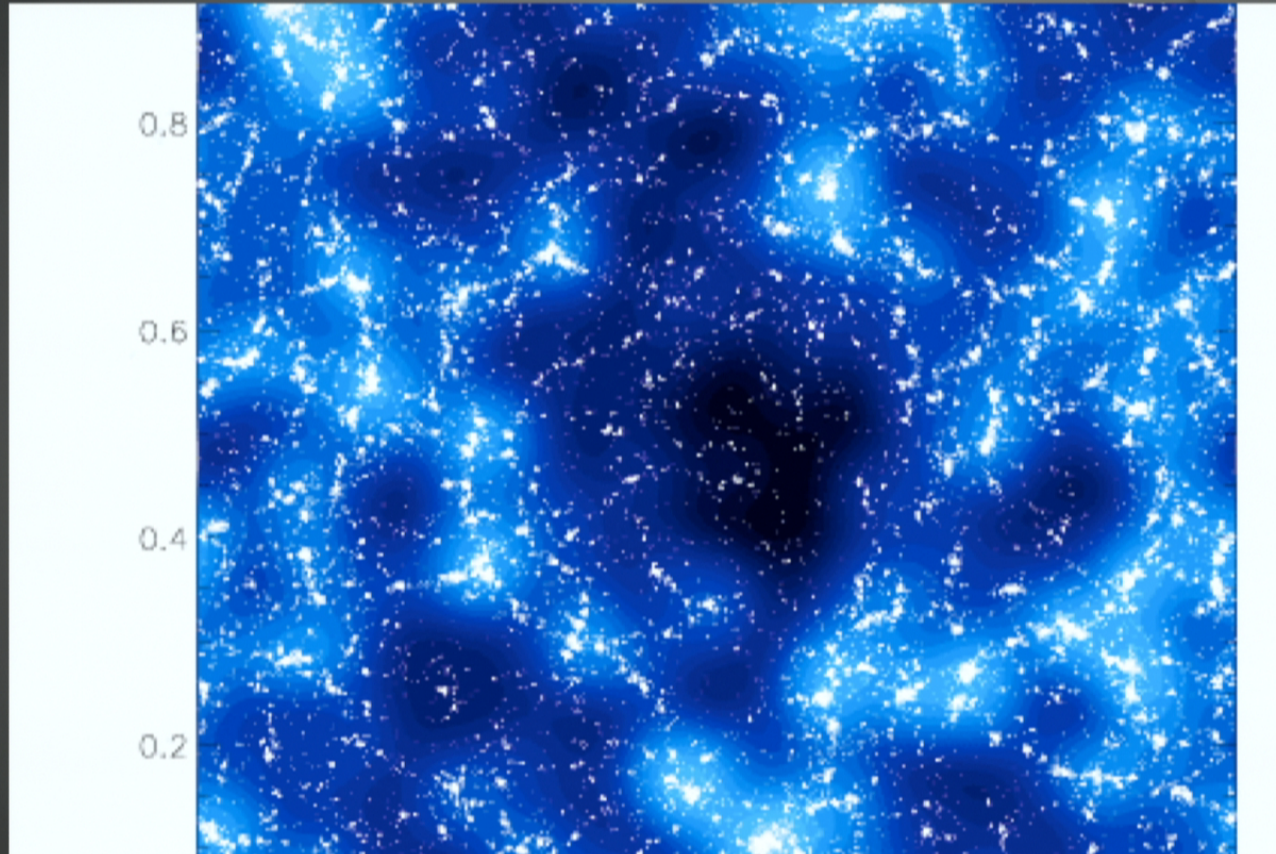


what is a void



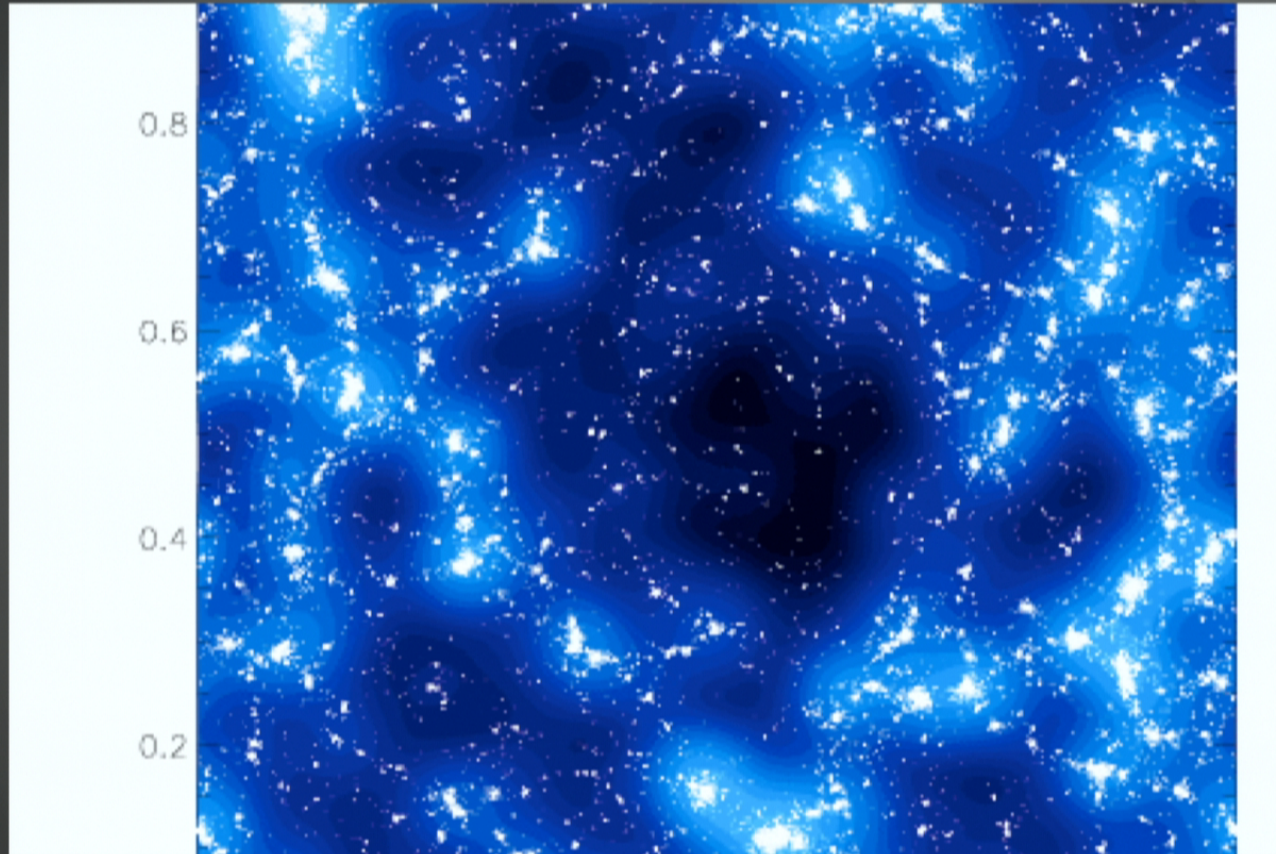
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what is a void



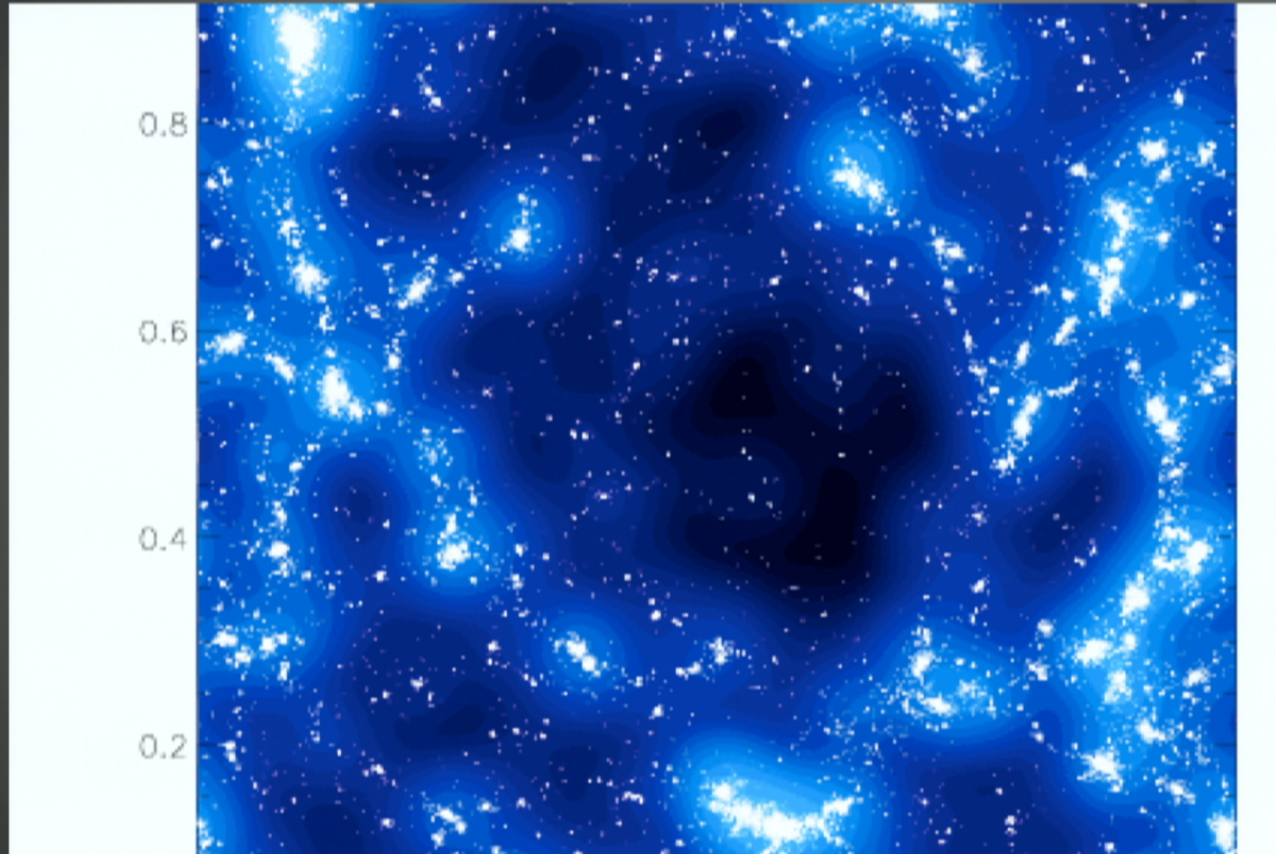
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what is a void



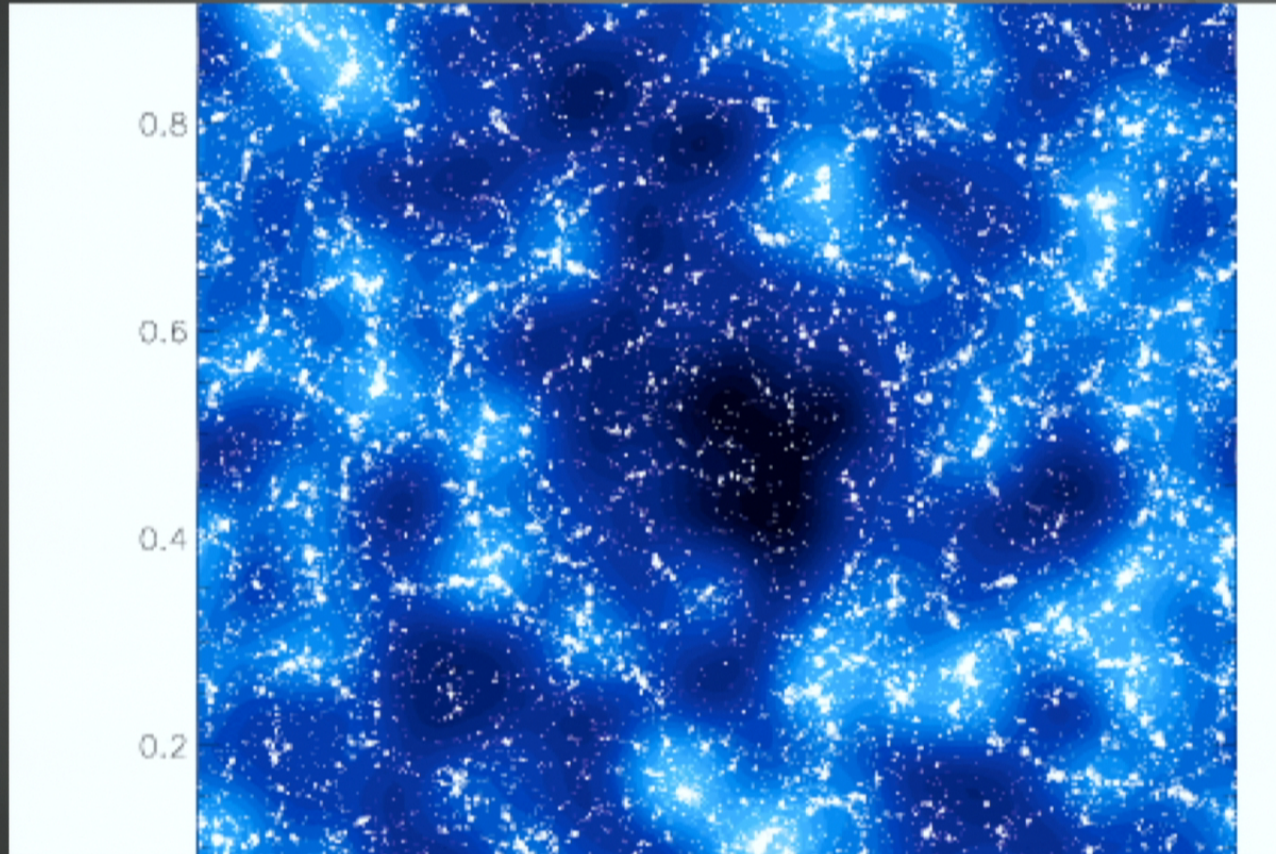
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what is a void



5

what is a void



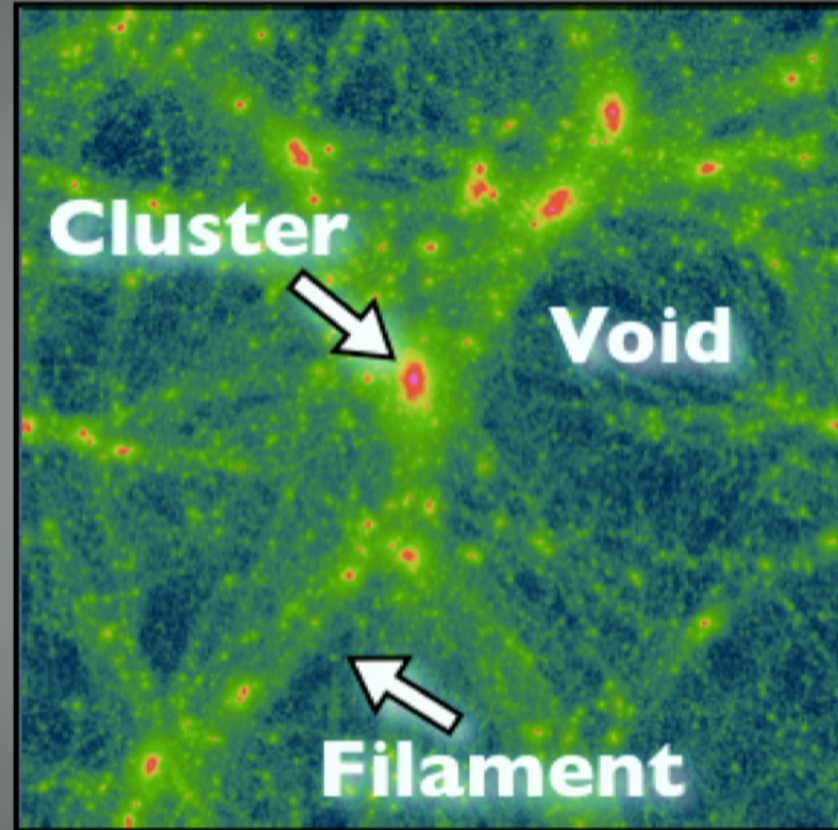
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abundant

many sizes

easy to identify

few systematics



size distributions (*Lee & Park 2006*)

ellipticity distributions (*Bos et al. 2012*)

the Alcock-Paczynski test (*Ryden 1995*)

integrated Sachs-Wolfe effect (*Granett et al. 2008*)

