CMÁS(S) o CMENOS?!

A road-trip to the galaxy assembly bias?

Or

A SAM perspective on massive galaxies

Find the Easter Eggs (6)

Starring MultiDark SAMs Featuring THE BOSS

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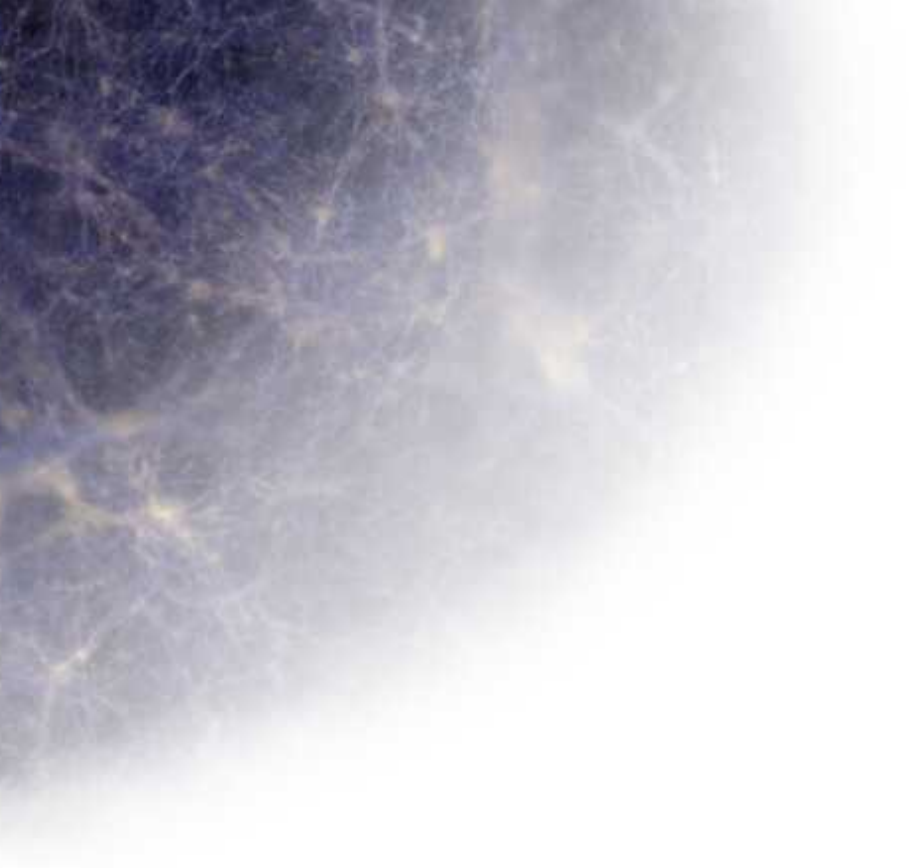

Who?!

What?!

Why?!

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SAMs

What?!

Why?!

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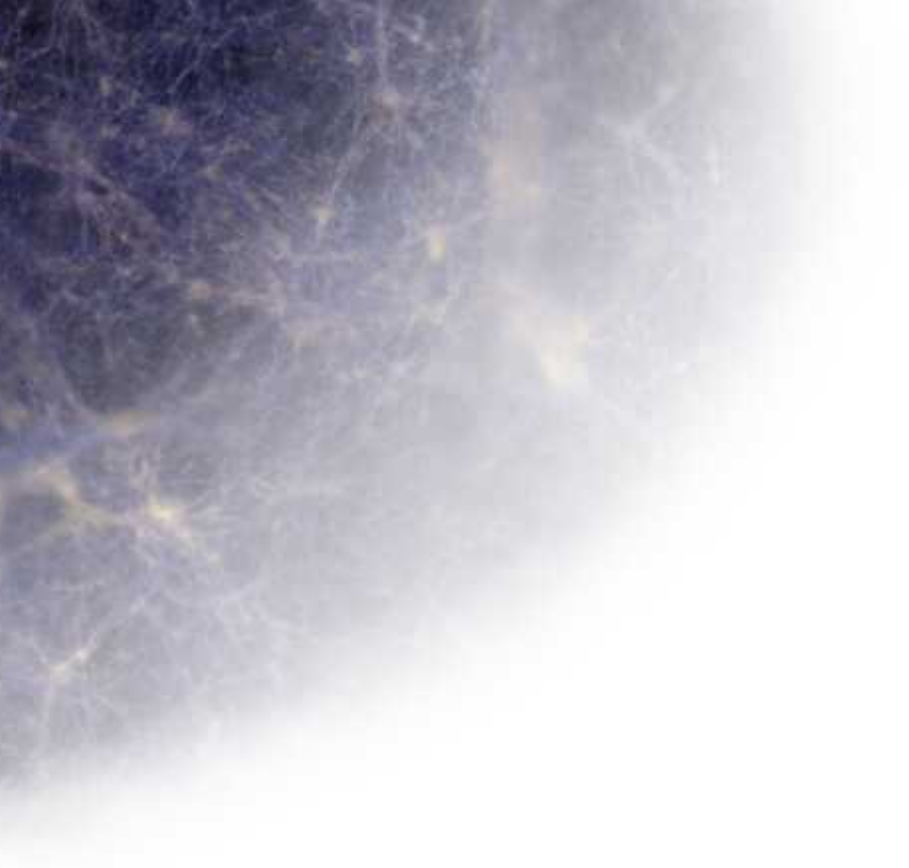

