

Building mock galaxy catalogues: overview

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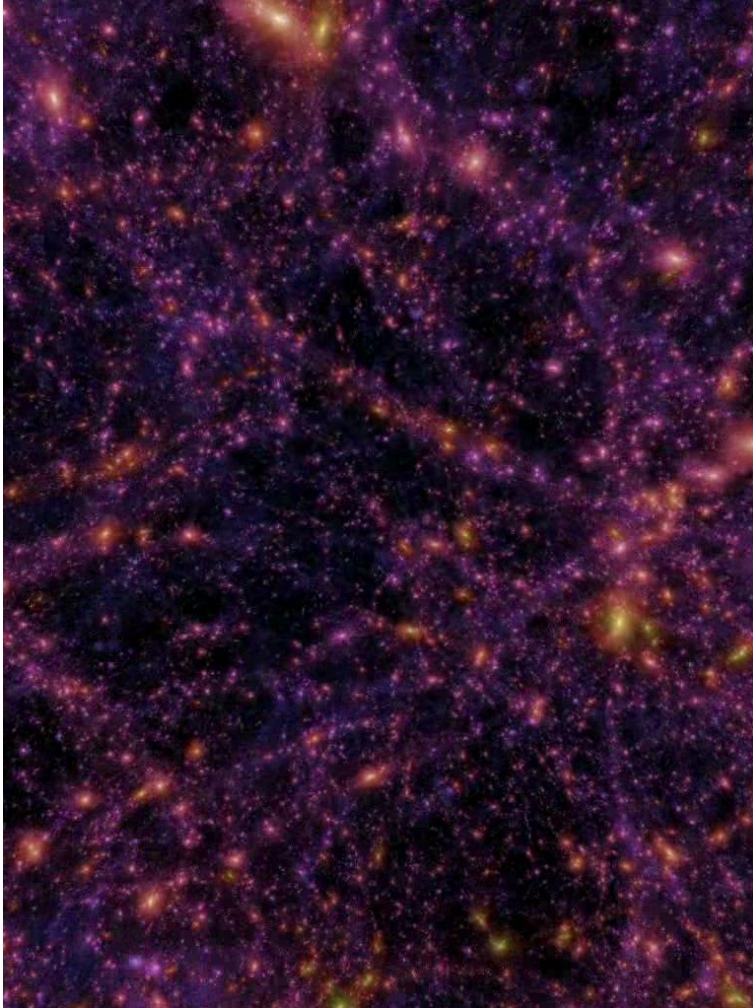
Durham PS1SC Extragalactic Workshop
7th - 9th January 2013



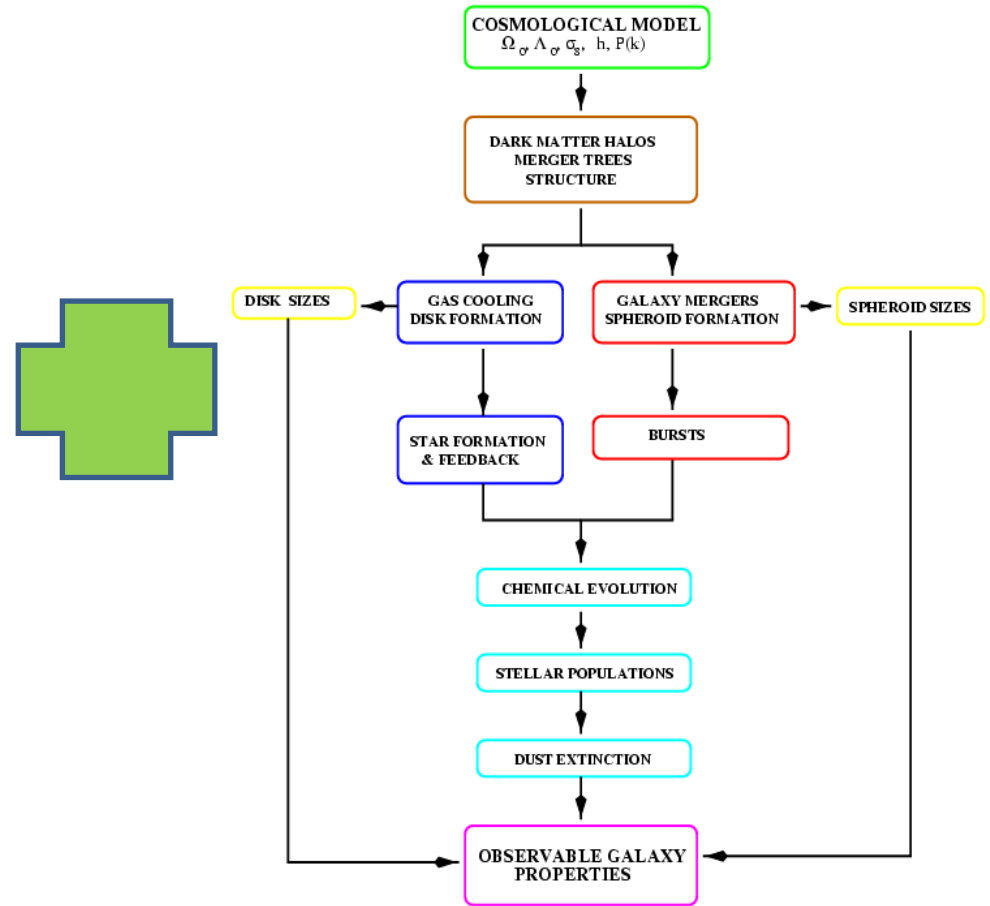
Mock catalogues: Why?

- Test galaxy formation models
- Test algorithms – validation (e.g. group finding, photo-z, projected clustering)
- Test processing pipelines
- Test survey performance (e.g. dark energy FoM)