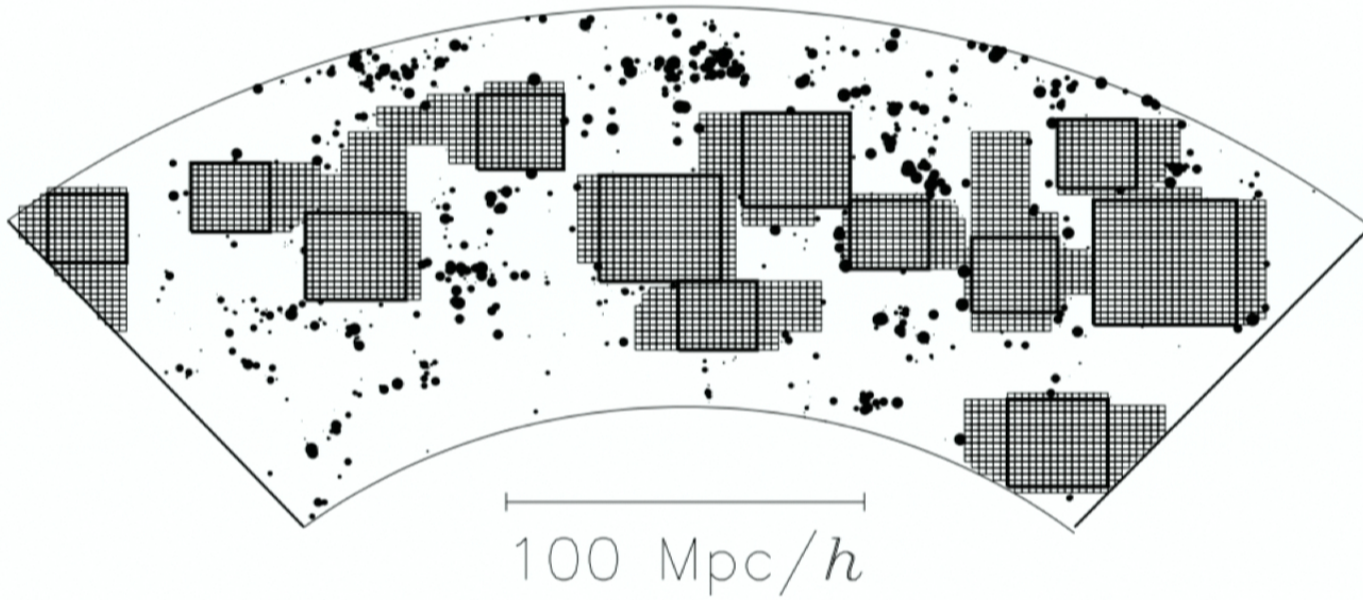
fifth forces and $f(R)$ gravity (*Li et al. 2012*)

weak anti-lensing (*Melchior et al. 2012*)

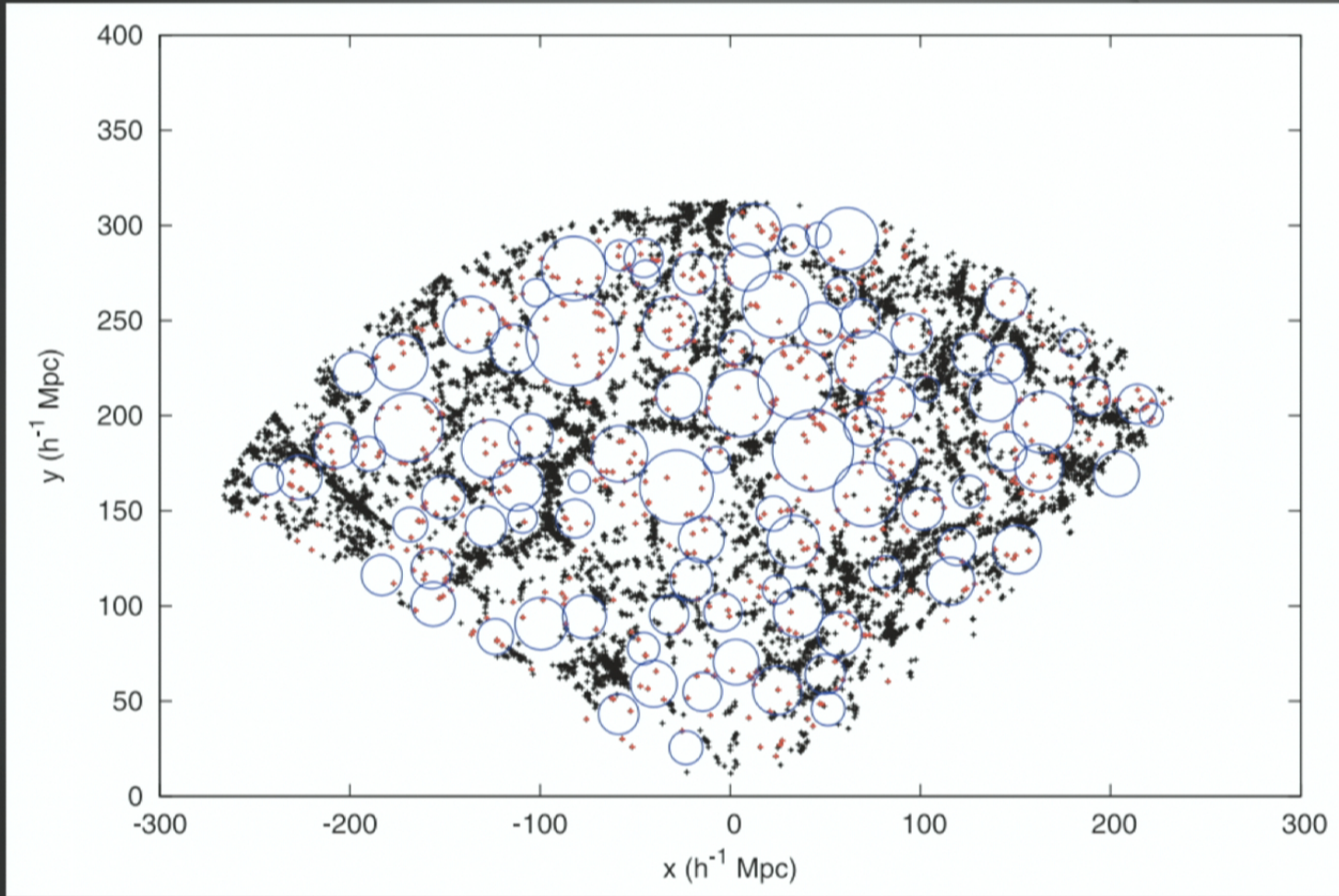
environmental dependence of galaxy metallicities (*Hoeft et al. 2006*)

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

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

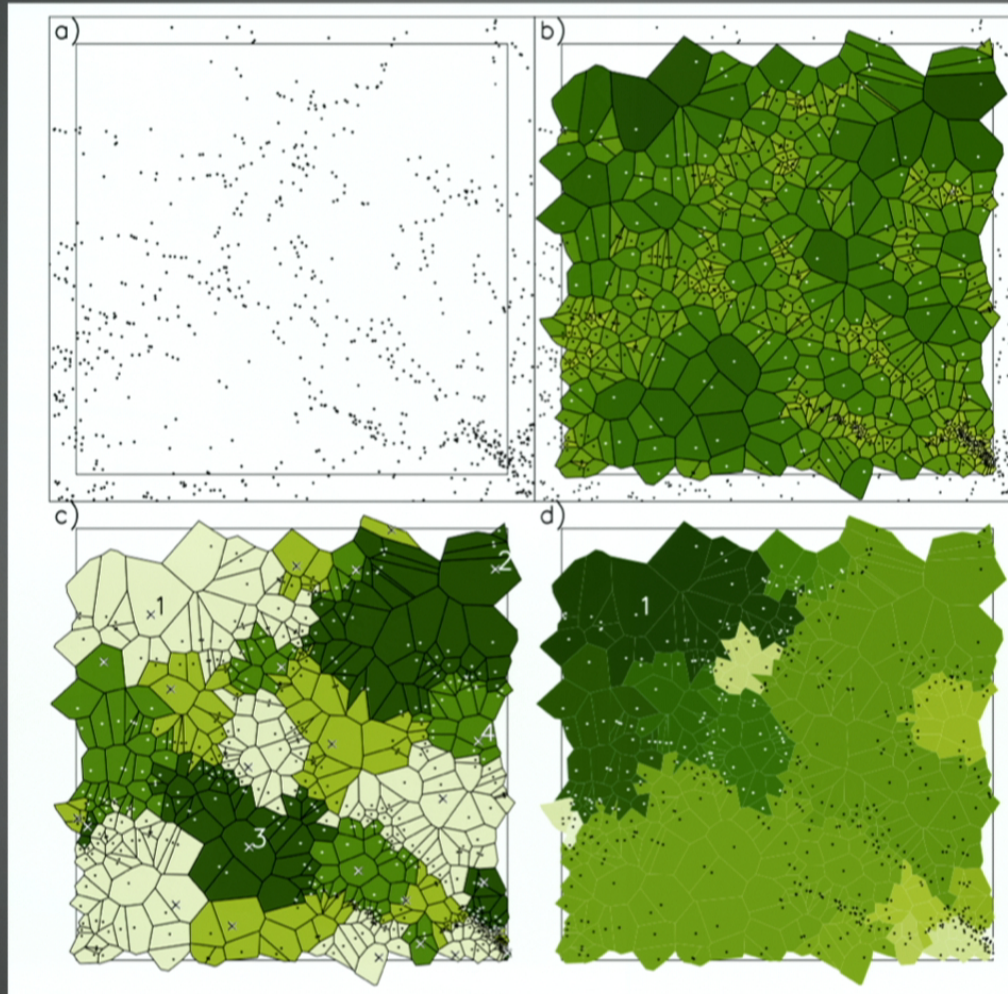


(Muller et al. 2000)



(Pan et al. 2011)

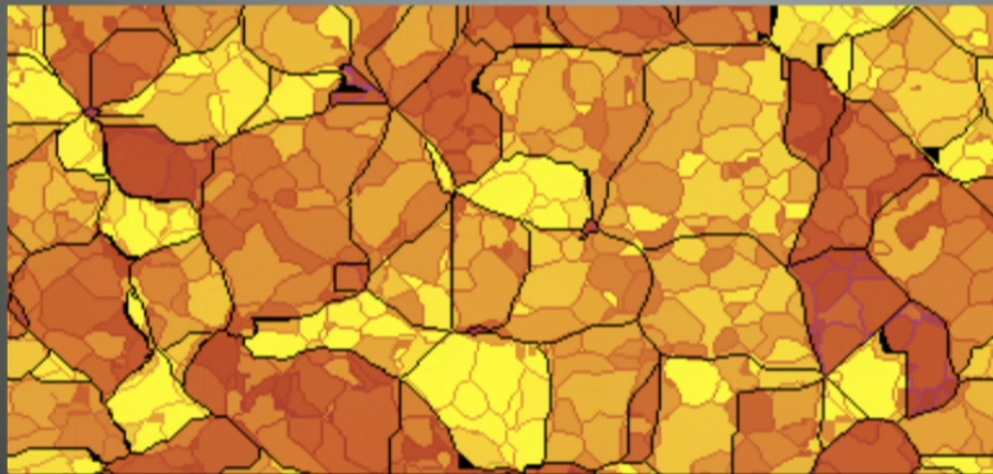
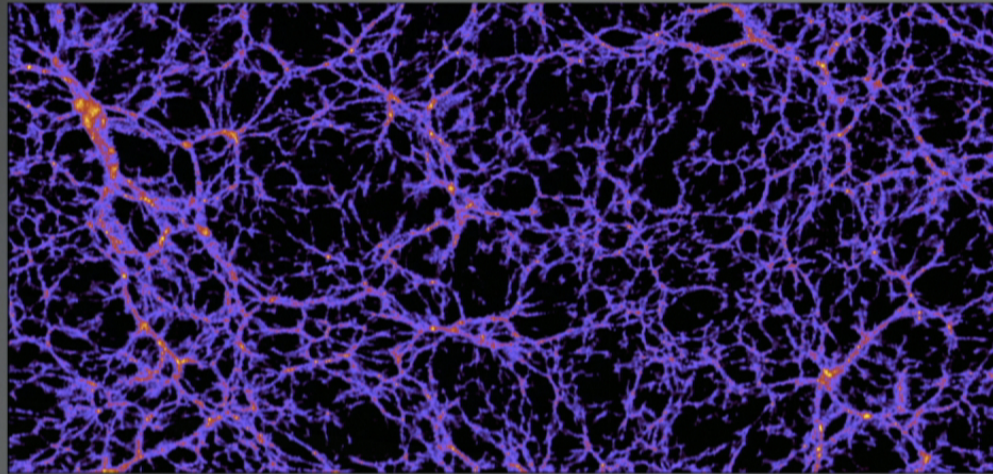
the watershed algorithm defines a void



(Neyrinck 2007)

