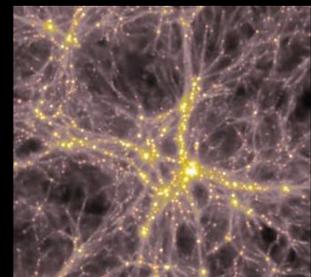


# LasDamas

## Large Suite of Dark Matter Simulations

Doug Watson, Andreas Berlind, Cameron McBride (Vanderbilt), Roman Scoccimarro (NYU), Risa Wechsler, Michael Busha (Stanford), Jeff Gardner (Univ. of Washington), Frank van den Bosch (MPIA)



### What is LasDamas?

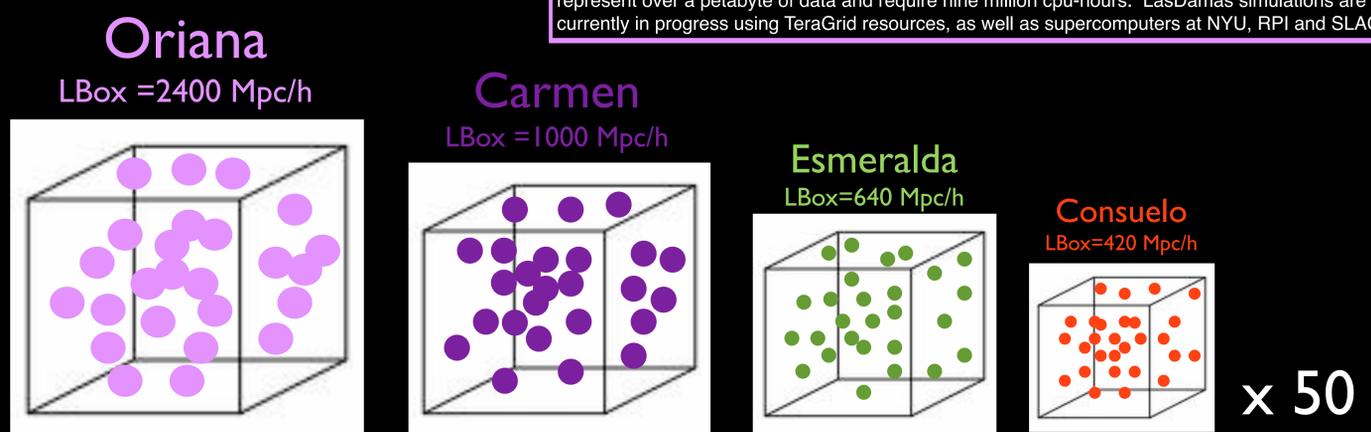
The statistical strength of large galaxy surveys, such as the SDSS, have ushered us into the era of precision measurements of galaxy clustering. We are now fitting physical models to measured clustering statistics. Galaxy clustering is thus in a position to directly constrain cosmological and galaxy formation theories. This paradigm shift from qualitative to quantitative demands that we understand the statistical and systematic errors in our measurements. Moreover, we must quantify the theoretical uncertainties in our models, which are no longer clearly sub-dominant to observational errors.

The LasDamas project addresses these emerging needs by producing an unprecedented number of independent and realistic mock universes. These are constructed from cosmological N-body simulations that are designed to model the clustering of SDSS galaxies over a wide luminosity range. We populate dark matter halos with artificial galaxies using the halo occupation distribution formalism, resulting in a series of mock galaxy catalogs.

#### Primary goals:

- (i) Estimate statistical errors and covariances in galaxy clustering measurements with unmatched accuracy.
- (ii) Quantify systematic uncertainties in measurements, methods of analysis, and theory.
- (iii) Test and refine theoretical models used to fit the data.

The basis of LasDamas is a series of high resolution dark matter N-body simulations. Fifty independent realizations are generated over four mass resolutions and box sizes. Initial conditions are generated using 2nd order Lagrangian Perturbation theory (2LPT) and evolved from a high redshift with aggressive force softening using the publicly available Gadget2 code. These 200 simulations represent over a petabyte of data and require nine million cpu-hours. LasDamas simulations are currently in progress using TeraGrid resources, as well as supercomputers at NYU, RPI and SLAC.



Name	SDSS sample	LBox (Mpc/h)	Npart	Mpart ( $M_{\text{sun}}/h$ )	rsoft (Kpc/h)
Oriana	LRG + Main: $M_r < -22.0$	2400	$1280^3$	$4.573 \times 10^{11}$	53
Carmen	Main: $M_r < -21.0$	1000	$1120^3$	$4.938 \times 10^{10}$	25
Esmeralda	Main: $M_r < -20.0$	640	$1250^3$	$9.311 \times 10^9$	15
Consuelo	Main: $M_r < -19.0/-18.0$	420	$1400^3$	$1.873 \times 10^9$	8

Cosmological model:  $\Omega_m=0.25$ ,  $\Omega_\Lambda=0.75$ ,  $\Omega_b=0.04$ ,  $h_0=0.7$ ,  $\sigma_8=0.8$ ,  $n_s=1.0$

### Mock catalogs

#### Esmeralda

#### SDSS Mock Catalogs

- Main + 2 LRG volume-limited samples
- 100 independent realizations of each sample
- SDSS DR7 geometry
- Redshift distortions + fiber collisions
- clustering designed to match SDSS:
  - galaxy number density  $n_g$
  - small scale correlation function  $w_p(r_p)$
  - large scale power spectrum  $P(k)$
  - bispectrum  $B(k)$

**Publicly available for download soon!**