Basic ingredients of mocks

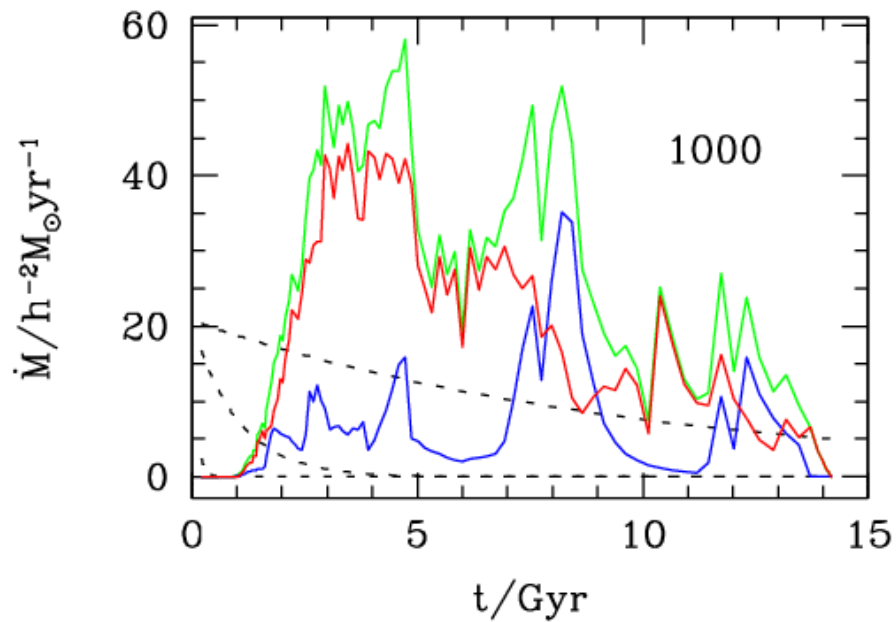


N-body simulation

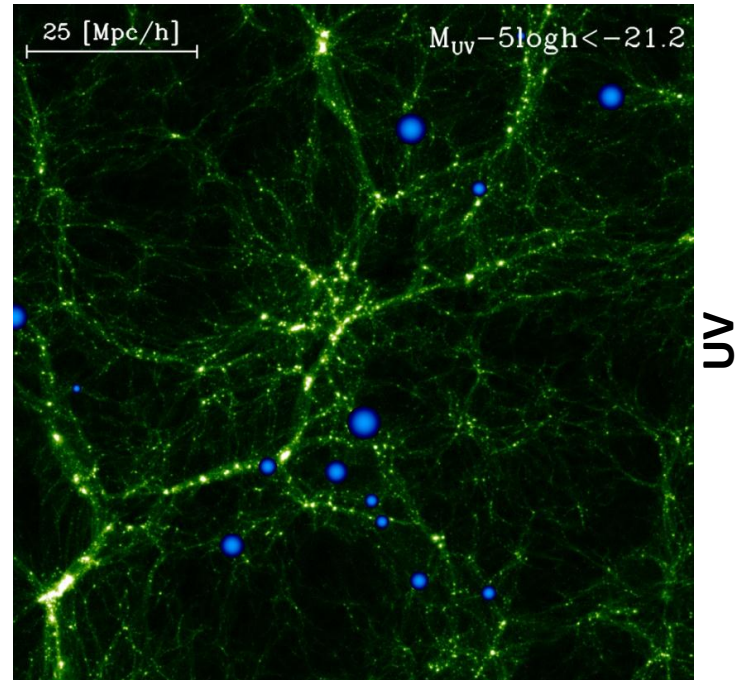
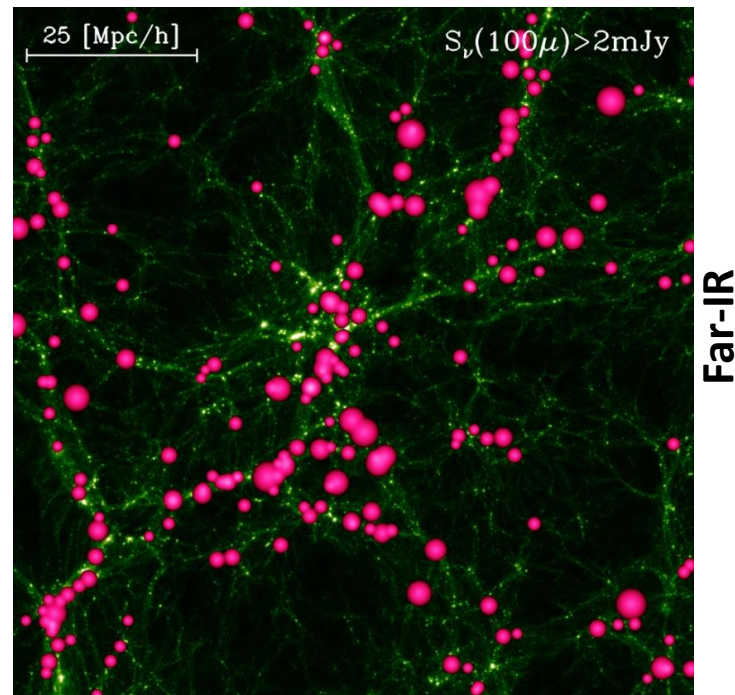


Galaxy formation simulation

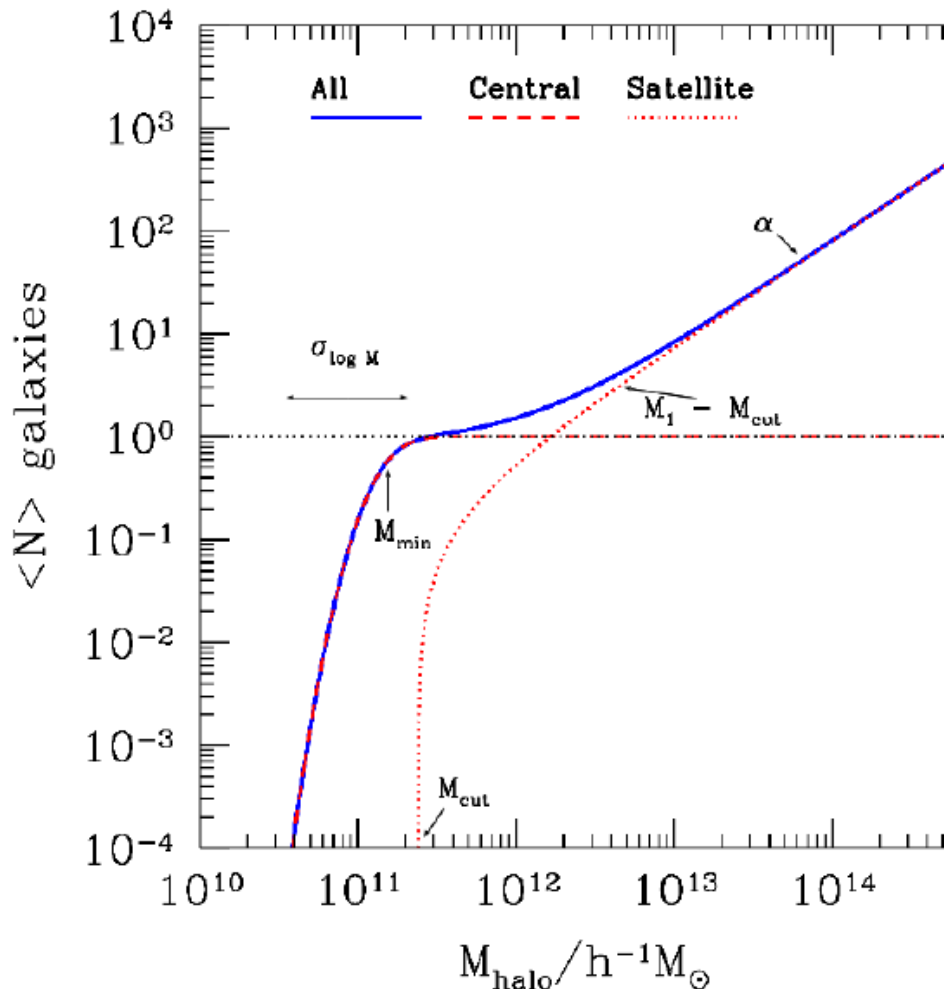
**Models predict
star formation, metal enrichment
and merger histories:
multi-wavelength predictions**



Lacey et al 2009

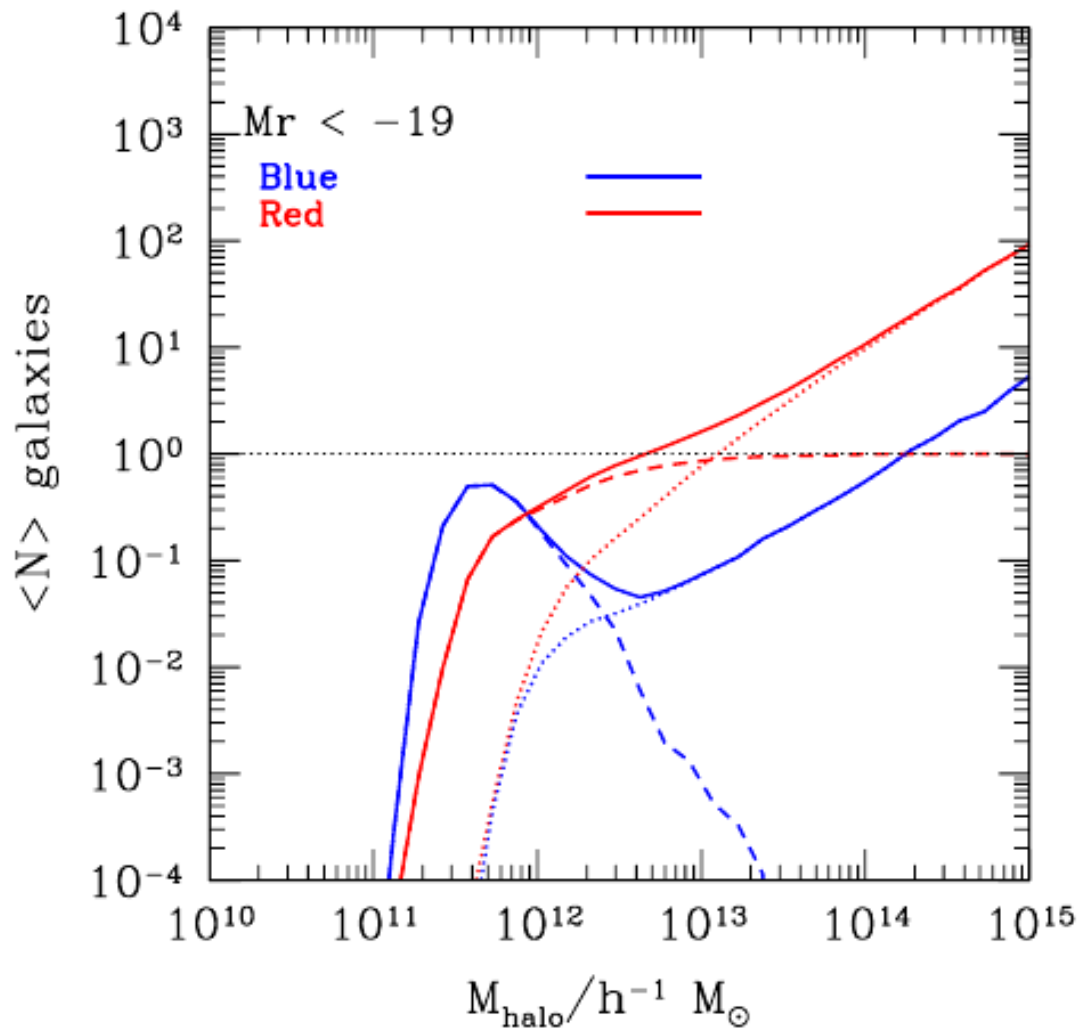


Why semi-analytics? Why not HOD?