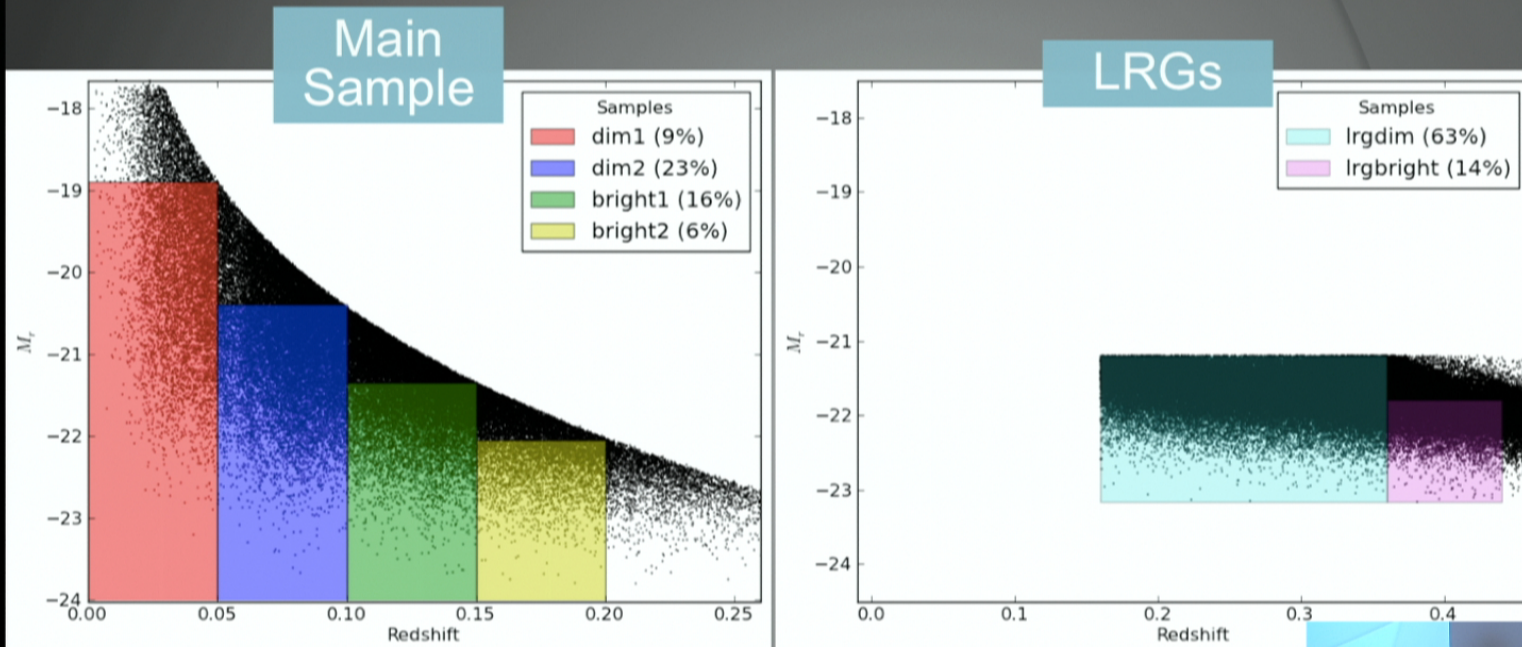


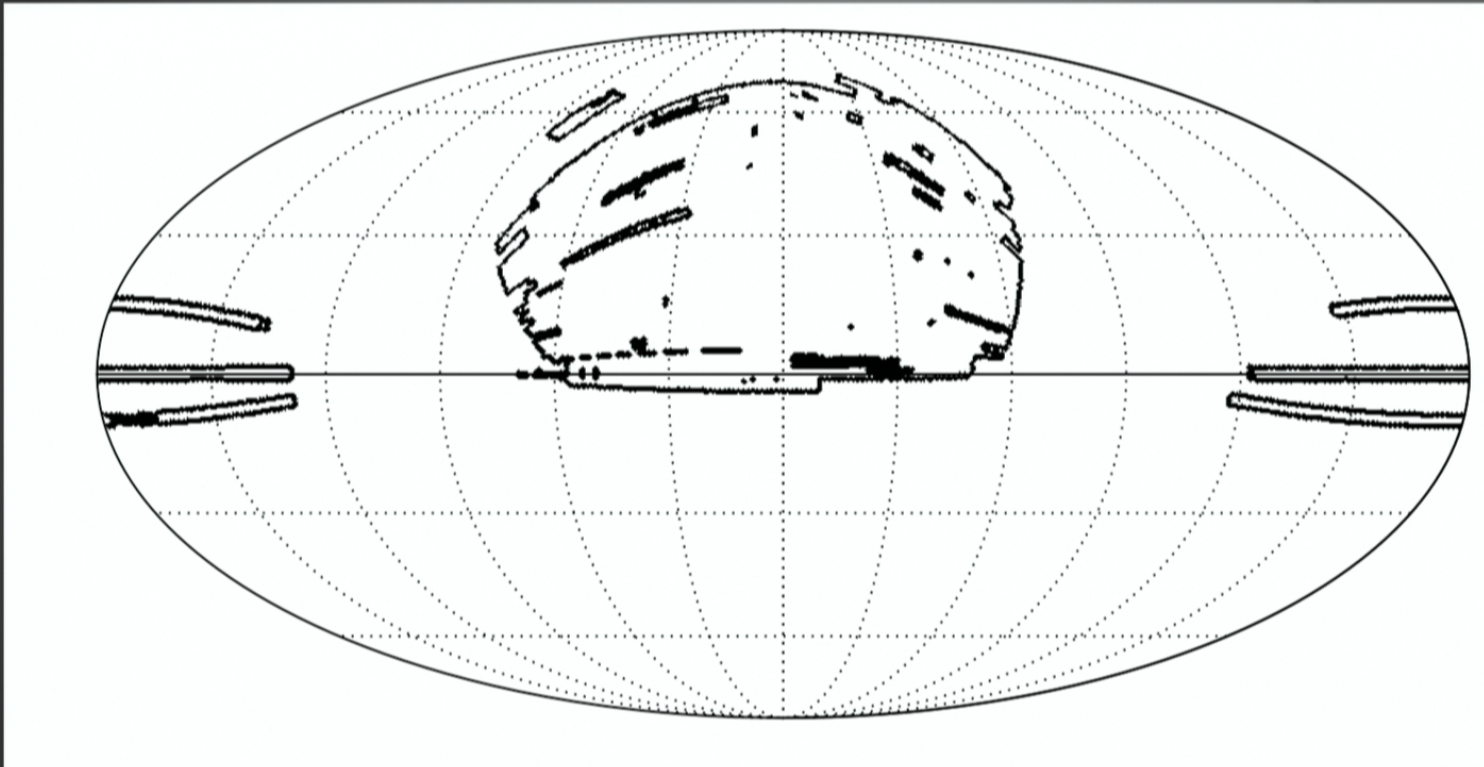
defining a void

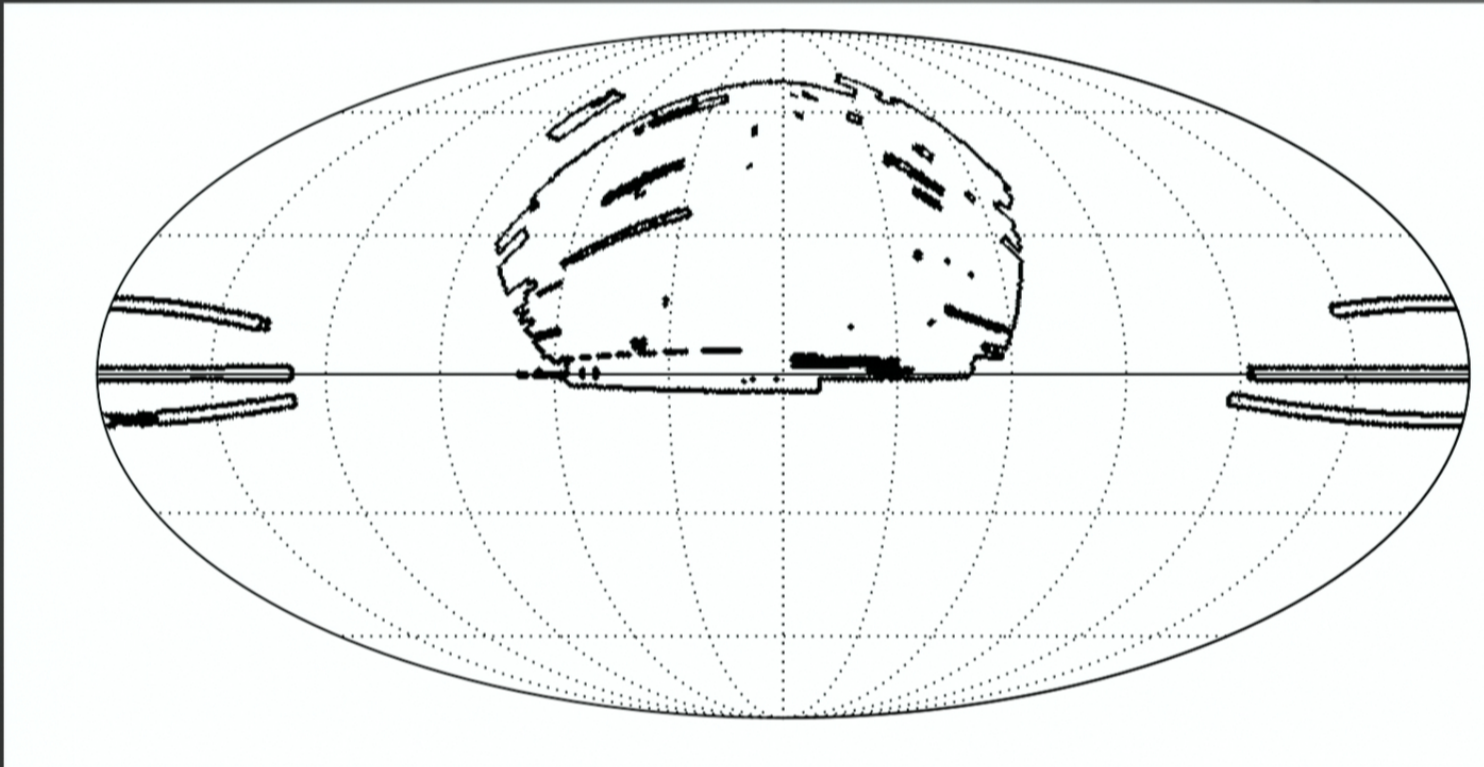


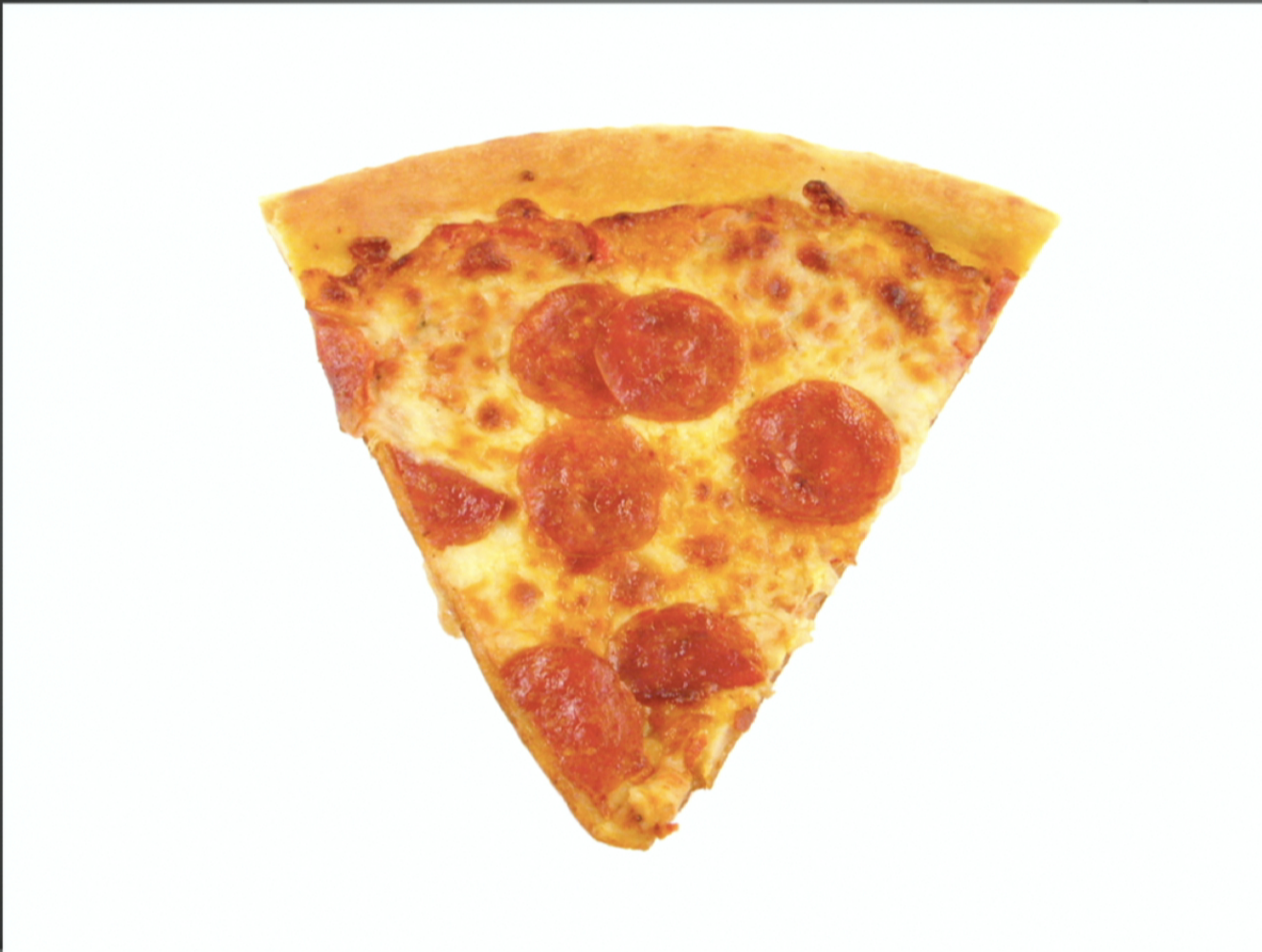
(Bos et al. 2012)



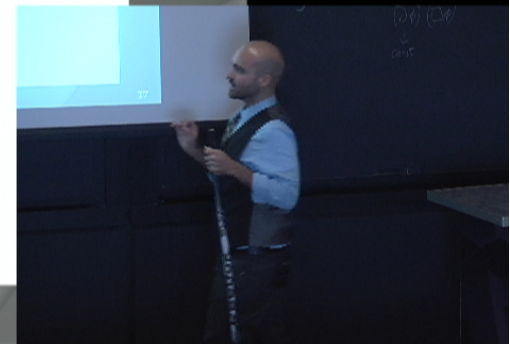
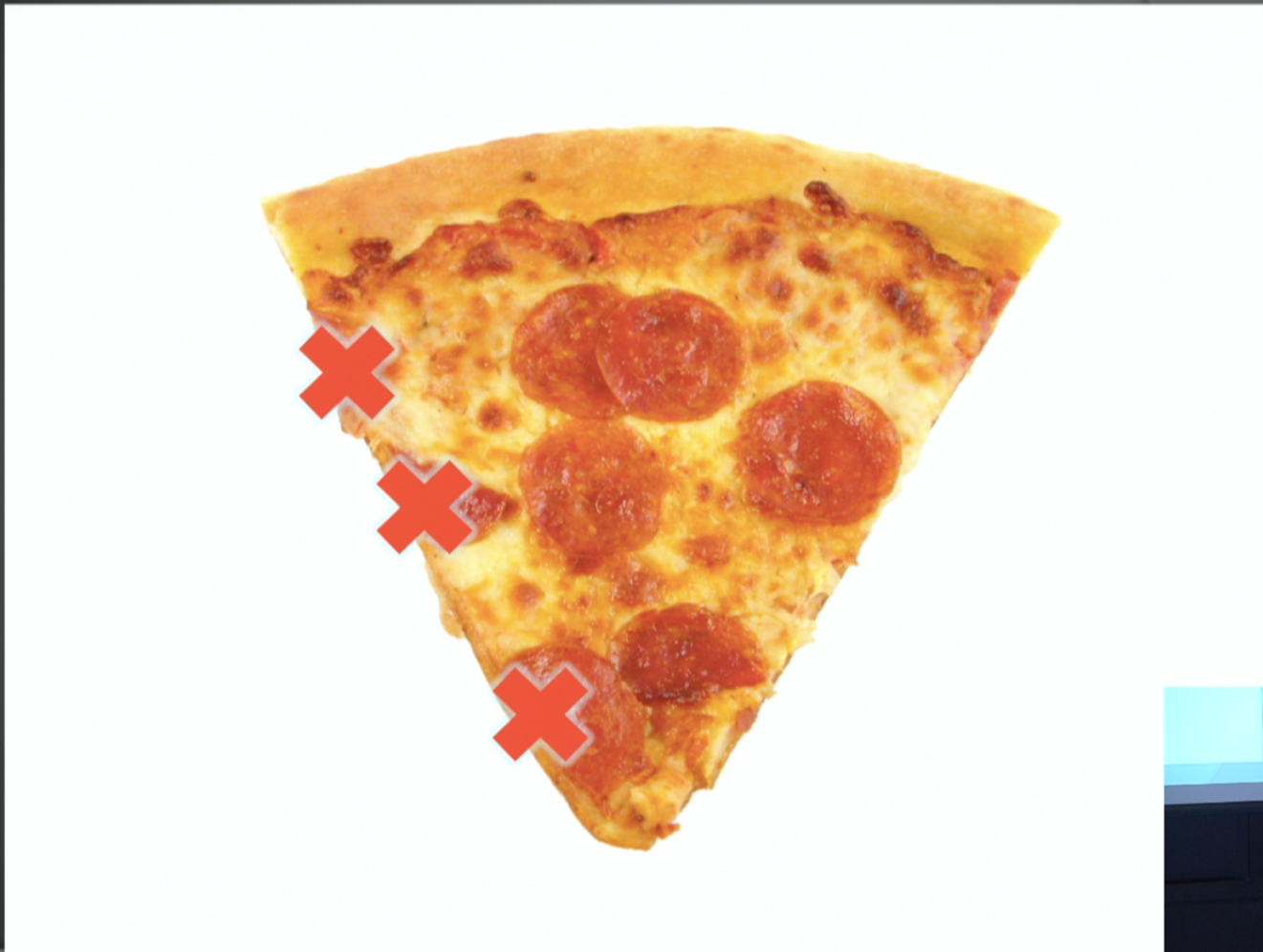