SAMs

LRGs/CMASS

Why?!

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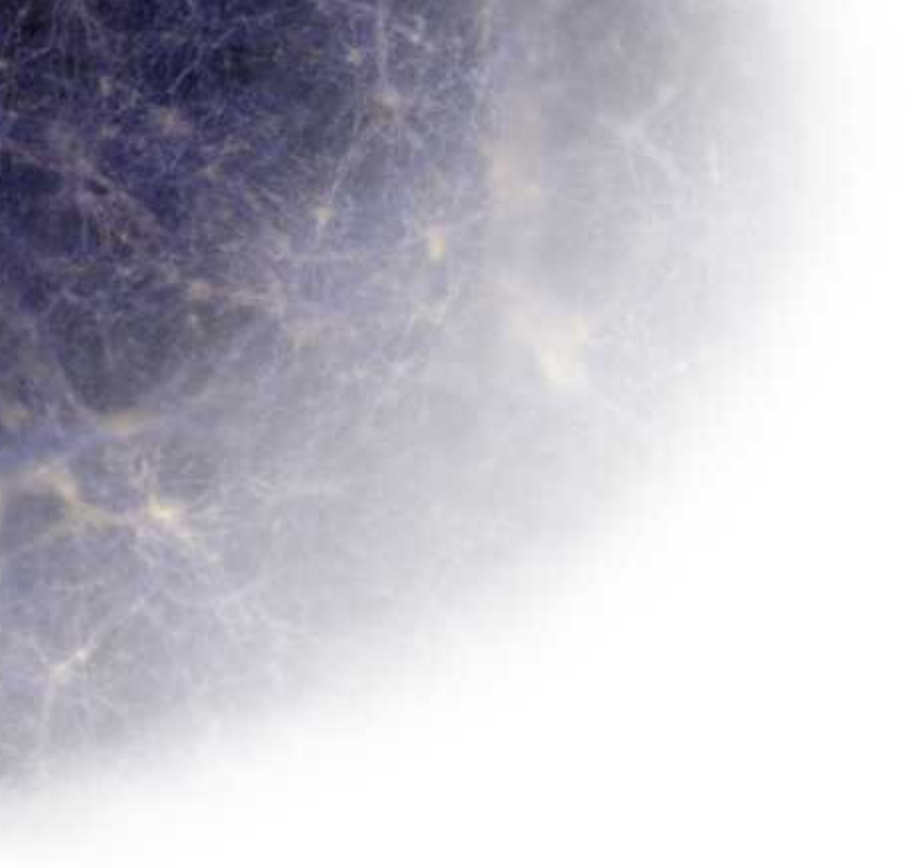

SAMs

LRGs/CMASS

Galaxy Formation
Assembly bias
Cosmology

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Who?!

The MultiDark SAMs

Galacticus
(Benson+2012)

SAG
(Cora+2018)

SAGE
(Croton+2016)

$1h^{-1}$Gpc box

Klypin+2016

Data release paper: 1710.08150
Knebe, DS, Prada et al. (2018)

https://www.cosmosim.org/
http://www.skiesanduniverses.org

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What?!

