

## LA-UR-15-27732

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Title: LANL 2015 Summer Work: Coyote Universe Emulator for Web

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Intended for: Web

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# Chris Bryan

LANL 2015 Summer Work



## Coyote Universe Emulator for web



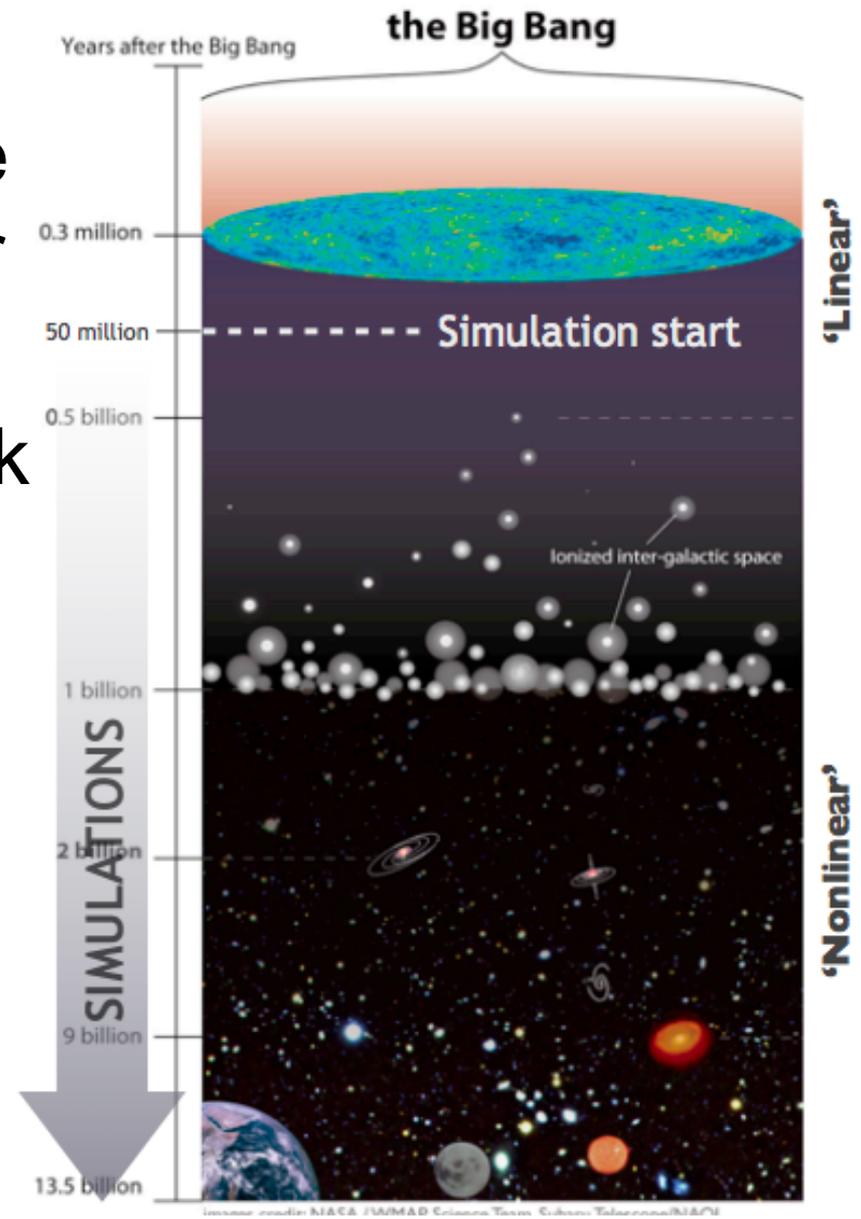


# A prediction tool for the **matter power spectrum $P(\mathbf{k})$**

- describes the density contrast of the universe
  - the Fourier transform of the matter correlation function
    - (which describes the distribution of galaxies in the universe)

The “non-linear epoch of structure formation” in the Universe (i.e.... stuff after the Big Bang)