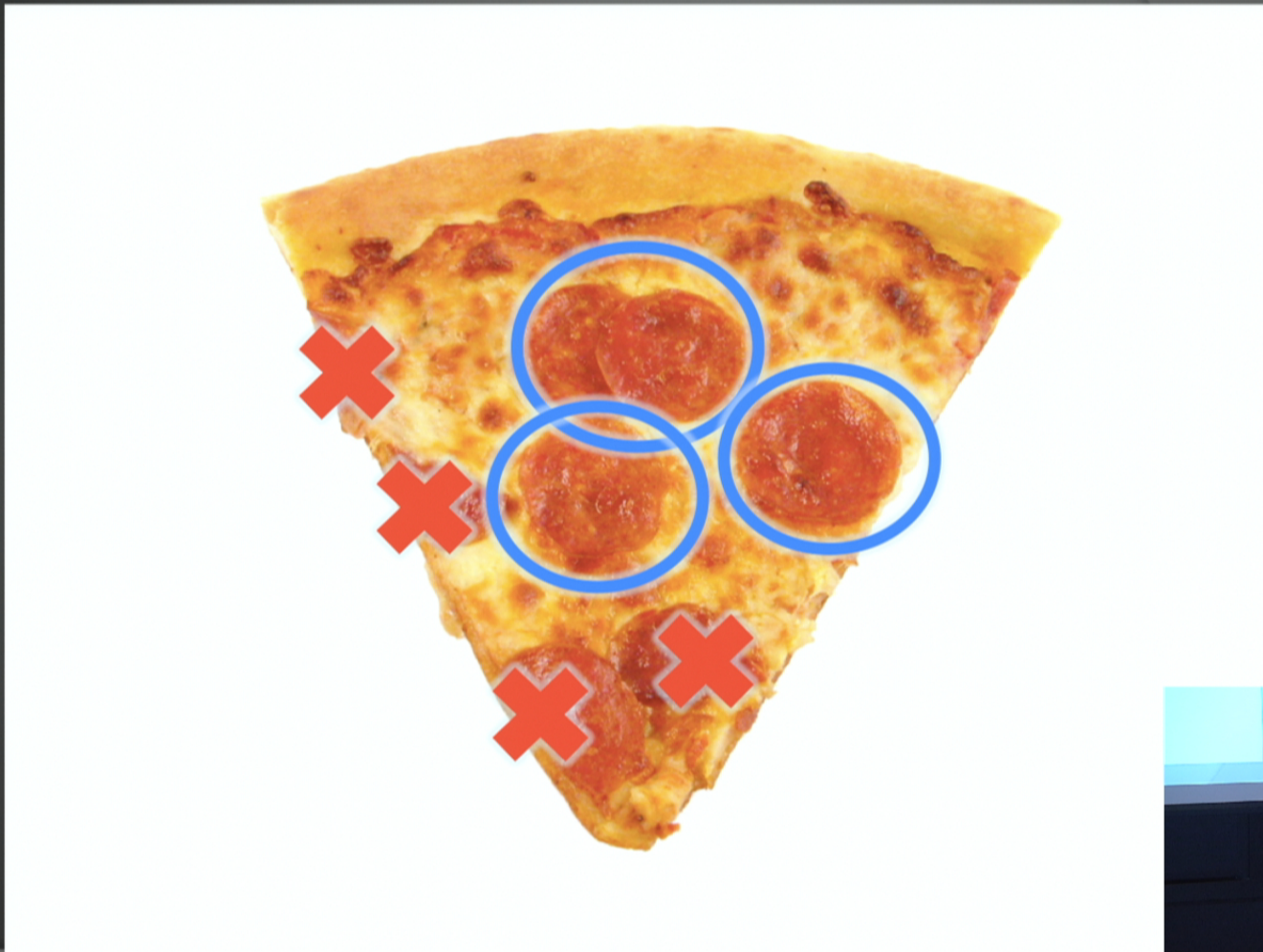


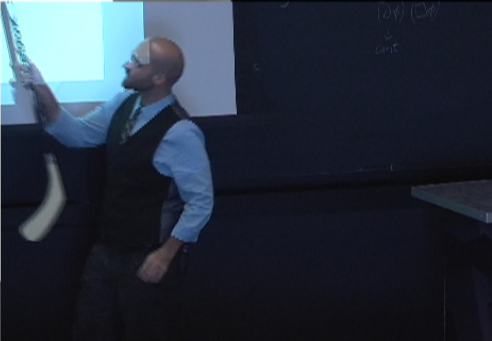
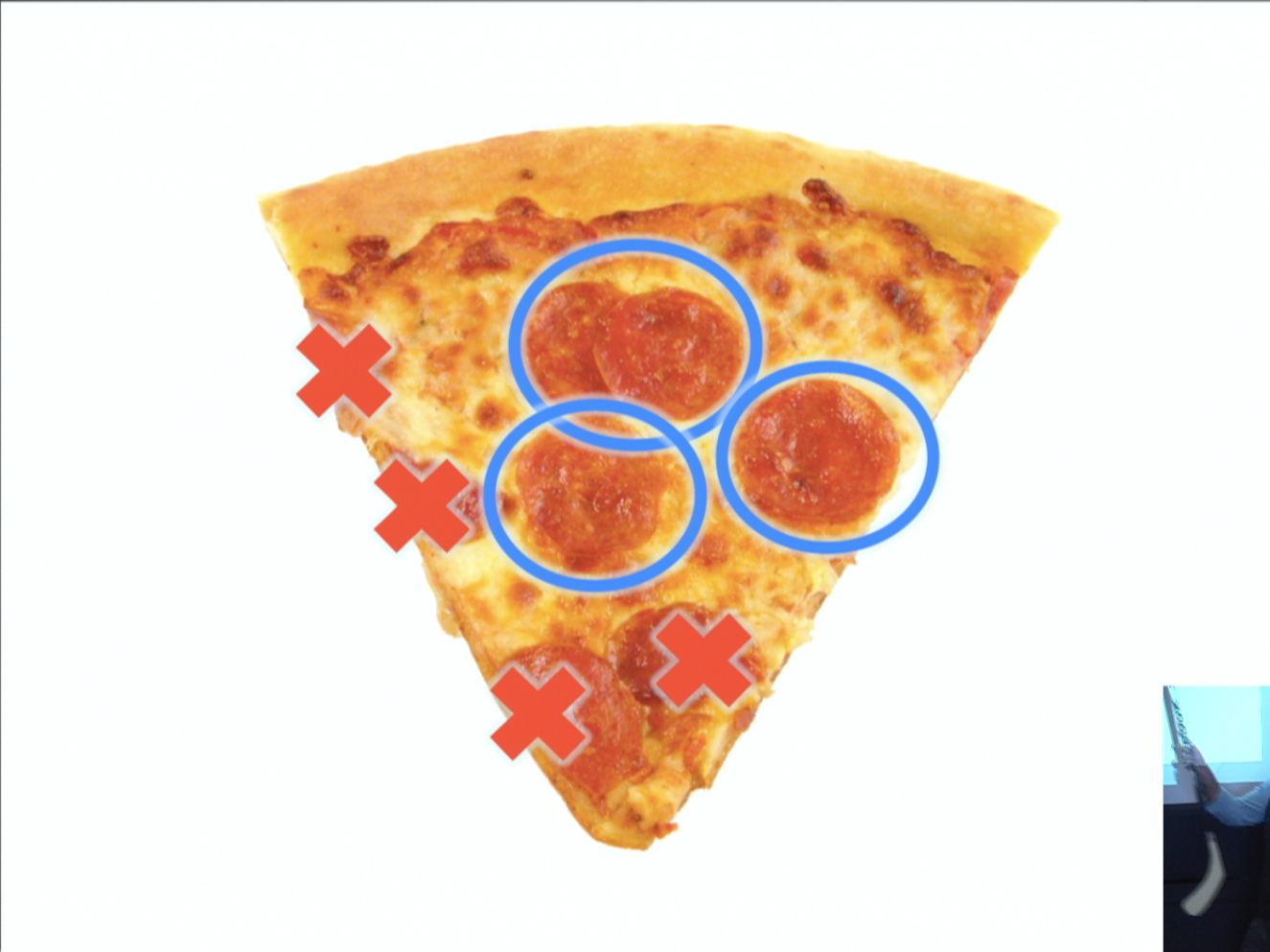