- HOD quantifies mean number of galaxies per halo
- Fit to measured clustering and counts
- Step fn for centrals, power-law for satellites

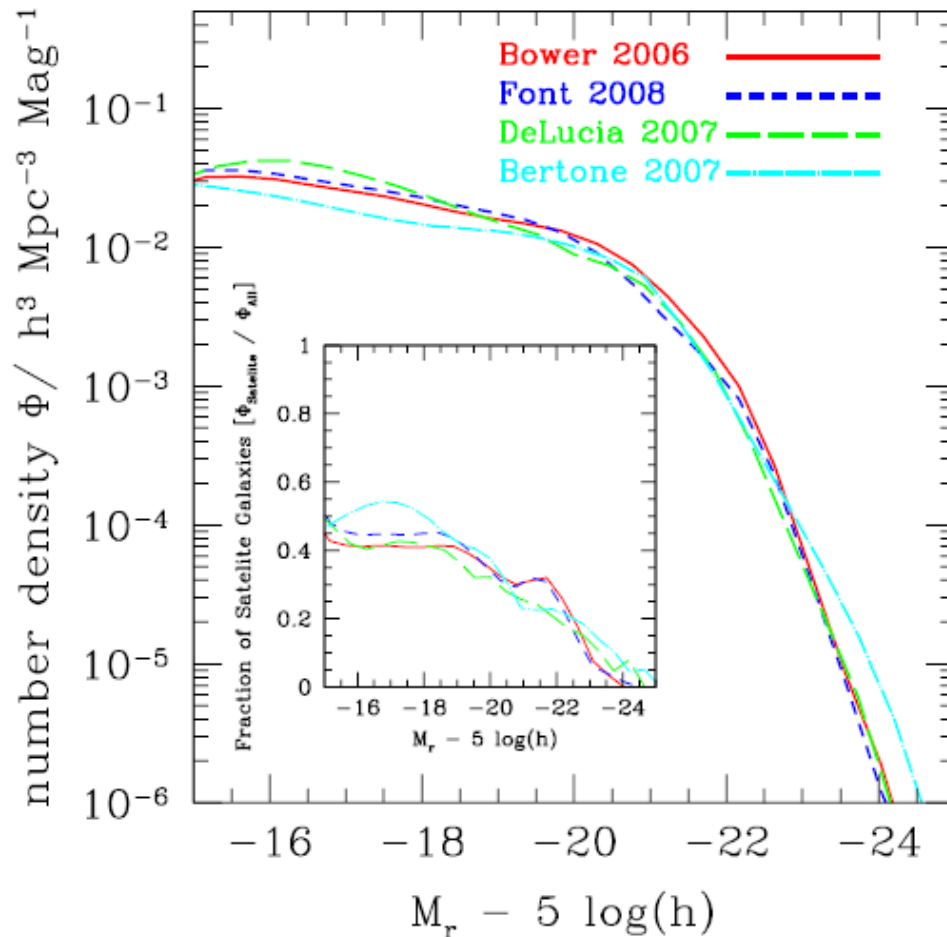
Why semi-analytics? Why not HOD?



- Models predict HOD
- Form depends on selection
- Blue/SFR/cold gas selections have peaked HOD for centrals
- Red galaxies show slow rise in $\langle N \rangle$

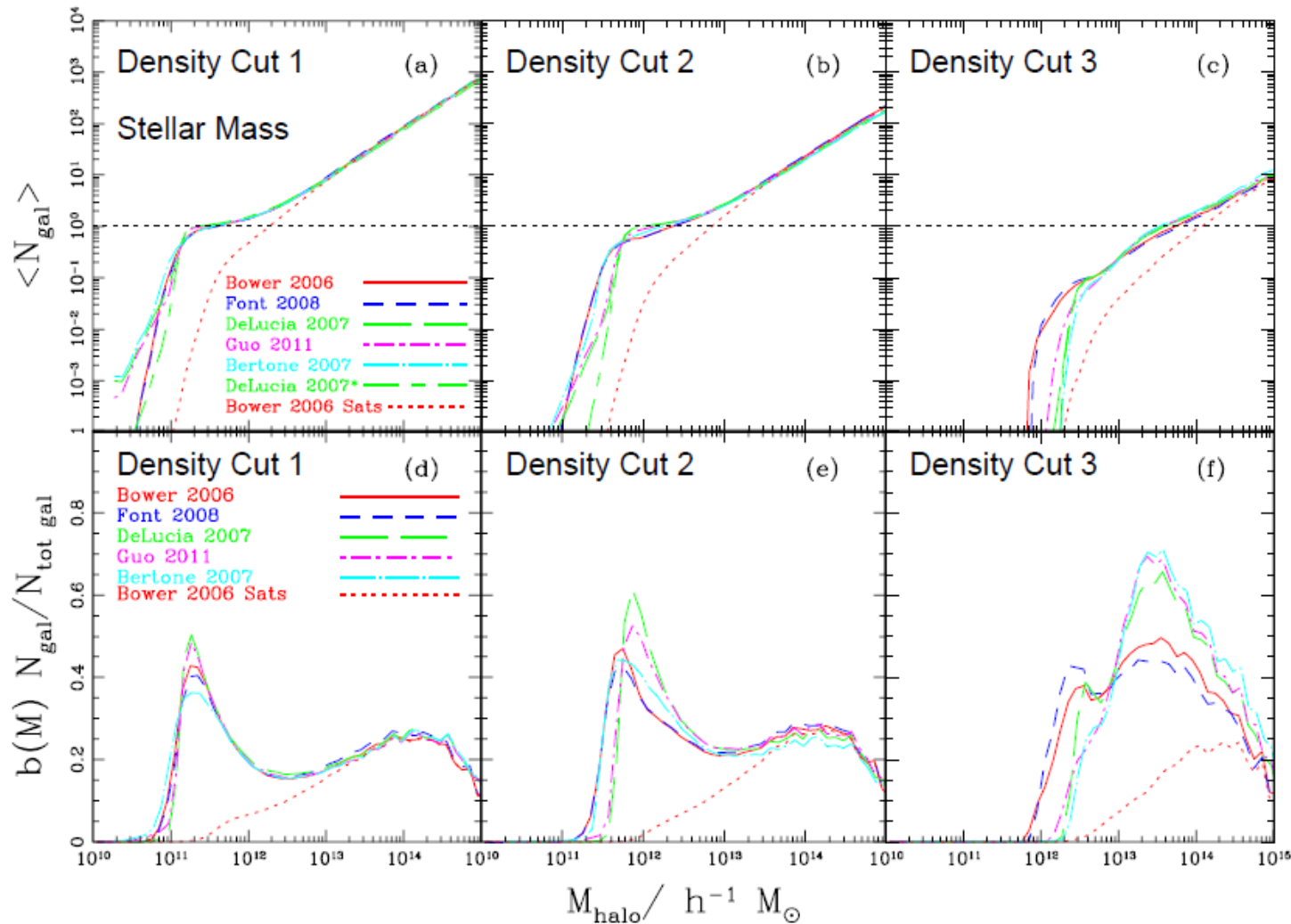
Why should you believe any of this?