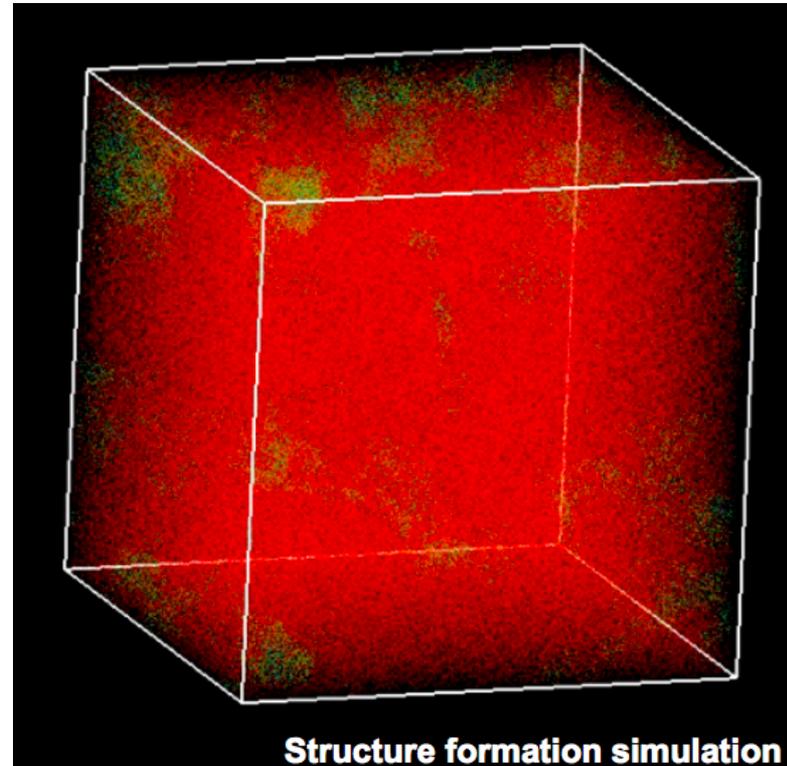
- responsible for the dark matter clumps within which individual galaxies, groups, and clusters of galaxies reside
- studied via N-body simulations.



# Want to extract some physics and stats from these sims

The problem is these simulations are...

- Biiiiiiig (1 billion particles, 1.3 gigaparsec volume, 20k CPU hours on the Coyote cluster)
- Need to extract accurate statistics



**Structure formation simulation**

1. Run a bunch of full sims
  - a. 38 different ones, with different resolutions for each
    - i. ~1000 total sims, 60 TB data
2. Build a prediction scheme (“emulator”) based on these sims
  - a. Has to be really accurate
3. Use emulator as basically a look-up table
  - a. sub-second results for non-linear power spectrum!

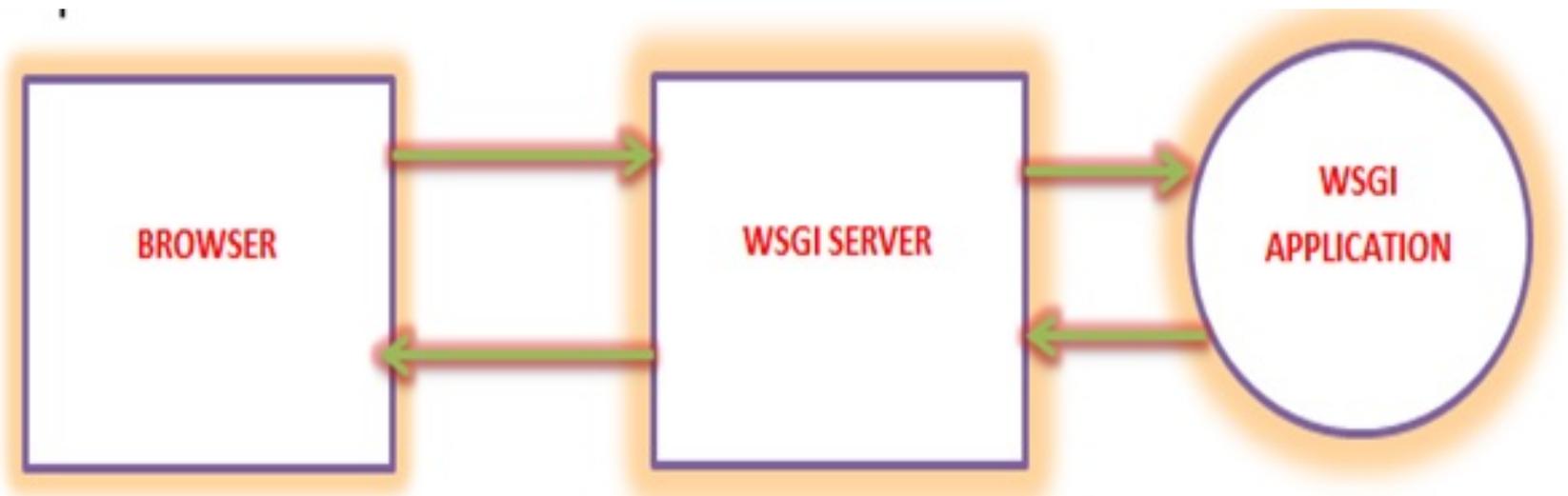
Cosmic Emulator



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“Cosmic Emu(lator)”