dealing with the mask

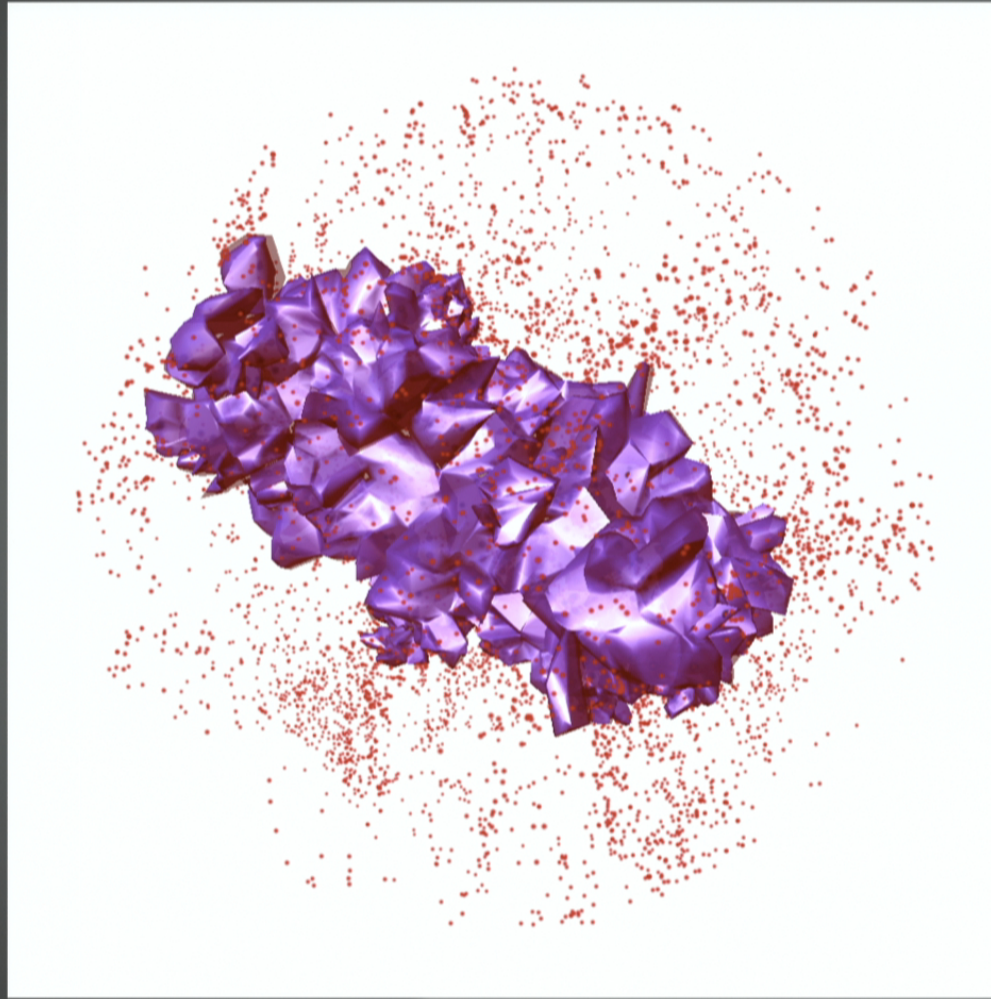


dealing with the mask

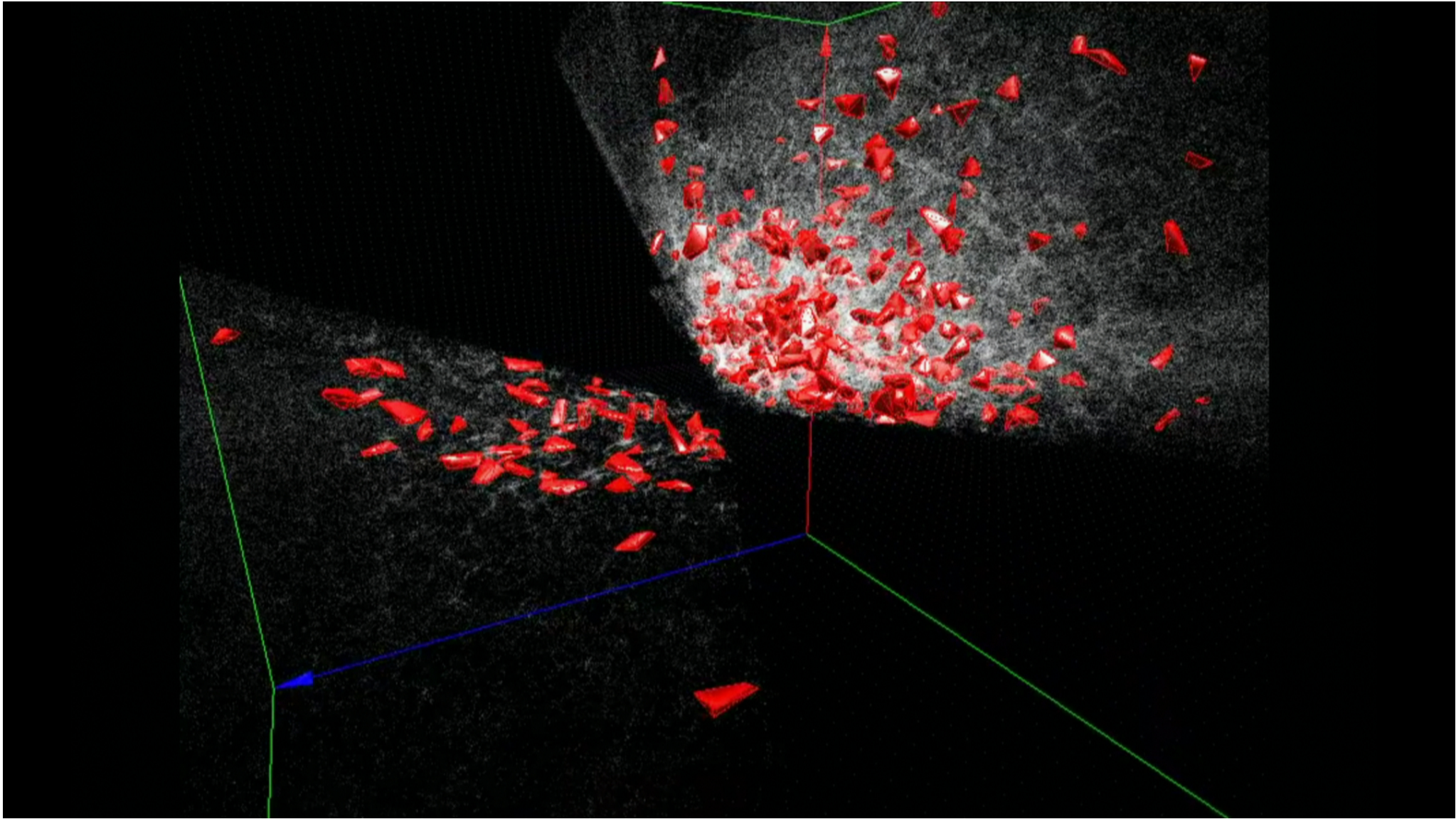


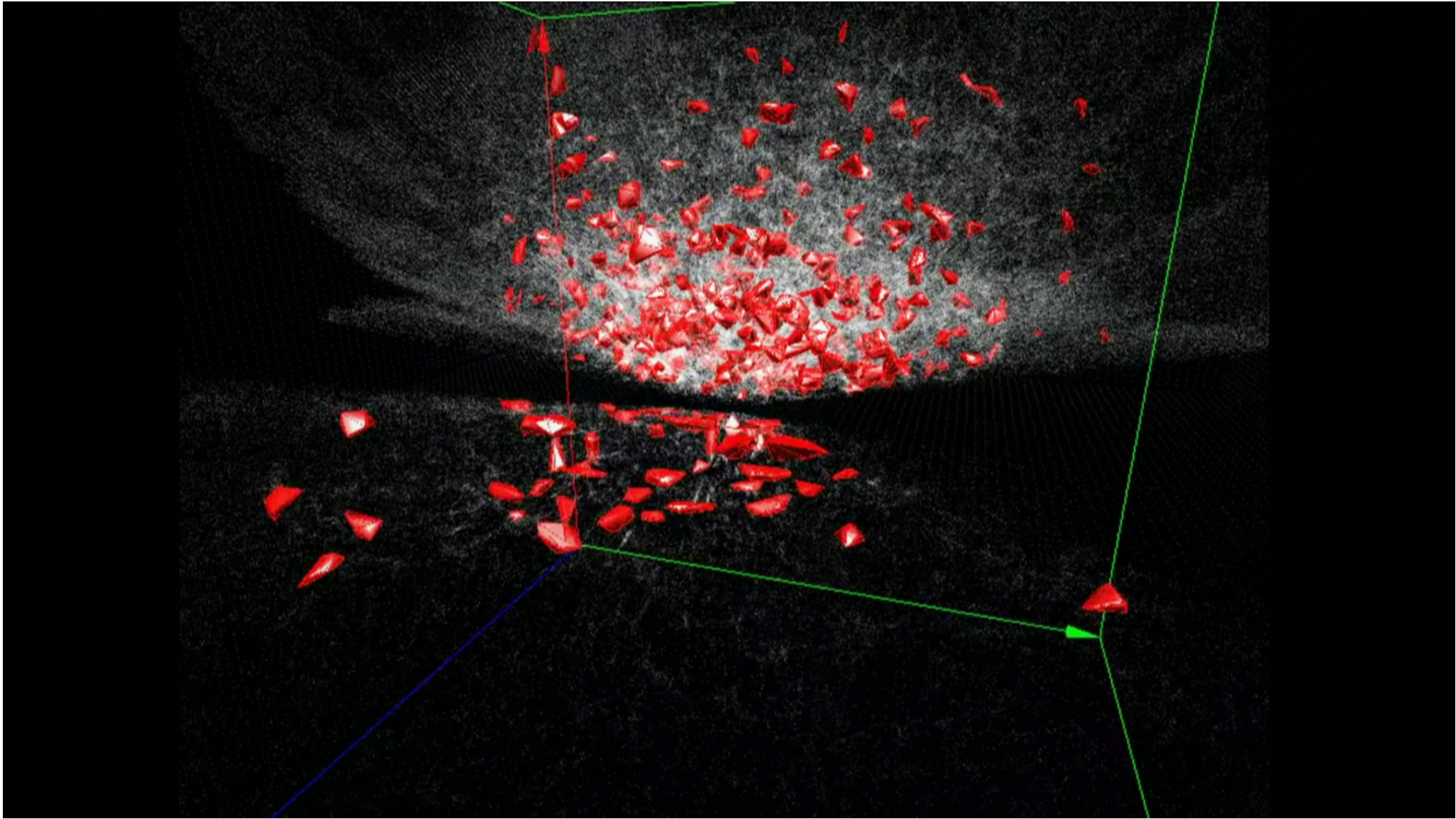


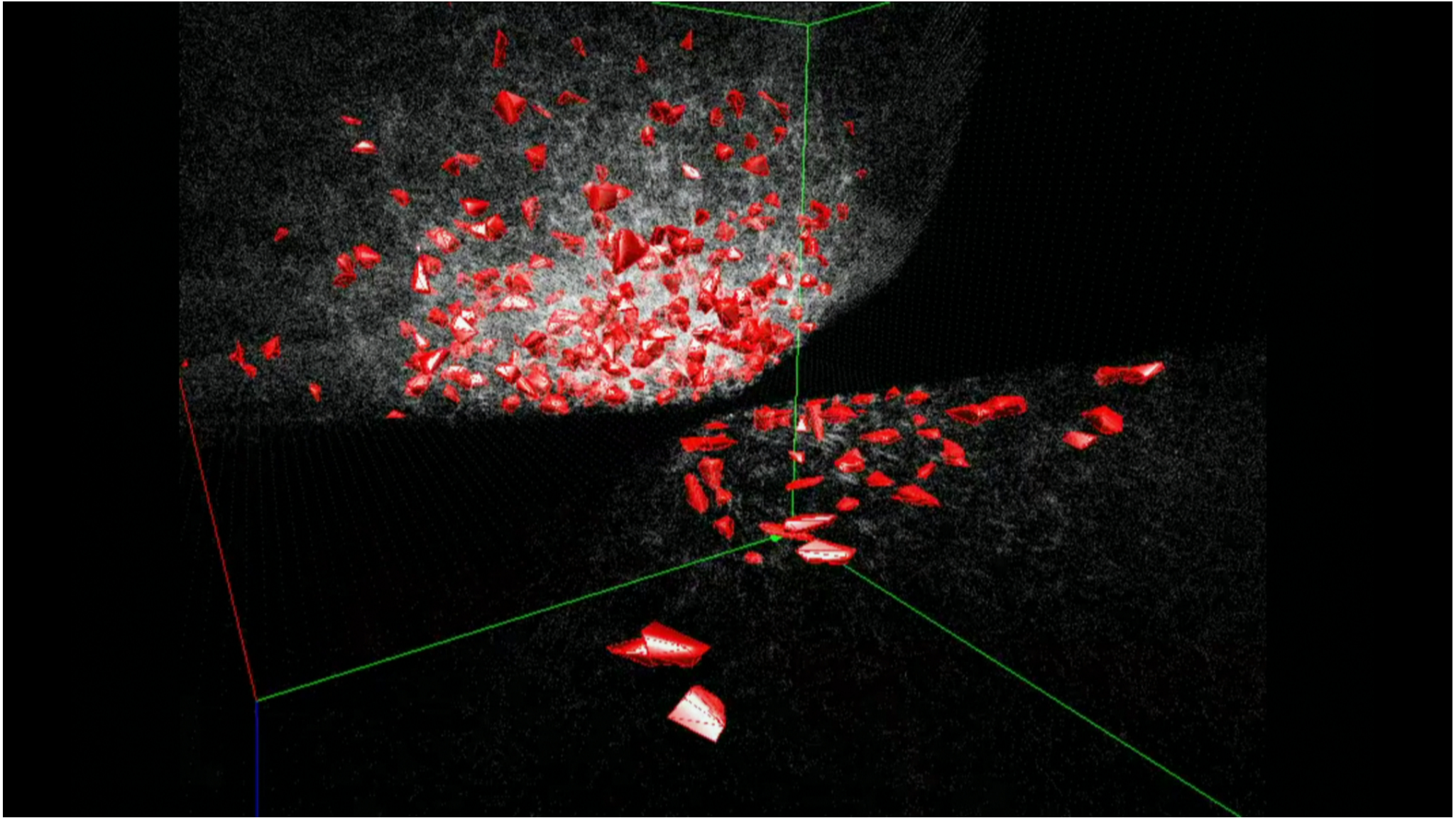
what a void looks like

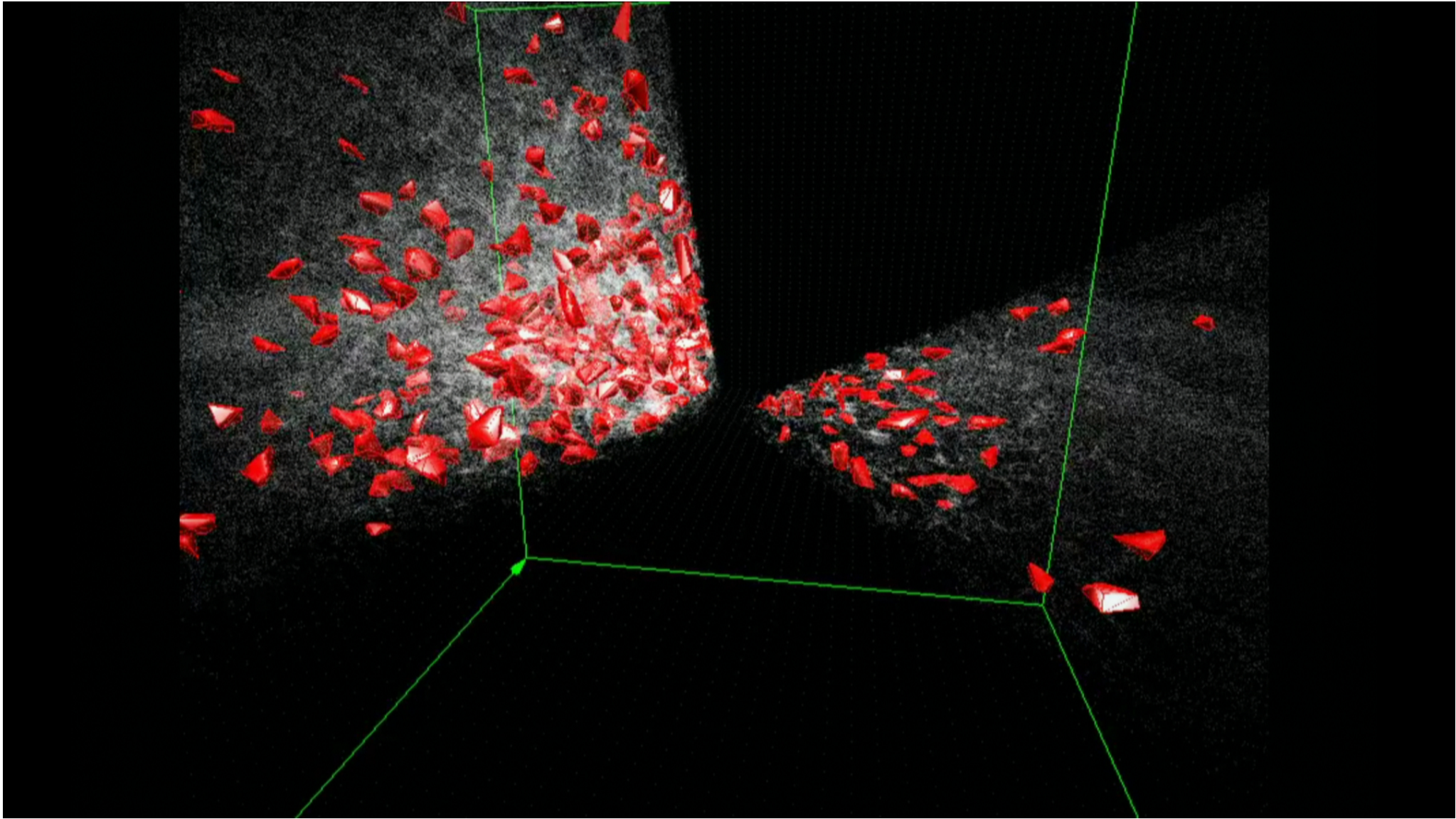


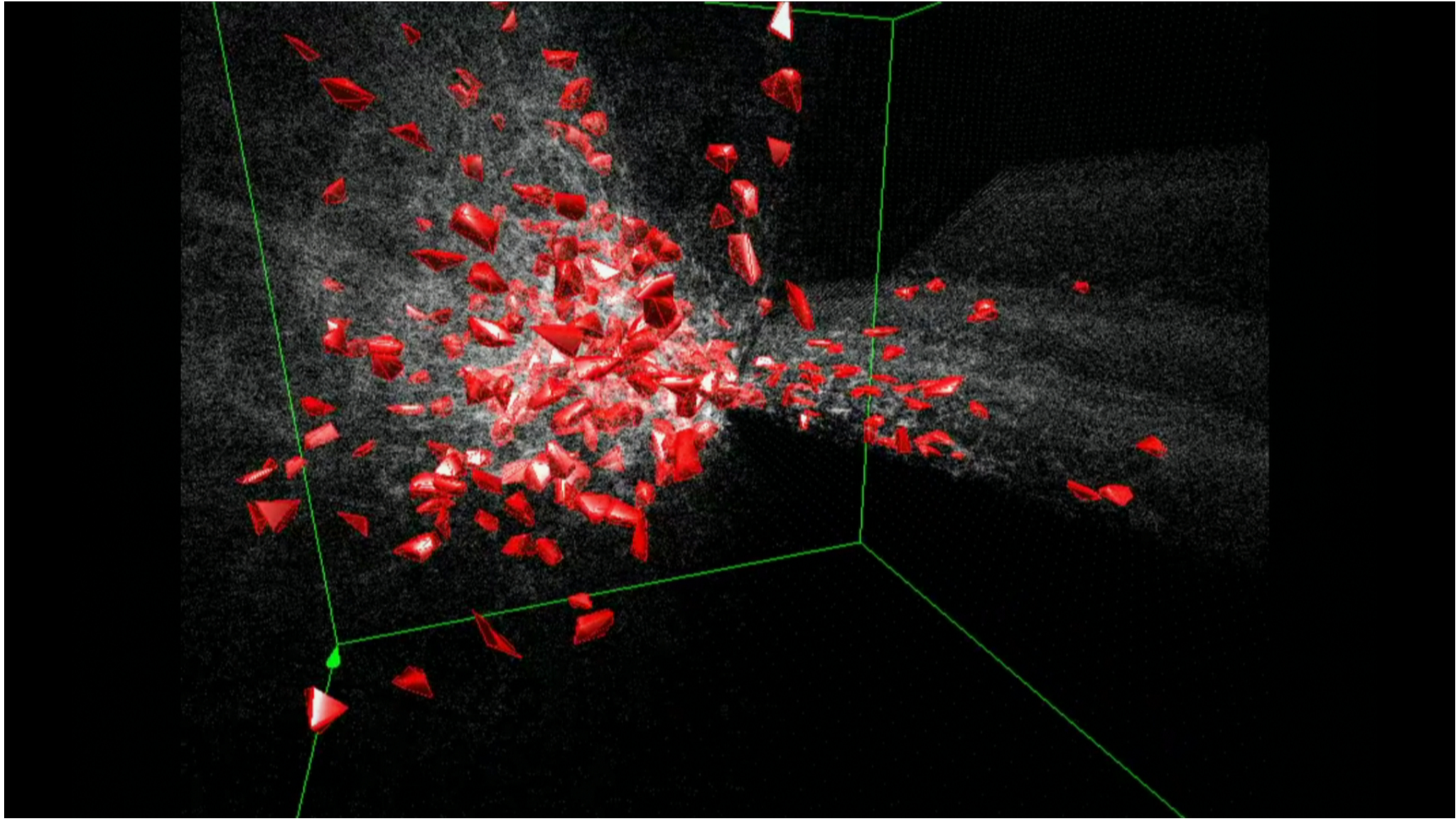
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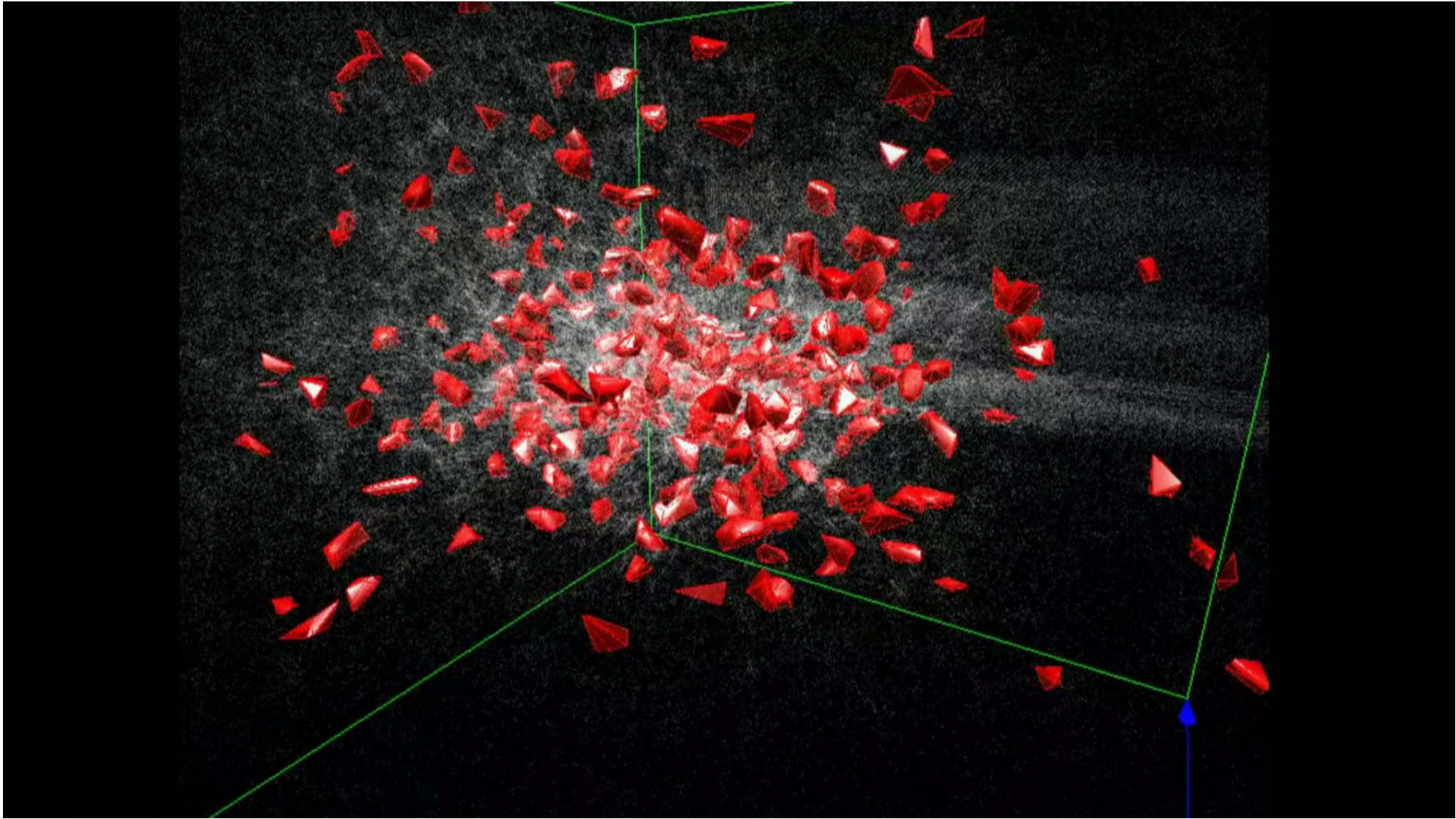