Comparison of model predictions

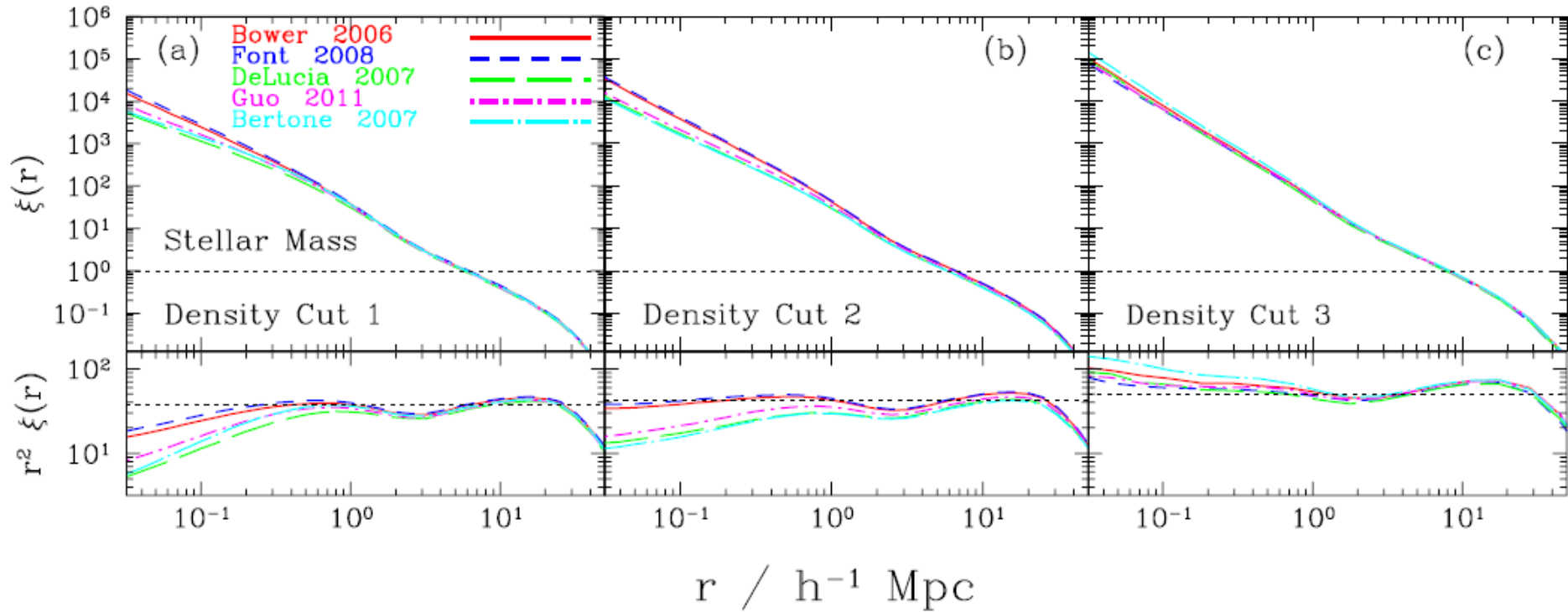


- Compare models from different groups using Millennium Simulation database.
- Same N-body
- Different halo merger histories
- Same physics, different implementations
- Different observations used to fit parameters

Do the models put the same number of galaxies in each halo?



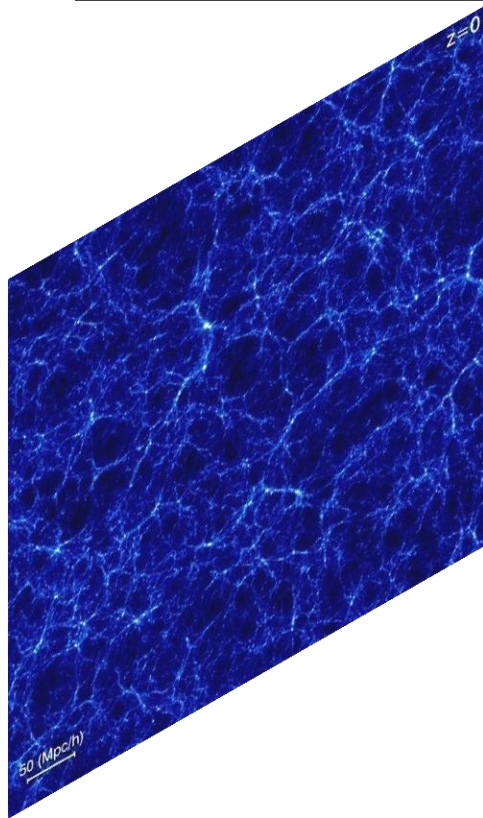
Robust predictions for clustering



Mock catalogues: How?