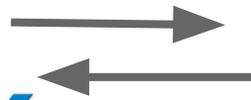


WSGI BASED BOTTLE FRAMEWORK

Data Driven Documents



**AJAX**  
Asynchronous Javascript And XML



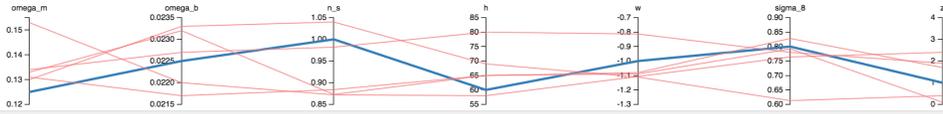
**Bottle**



python

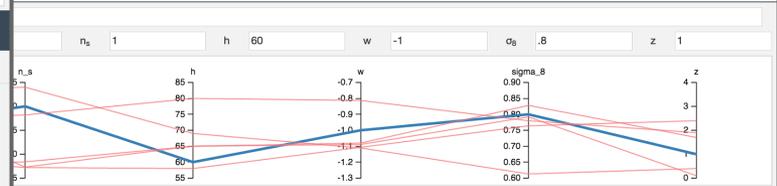
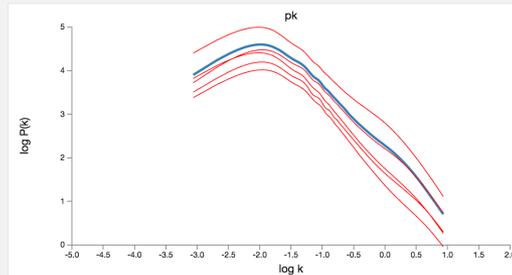
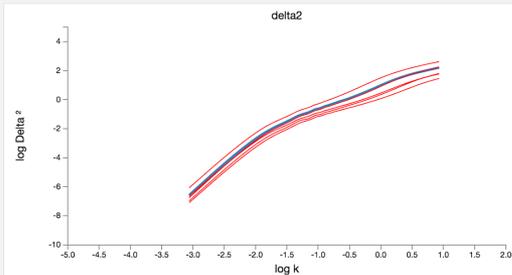
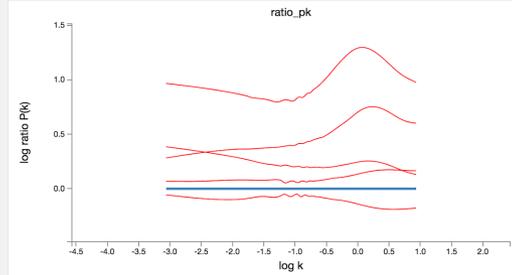
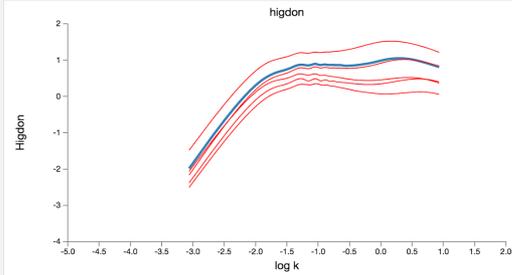
Reference Input Parameters  $\omega_b$  .125, 0.0225, 1, 60, -1, .8, 1

$\omega_b$  .125  $\omega_b$  0.0225  $n_s$  1  $h$  60  $w$  -1  $\sigma_b$  .8  $z$  1



Line Charts Spreadsheet Options

Save Images

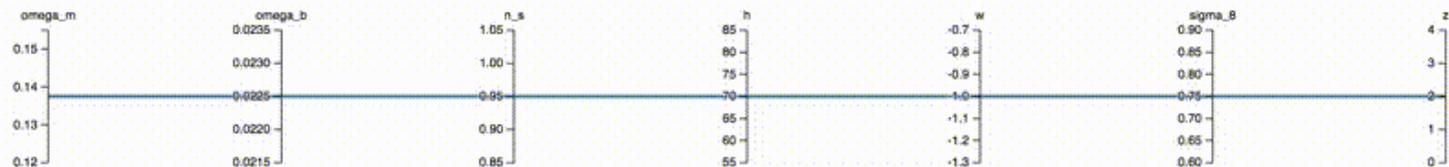


Add Row Upload File Save As File Add Random Row

	$\omega_b$	$n_s$	$h$	$w$	$\sigma_b$	$z$
5	0.0225	1	60	-1	.8	1
3	0.0232	0.873	65	-1.08	0.828	1.7
4	0.0227	0.982	80	-0.813	0.78	1.9
1	0.0217	0.884	65	-1.089	0.792	0.1
3	0.0233	1.04	69	-1.111	0.613	0.4
3	0.022	0.872	58	-1.107	0.764	2.4

Reference Input Parameters 0.1375, 0.0225, 0.95, 70, -1.0000005, 0.74999995, 2

$\omega_m$  0.1375     $\omega_b$  0.0225     $n_s$  0.95     $h$  70     $w$  -1.0000005     $\sigma_8$  0.74999995     $z$  2



Line Charts    Spreadsheet    Options

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