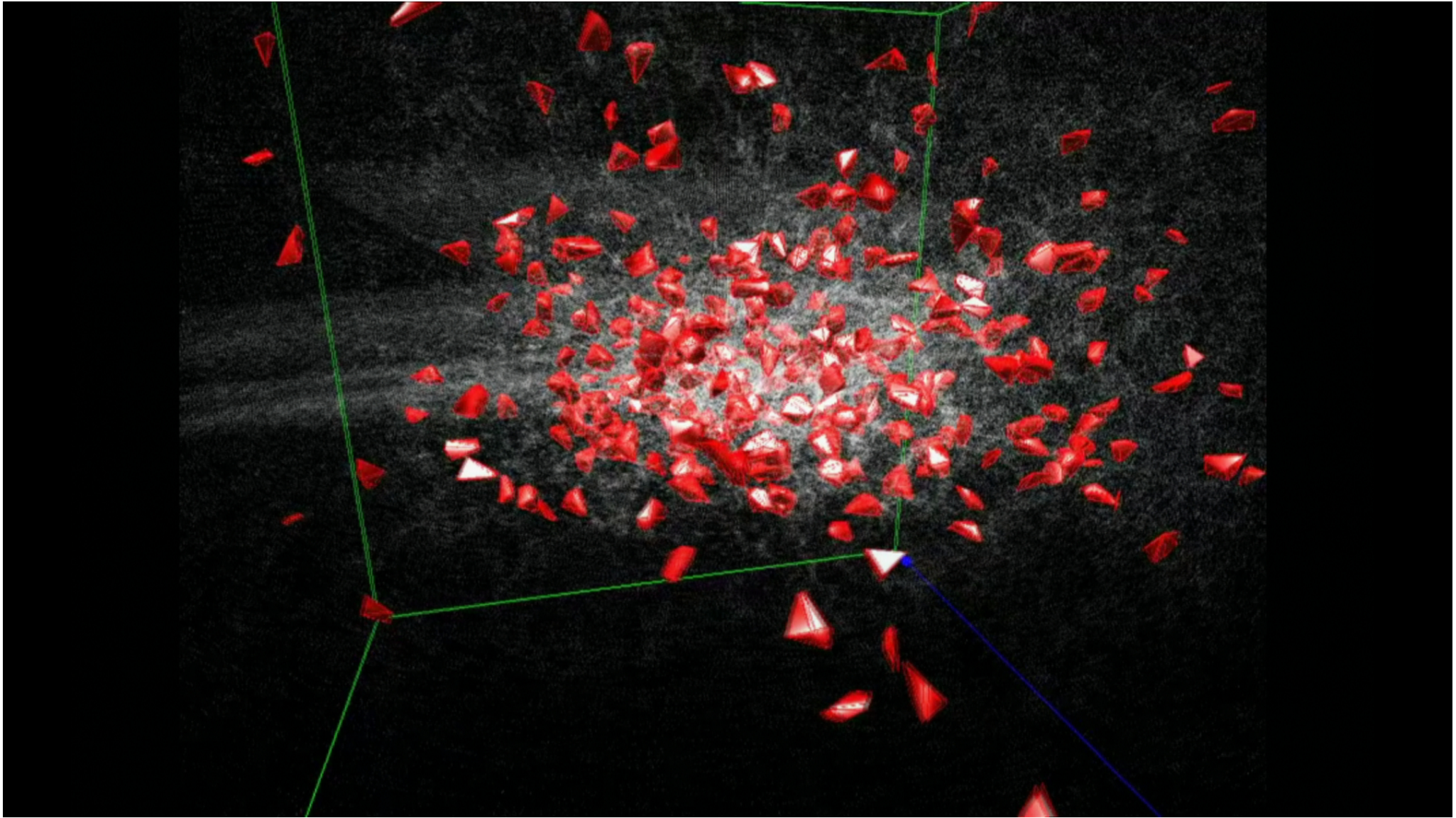


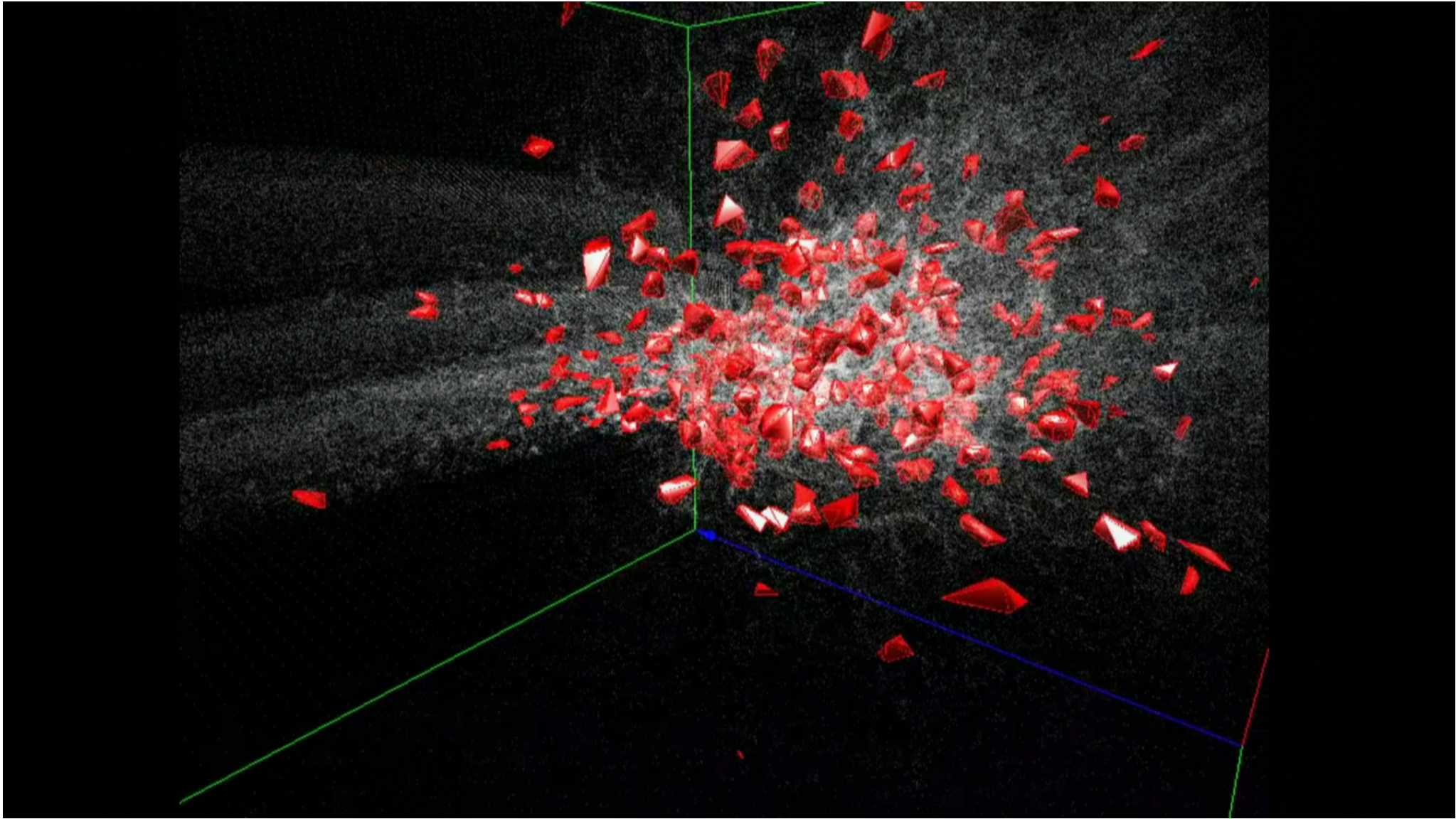


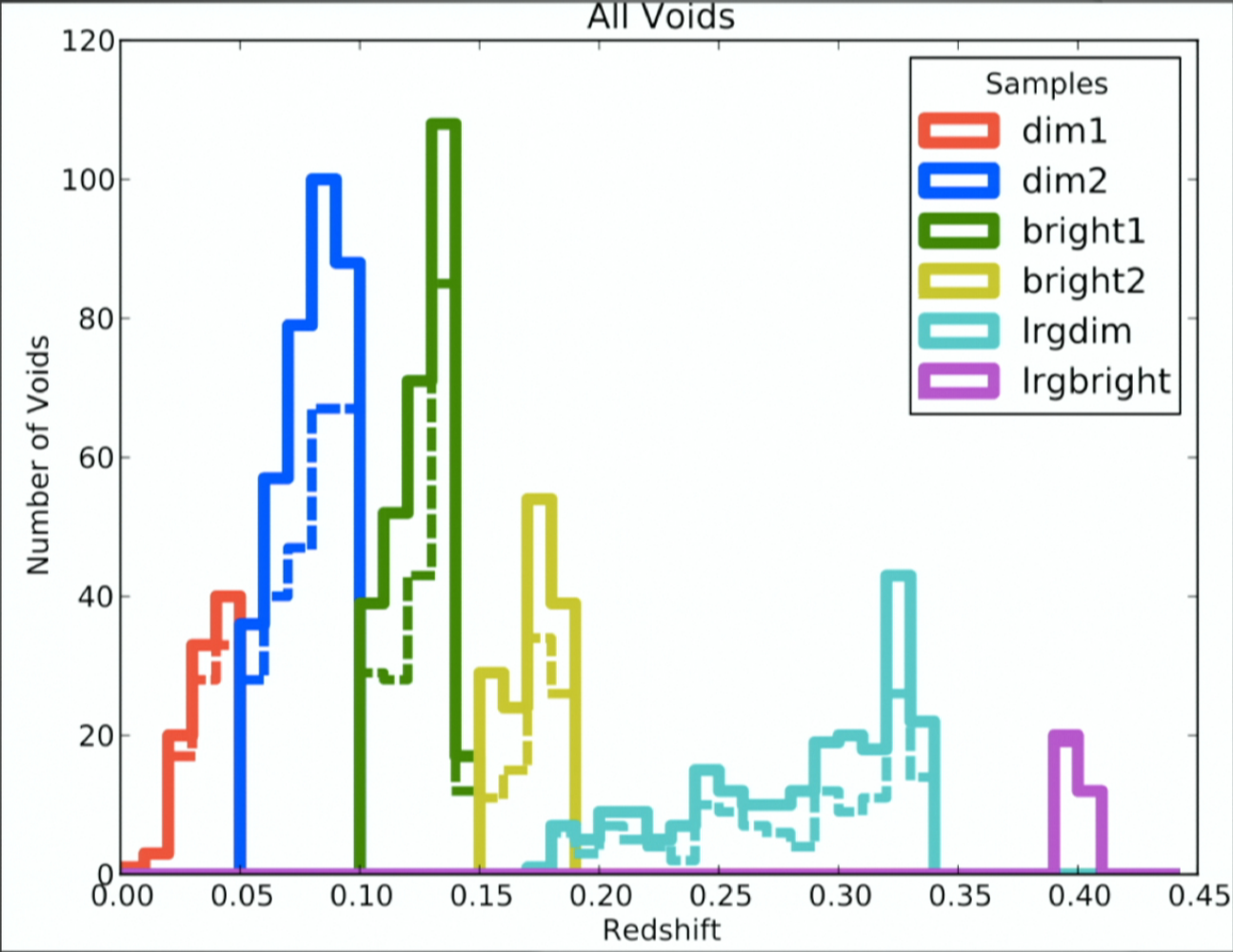


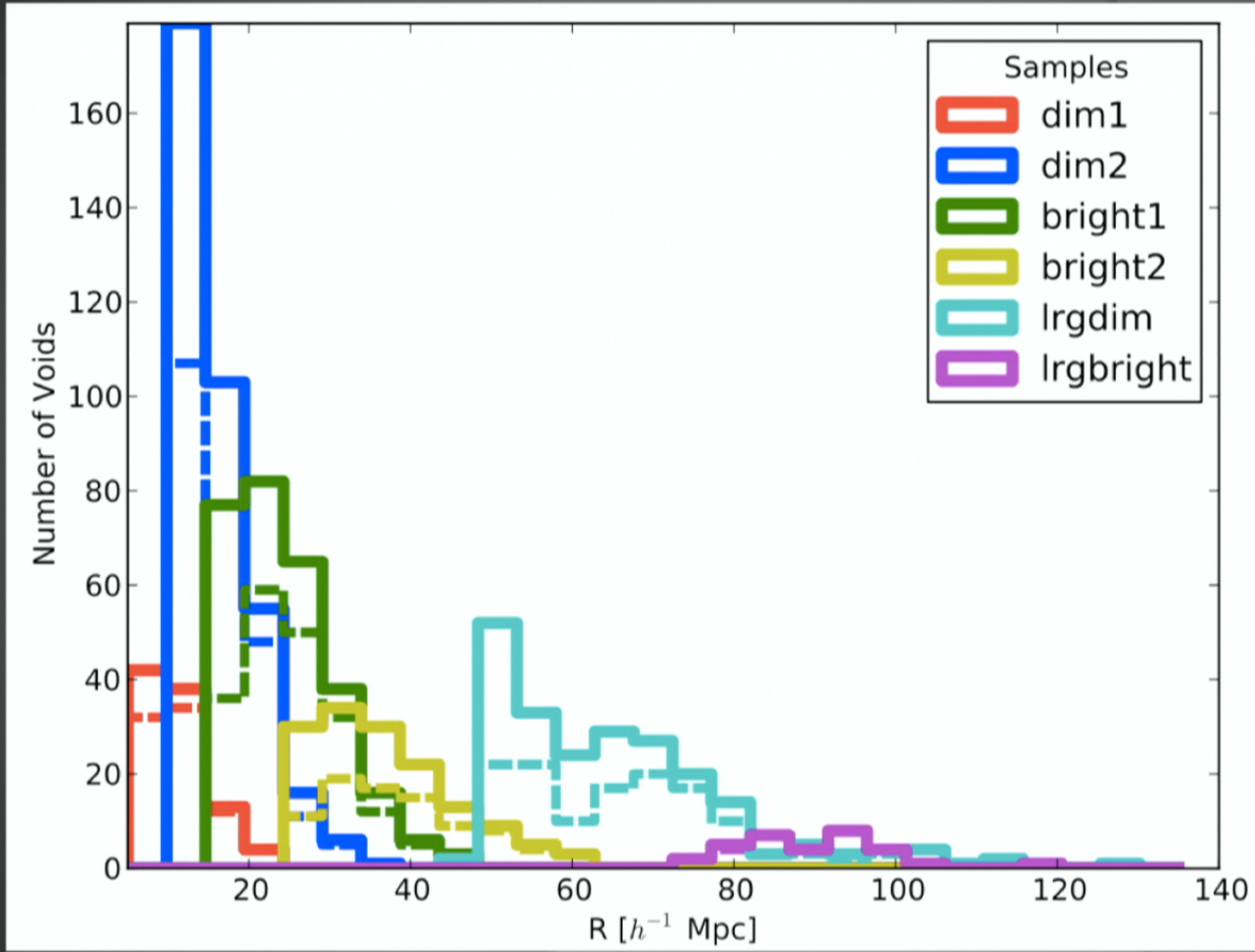




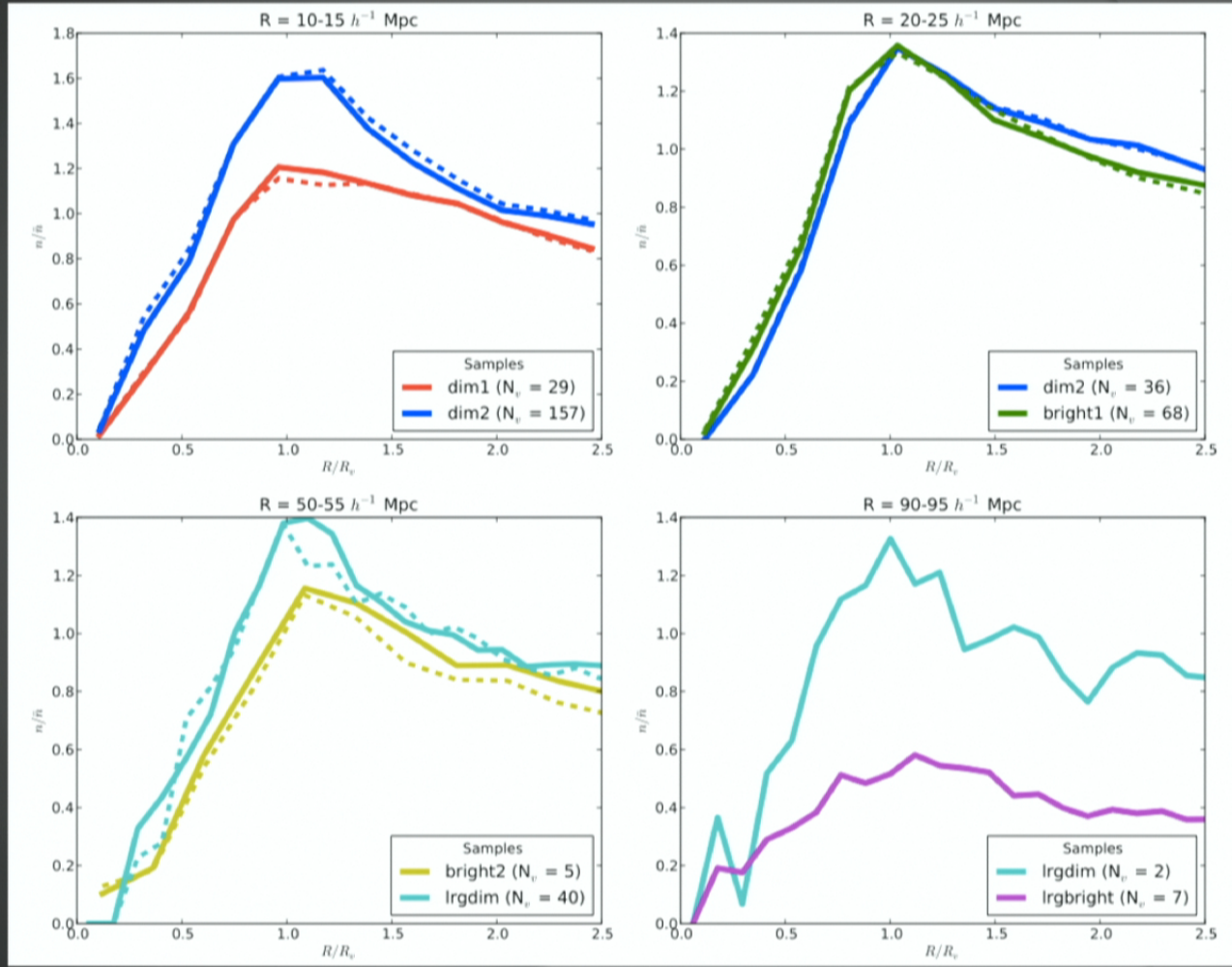


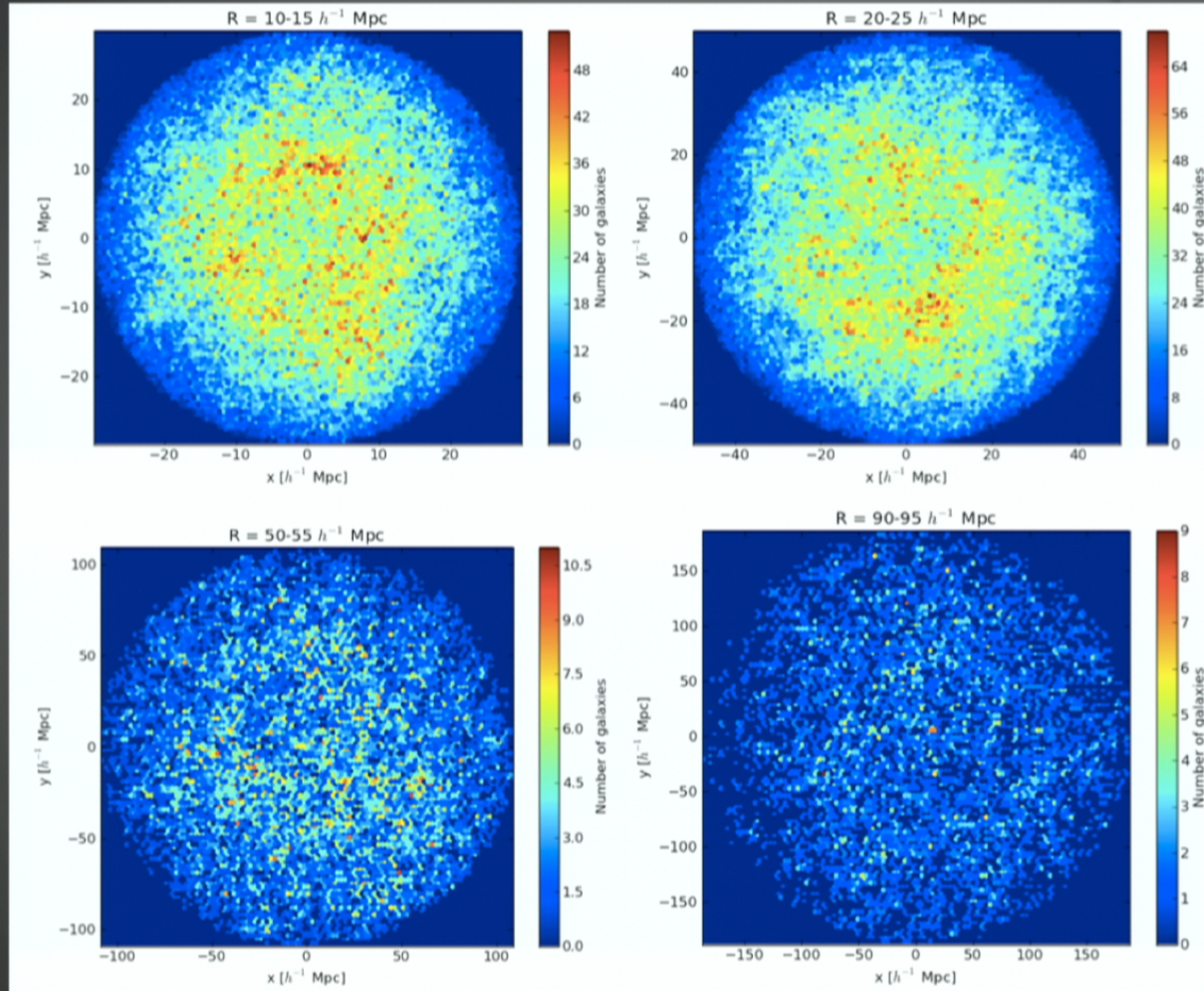




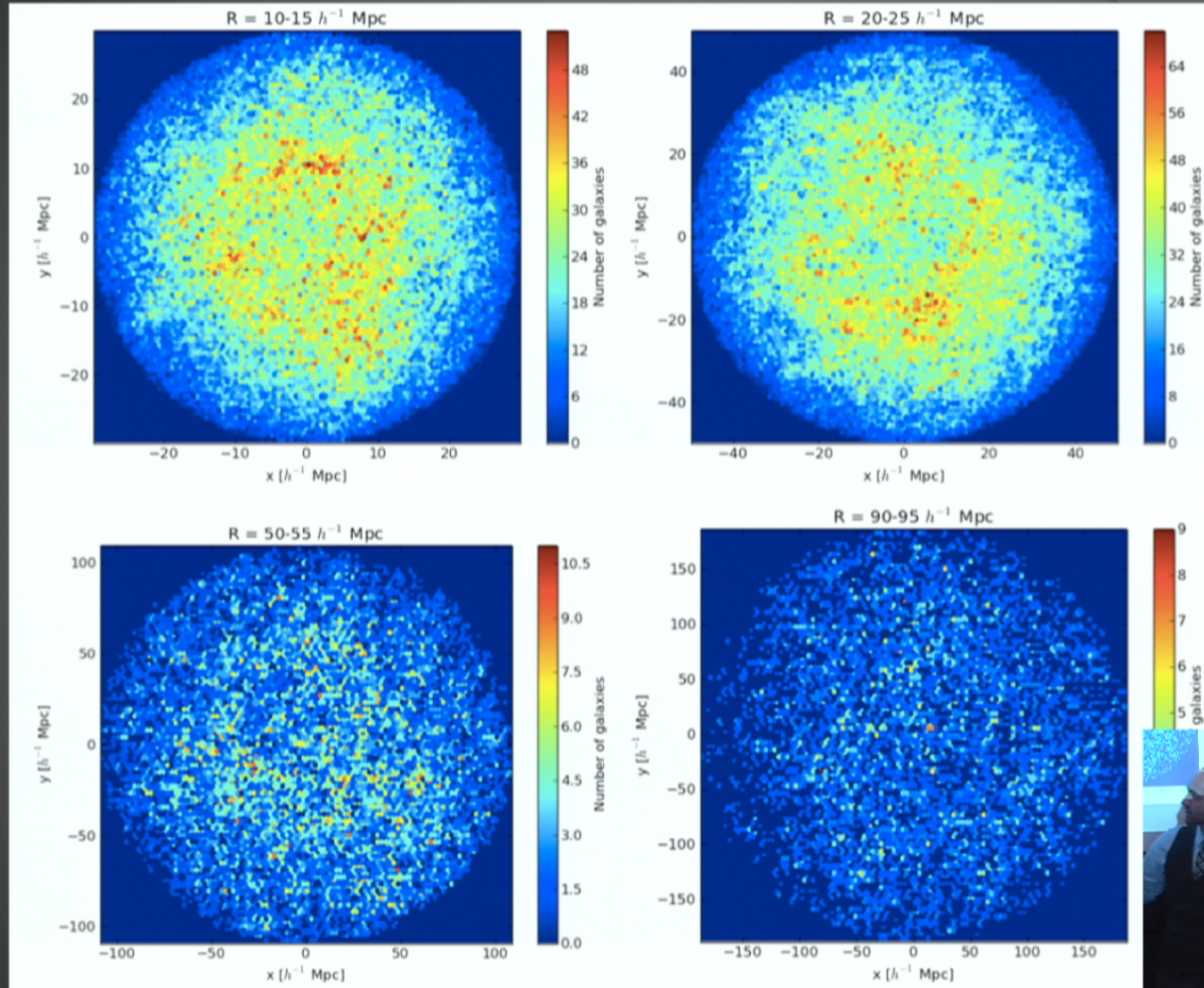


one dimensional profiles





density projections



<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*)

the Alcock-Paczynski test (*Ryden 1995*)

integrated Sachs-Wolfe effect (*Granett et al. 2008*)

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