STEP 1

N-body simulation

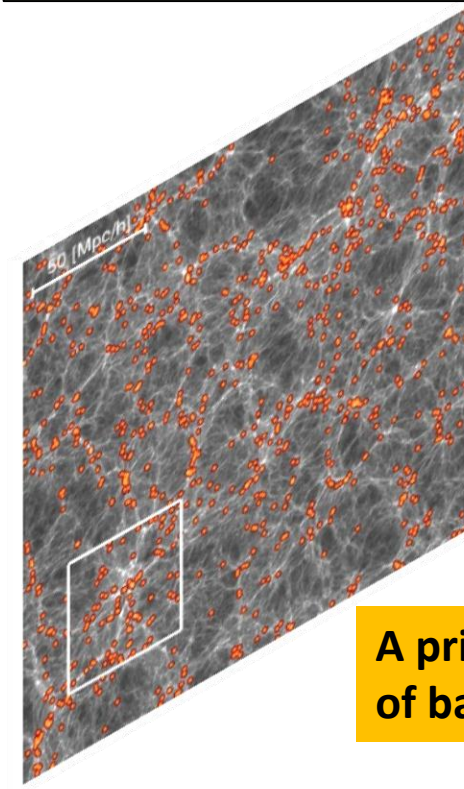


Millennium, Horizon, MICE, MXXL



STEP 2

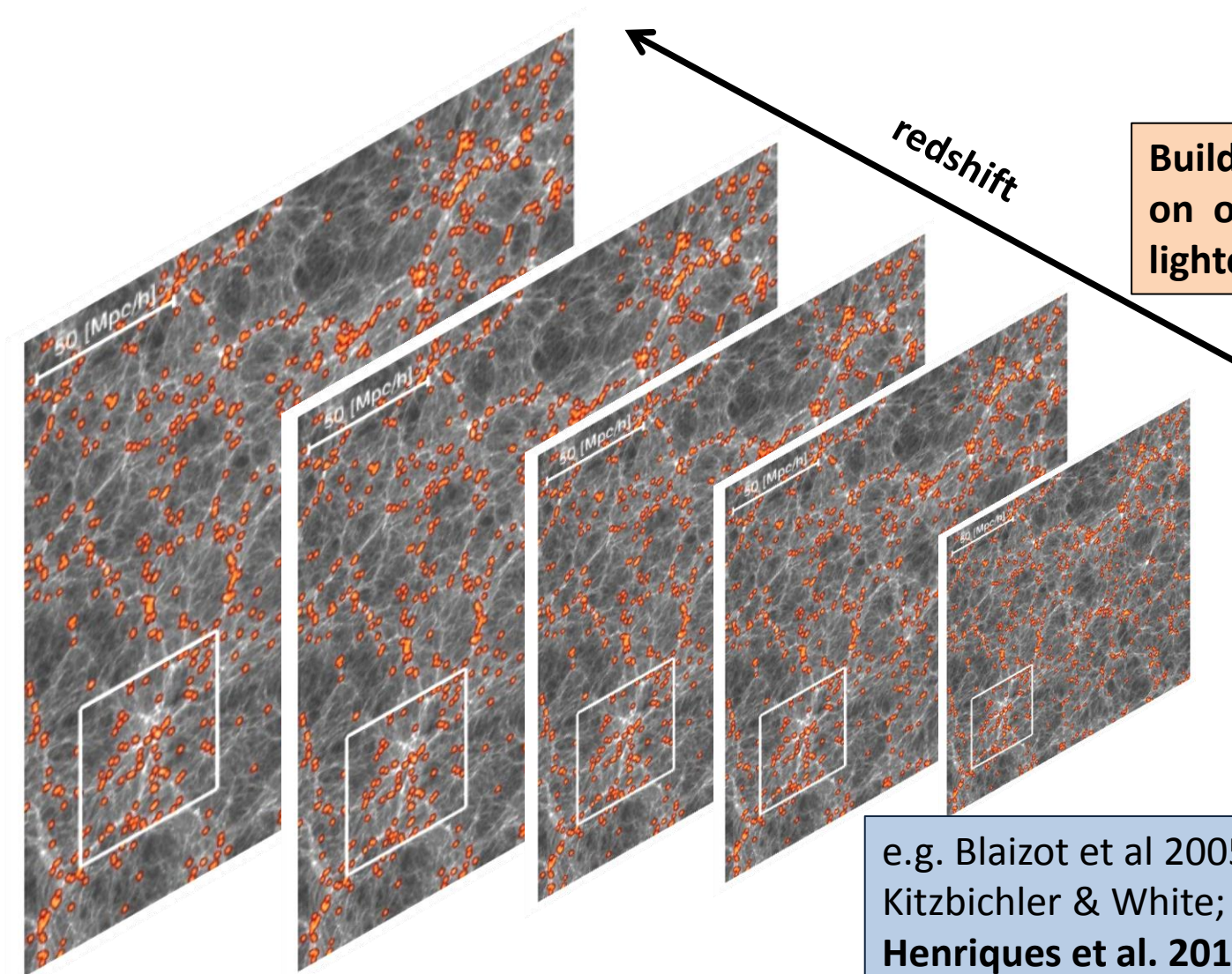
Combine with galaxy formation model



A priori calculation of baryon physics

e.g. GALFORM; GALICS, LGALAXIES; MORGANA

Constructing observer's past lightcone



STEP 3

Build galaxy catalogue
on observer's past
lightcone.

e.g. Blaizot et al 2005; Fosalba et al.
Kitzbichler & White; **Merson et al. 2012**
Henriques et al. 2012

Mock Images

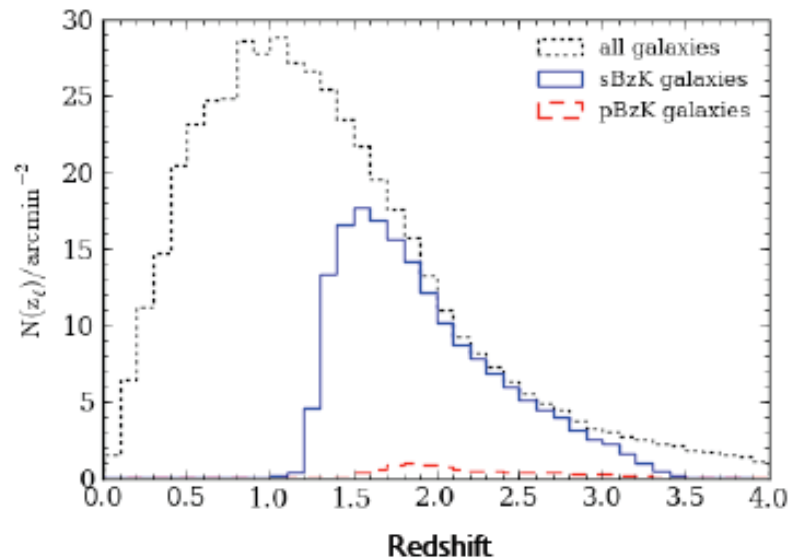
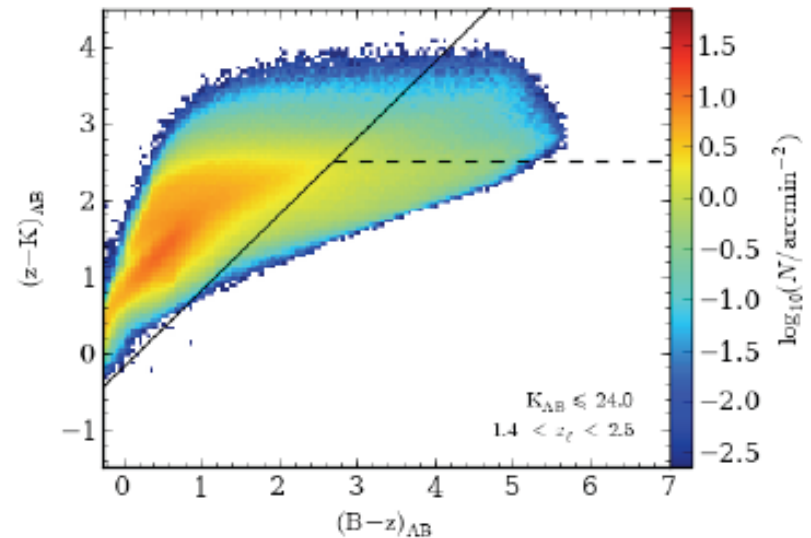
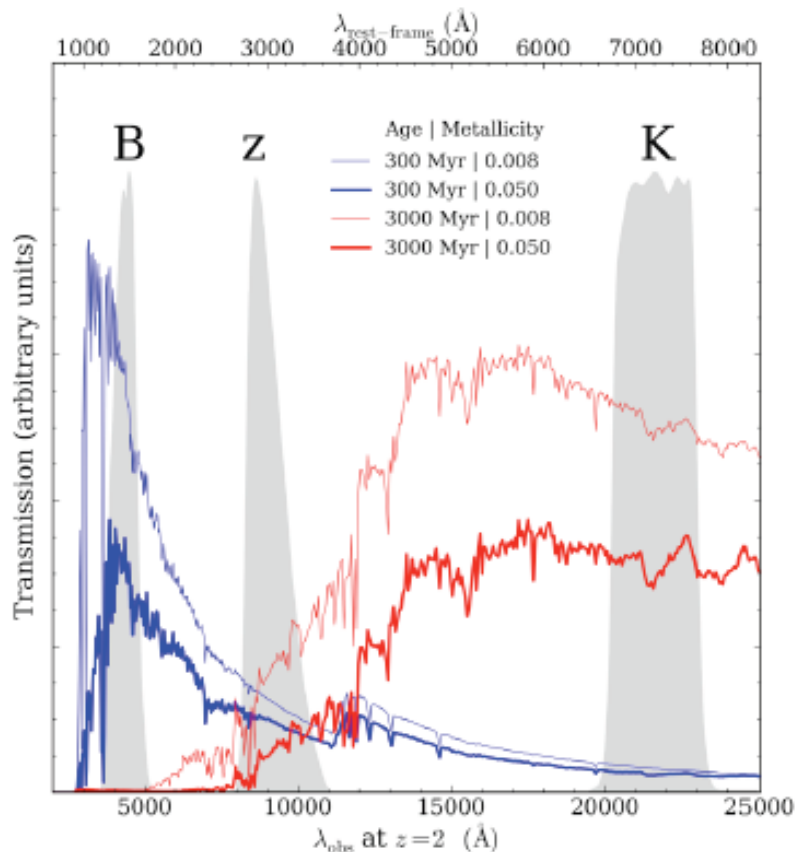


Daniel Farrow (Durham)

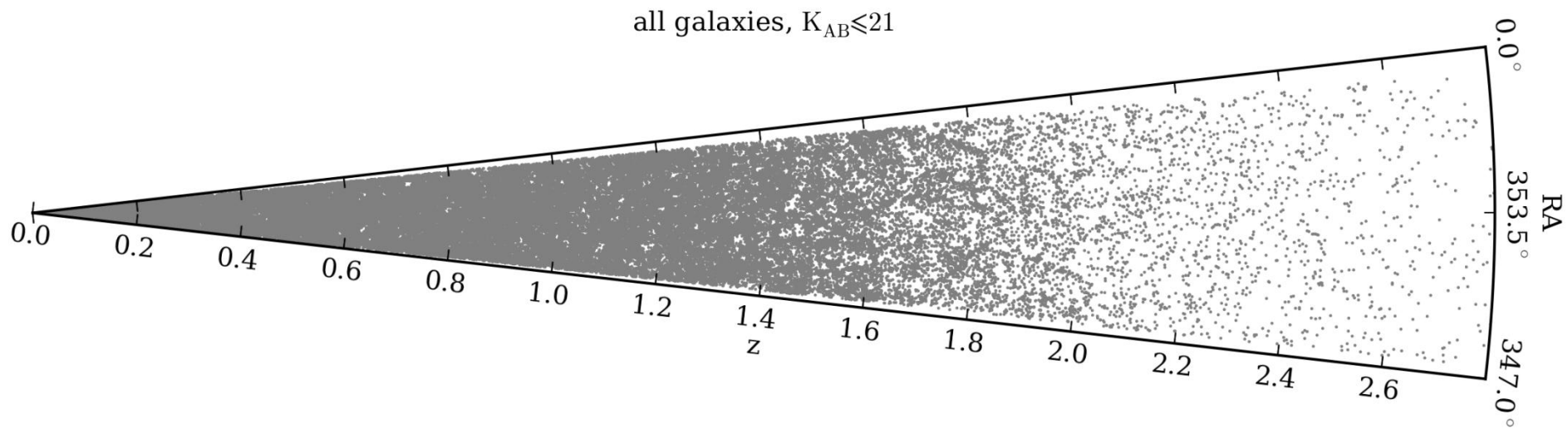
PanSTARRS gri image

Galaxy Colour Selections

- BzK selection (Daddi et al. 2004)
- select star-forming & passive galaxies at $1.4 < z < 2.5$

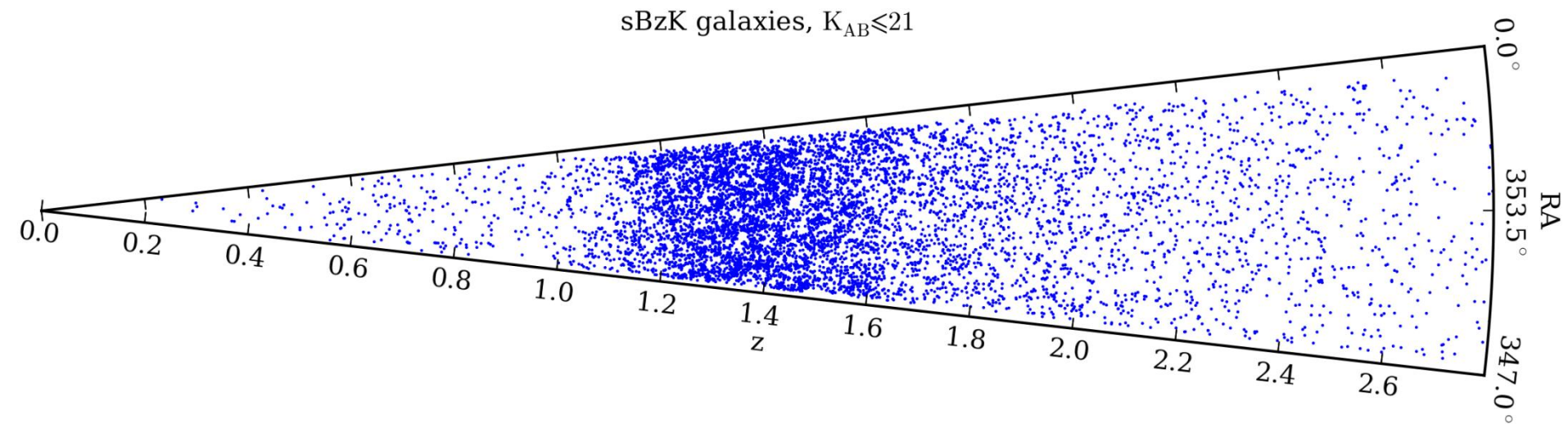


Mocks in action: K-selected galaxies

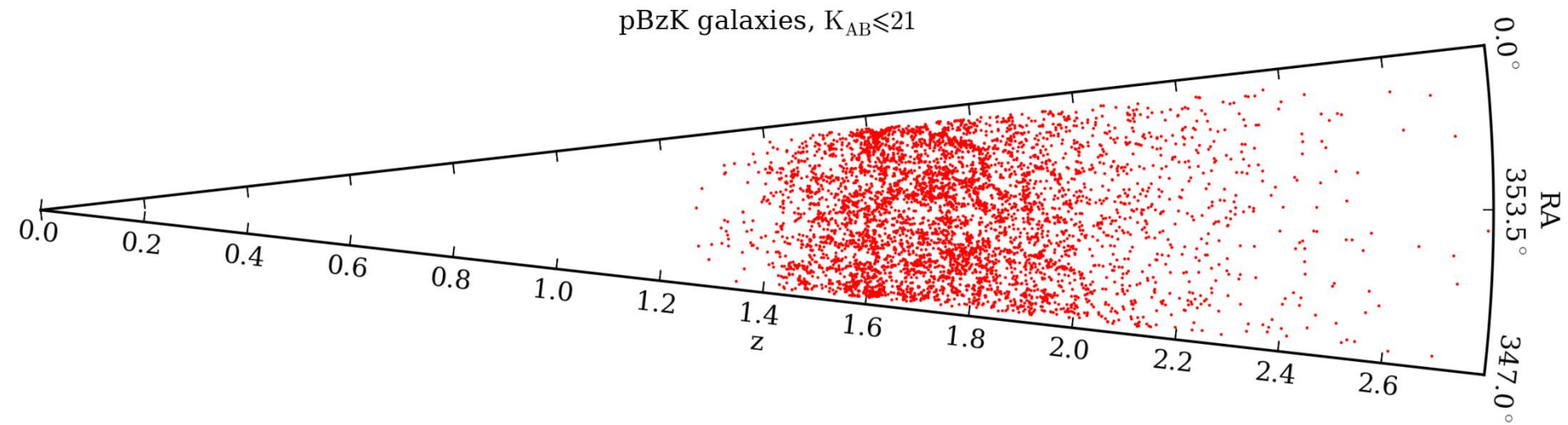


Merson et al. 2013, MNRAS, in press. arXiv:1206.4049

Star forming galaxies: BzK colour selection

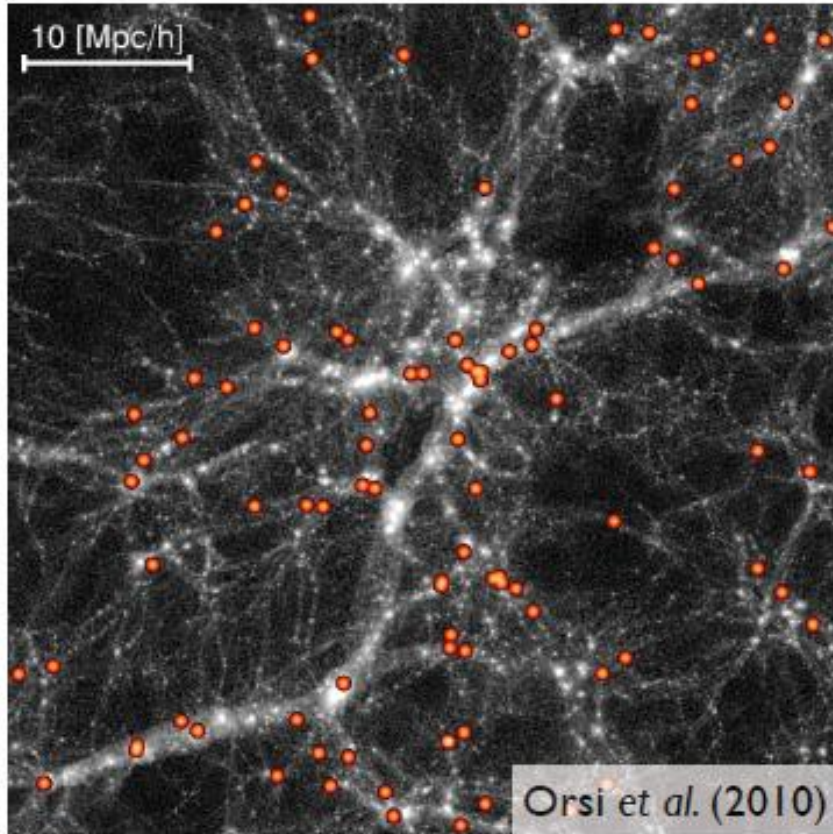


Passive galaxies: BzK colour selection

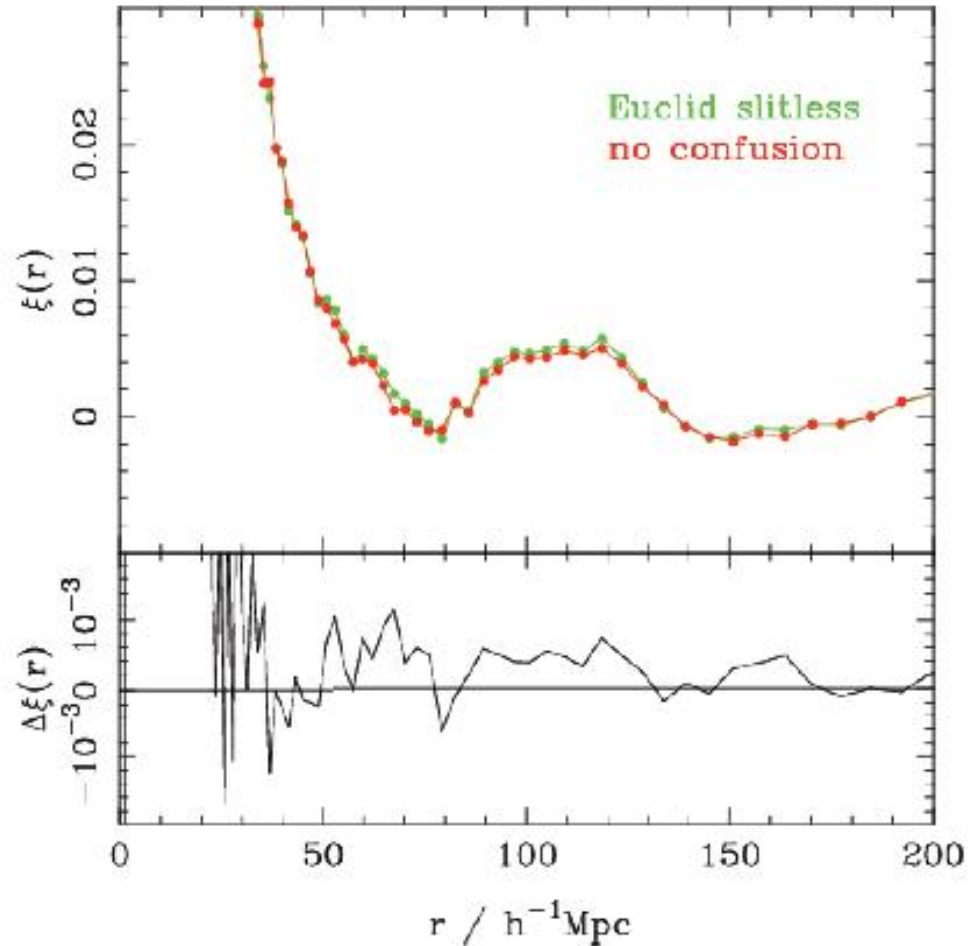


Merson et al. 2013, MNRAS, in press. arXiv:1206.4049