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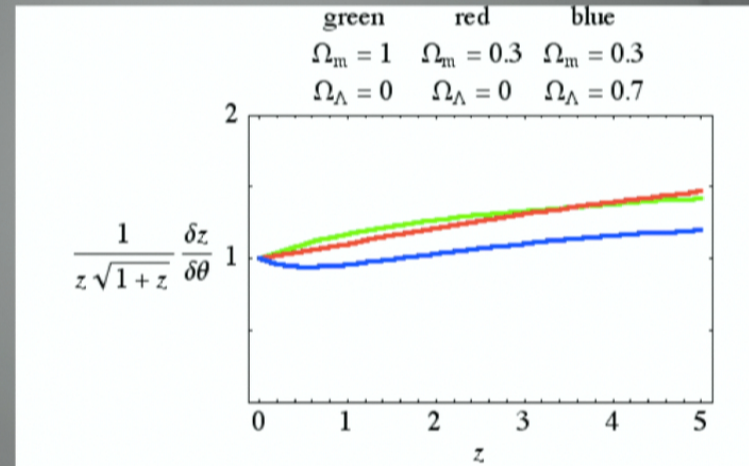
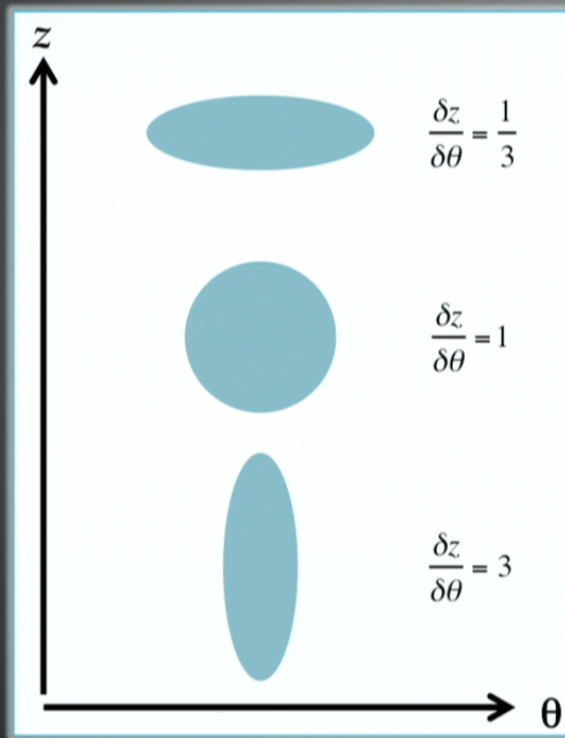
origins of large-scale magnetic fields (*Neronov & Vovk 2010*)

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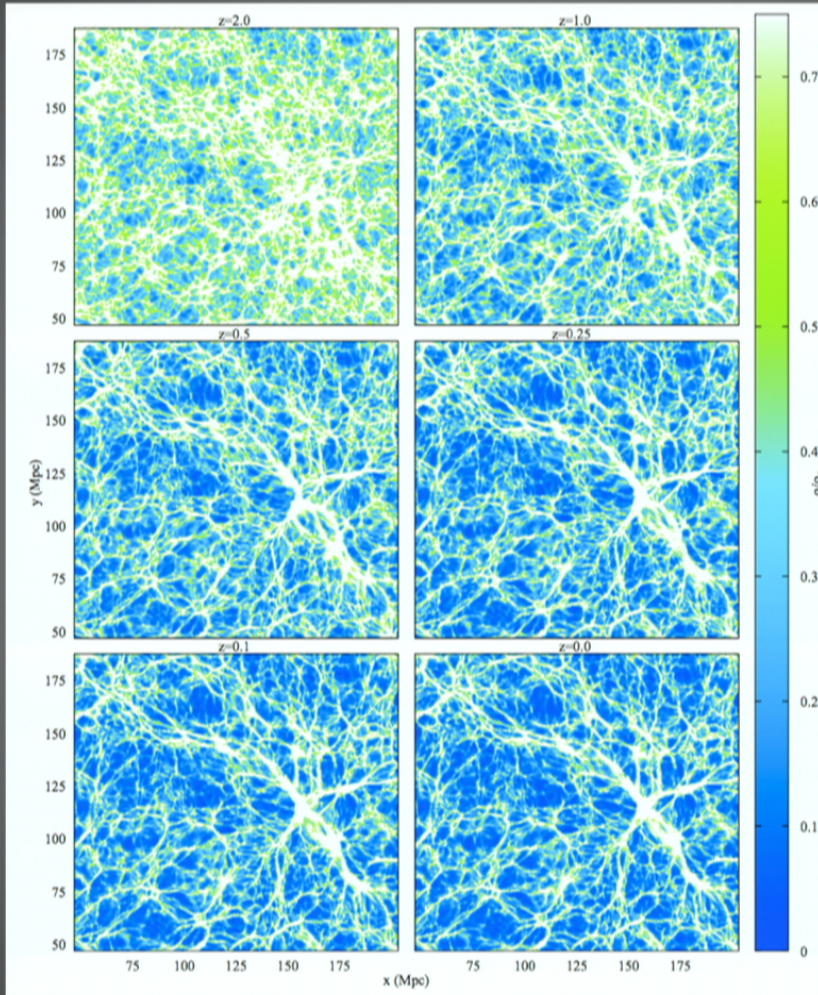
the alcock-paczynski test probes cosmology

$$\frac{\partial z}{\partial d} = \left(\frac{H_0}{c}\right)^2 \frac{D_A(z)}{z f'_k(\chi(z))} E(z) = \left(\frac{H_0}{c}\right)^2 \frac{D_A(z) E(z)}{z}$$

(Alcock & Paczynski 1979)