EUCLID Lightcones



- GALFORM galaxies: H α , H-band selection
- EUCLID JHK filters (also PanSTARRS, DES, LSST)



Laureijs et al. (2011)
EUCLID red book,

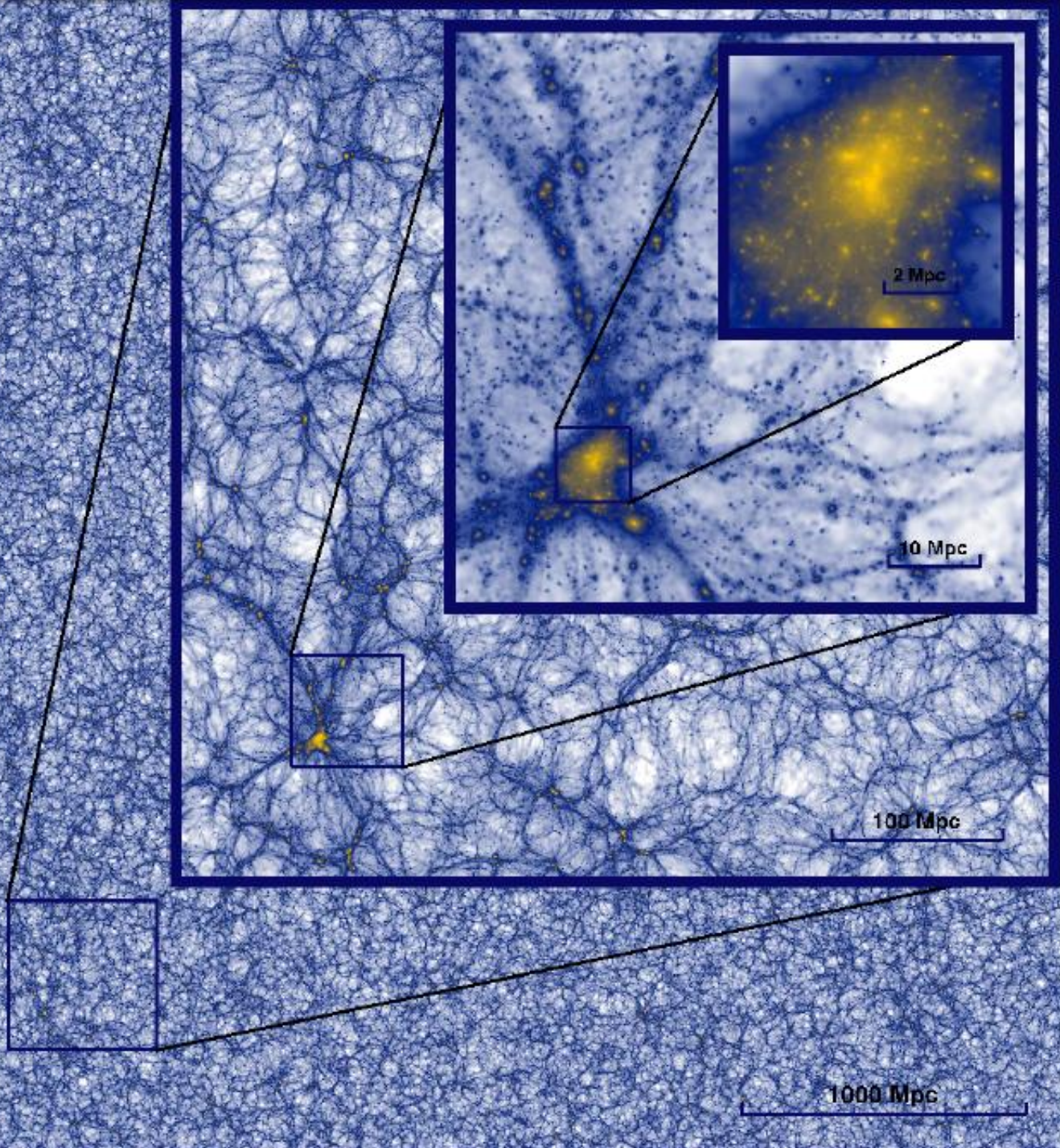
Future mocks

- Current release uses Millennium-I (WMAP-0)
- Future releases – WMAP-7 + revised galaxy formation models
- (See Jo's talk for more about the above)
- Still 500/h Mpc boxes
- Mocks in Giga-parsec boxes

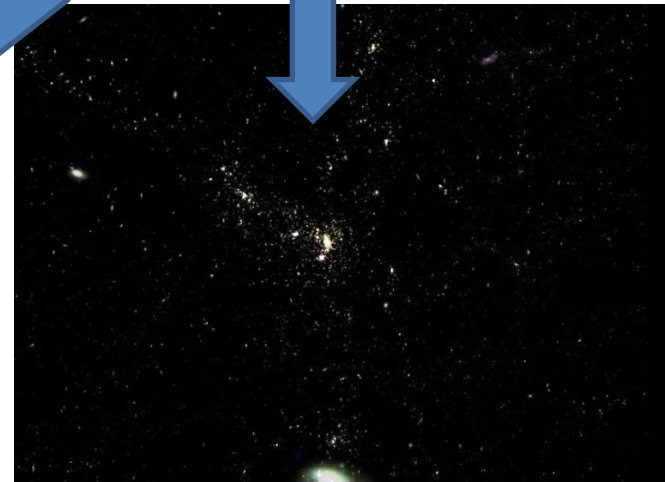
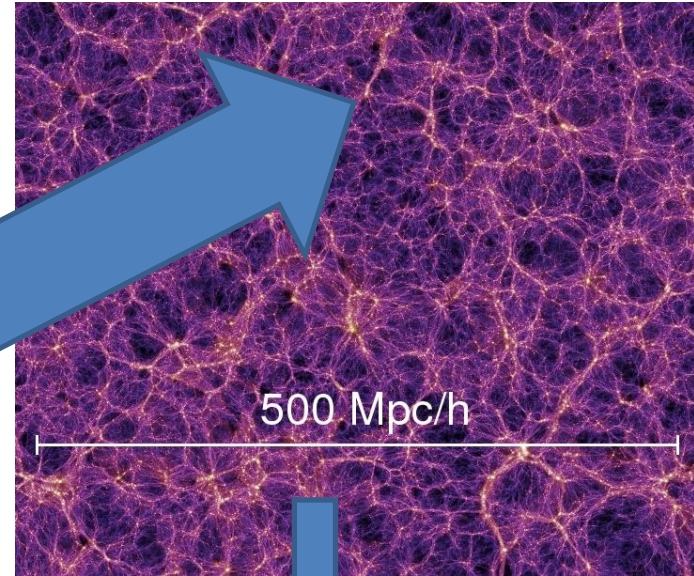
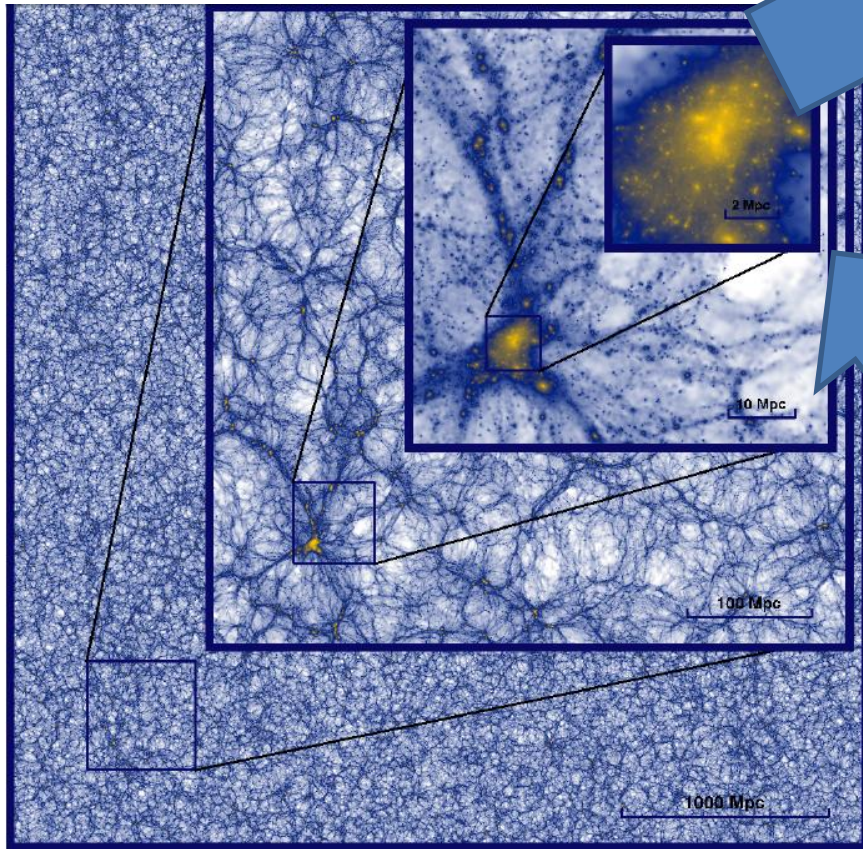
MXXL

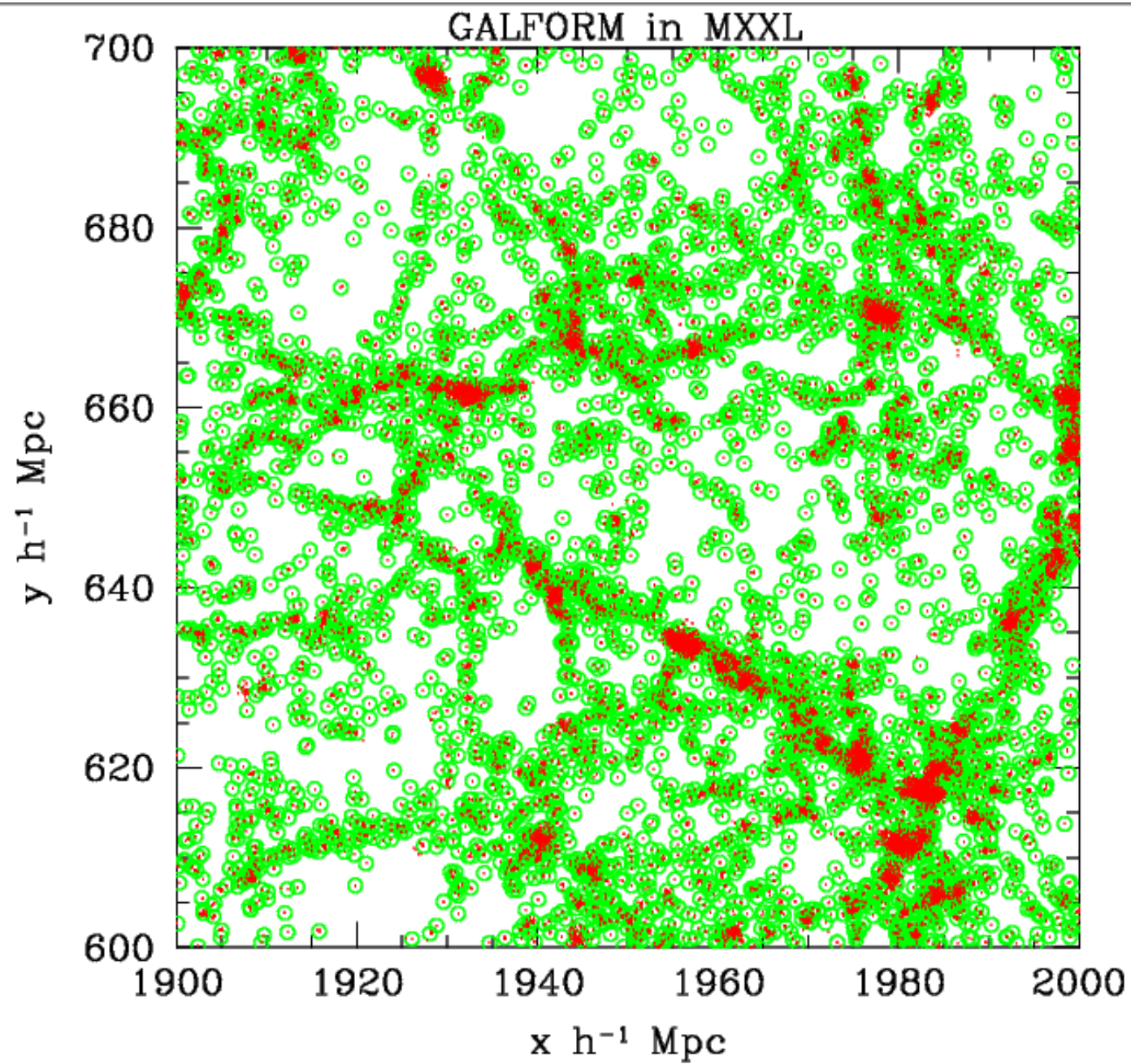
- 216 times M-I volume
- 303 billion particles

Angulo et al 2012



Cut and paste





Currently available mocks

[article](#) [discussion](#) [edit](#) [history](#) [move](#) [watch](#)

Key Project 12 (Large Scale Structure) Progress details

The [archived original content](#) of these wiki pages is now redundant as that information is contained in the official [White Paper](#). use the pages below as a true project wiki into which any team member can add information on the progress and organisation of project.

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1 Description of PhD and Diploma projects
2 Links to ongoing work in each of the main Sub-Areas
2.1 Sub-Area A: Catalogue Construction
2.2 Sub-Area B: Mock Catalogues
2.3 Sub-Area C: LSS and BAOs
2.4 Sub-Area D: Higher Order Clustering
2.5 Sub-Area E: Clustering as a function of X
2.6 Sub-Area F: Galaxy Clusters
2.7 Sub-Area G: CMB foregrounds from LSS
3 Early Data Release Discussion
4 The Key Project 12 Meeting in Heidelberg
4.1 Programme

pan-starrs project

- PS Public Pages
- PS Project Pages

ps1 science consortium

- PS1SC Home Page
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