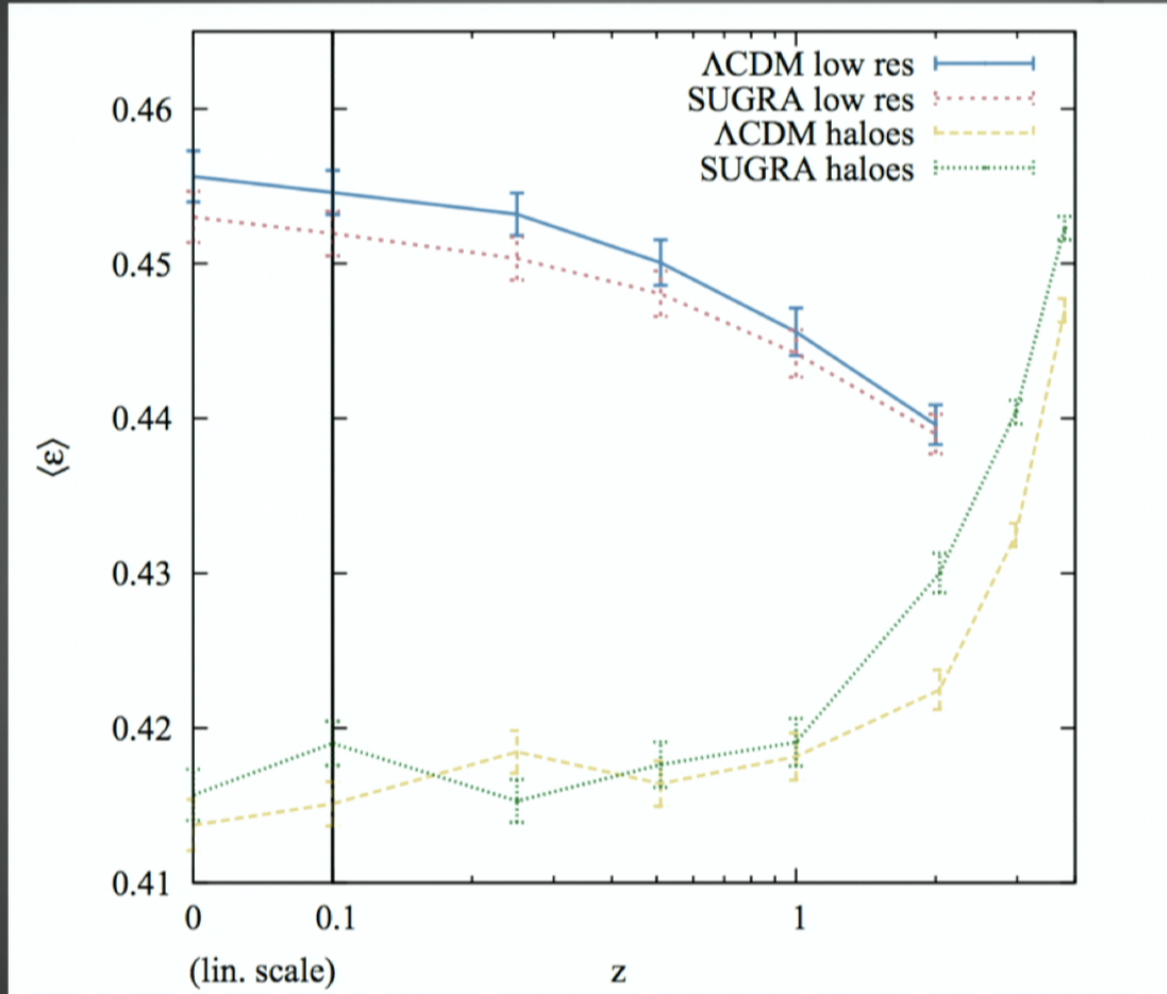


void shapes probe cosmology



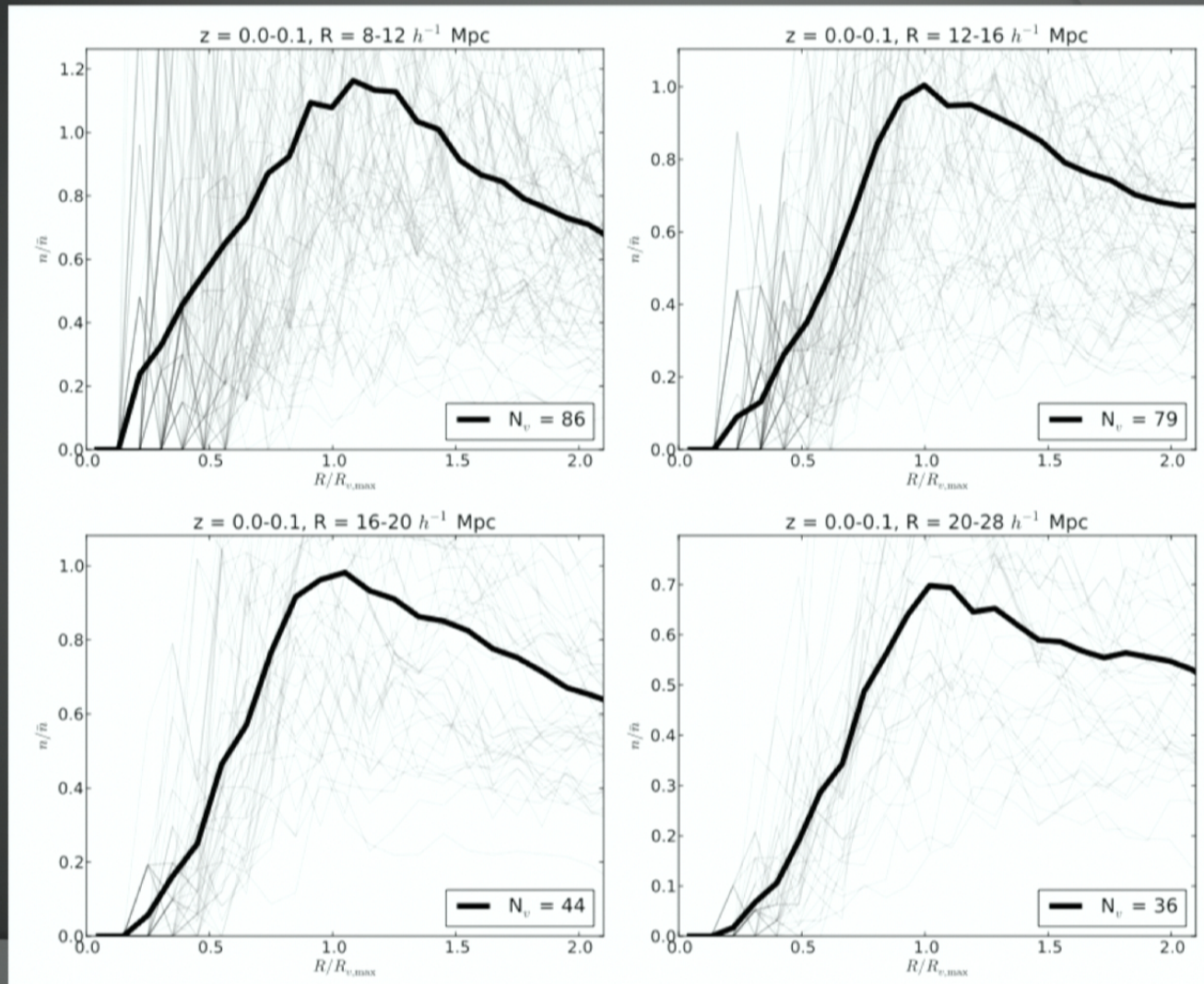
(Bos et al. 2012)

hopeless?



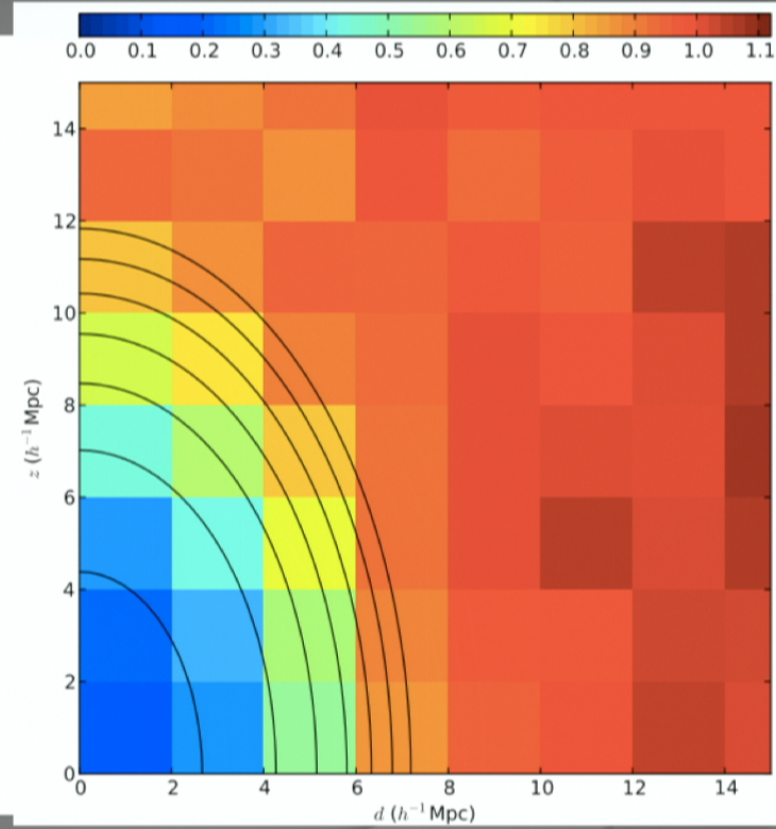
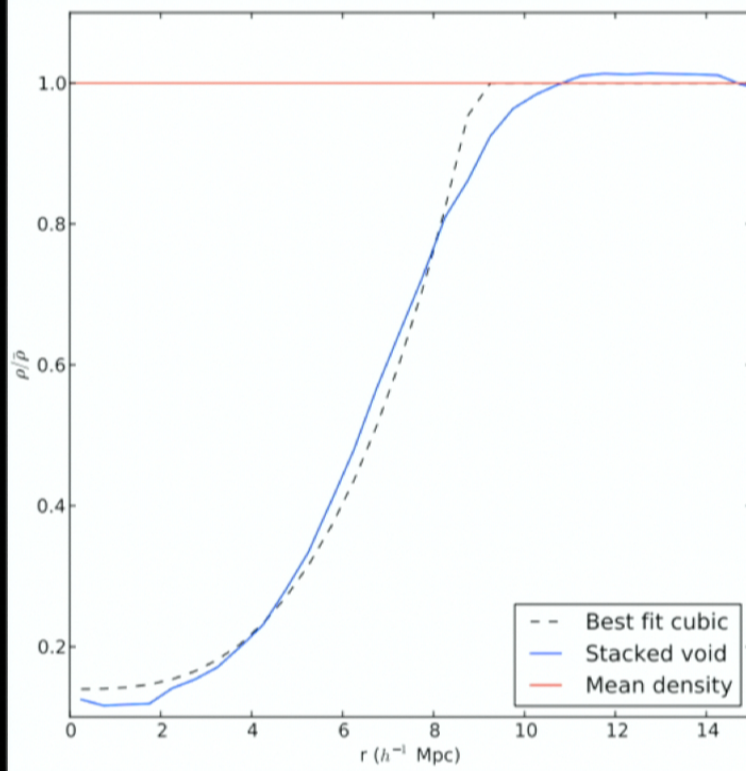
(Bos et al. 2012)

stacking is necessary



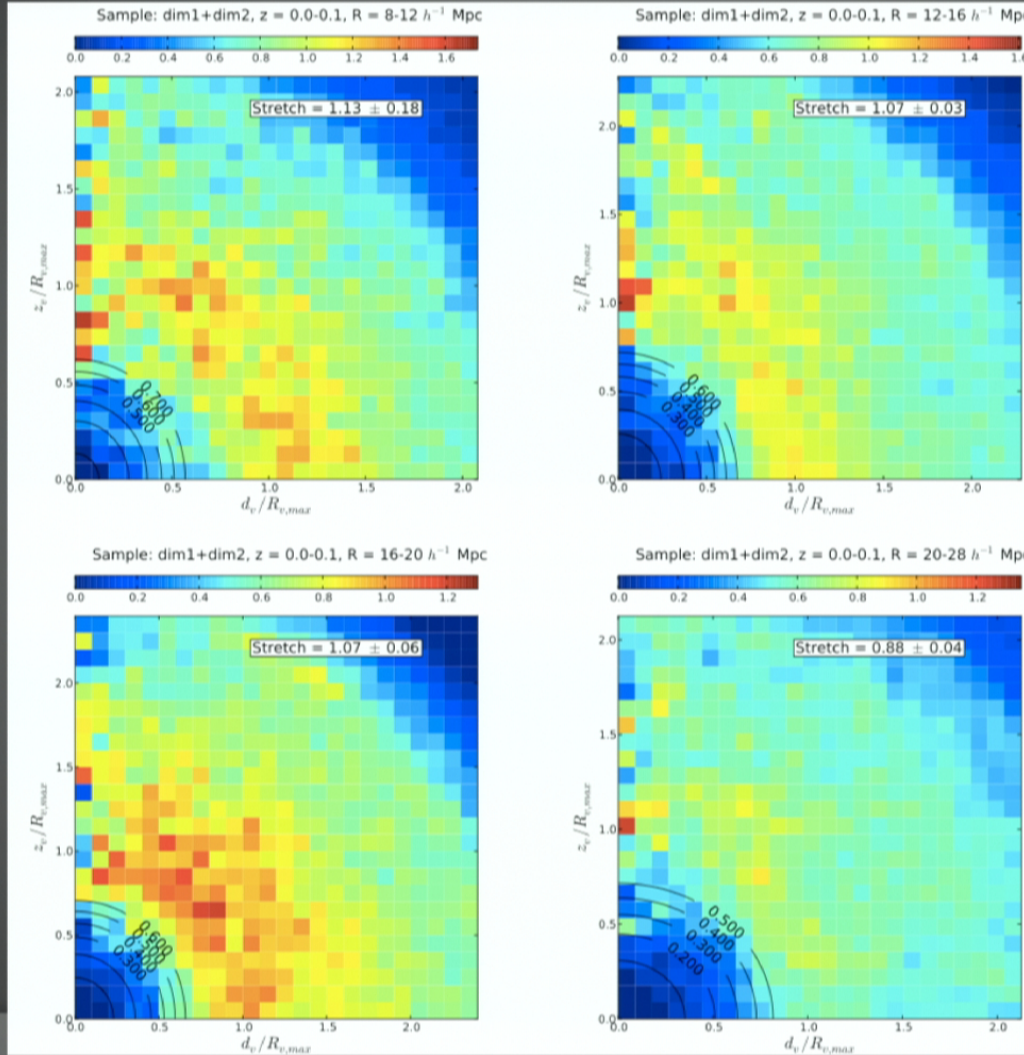
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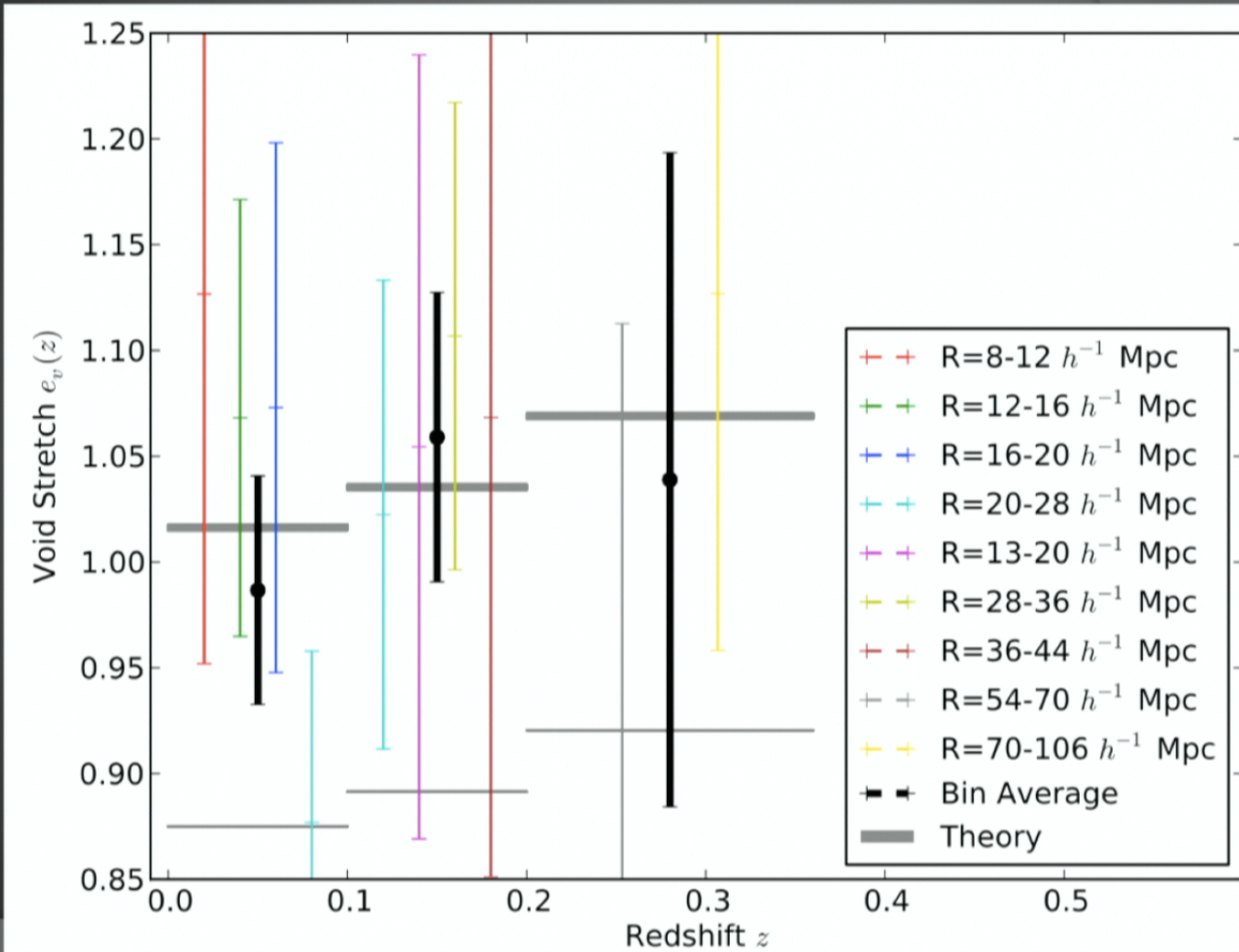
fitting ellipses to void stacks



(Lavaux & Wandelt 2012)

stacked voids from observations





- robust void determination
- public void catalog
- fundamental and derived void properties available

- hints of A-P signal in SDSS

- need more robust profiling
- need more data
- need to determine optimum stacking, sampling, survey design