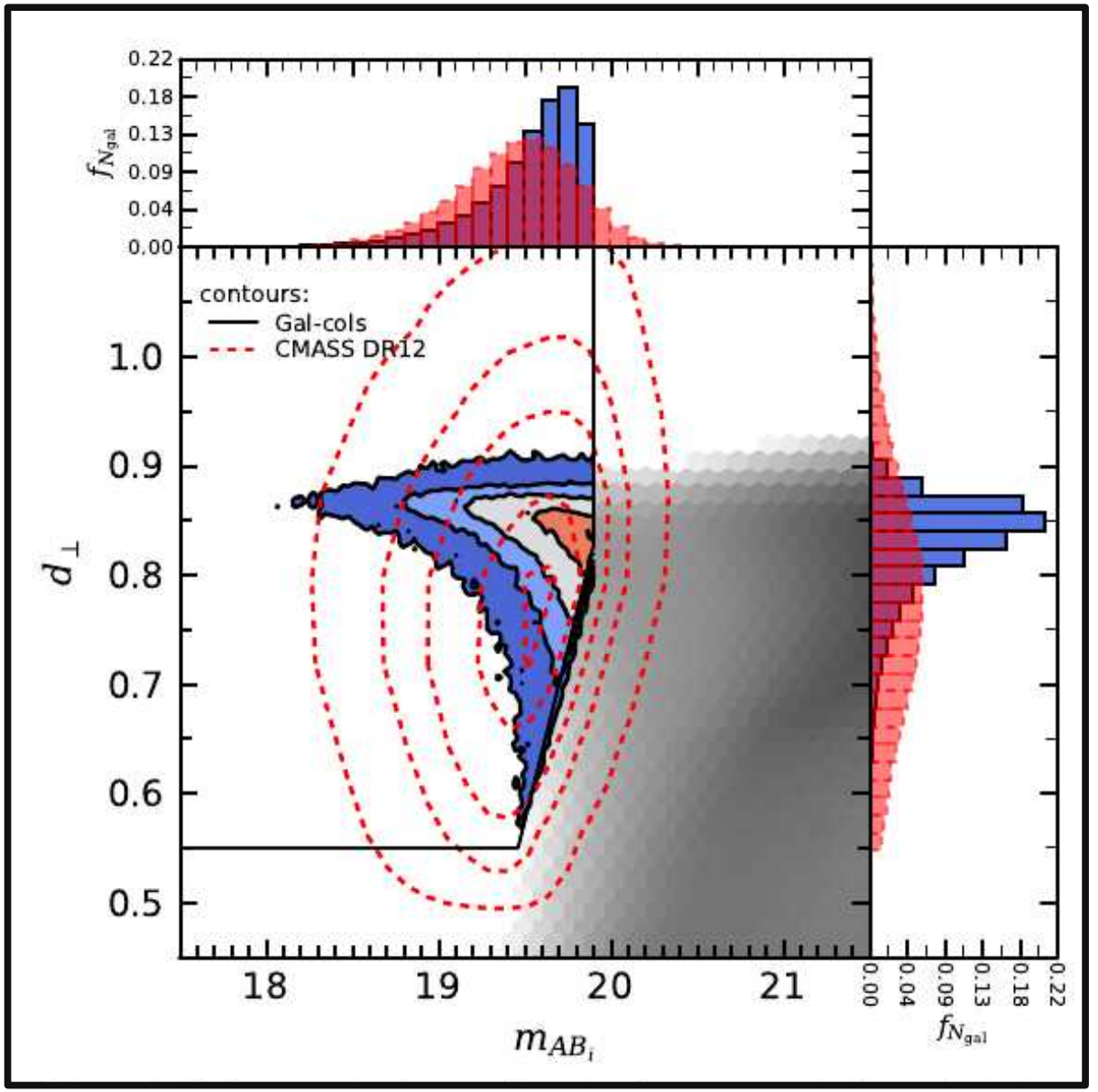
BOSS-CMASS GALAXIES

z~0.55

"A SAM perspective on massive galaxies"

Stoppacher+19
arXiv: 1902.05496

DR12 Alam+15
LSS Reid+15
Maraston+ 05 & 09



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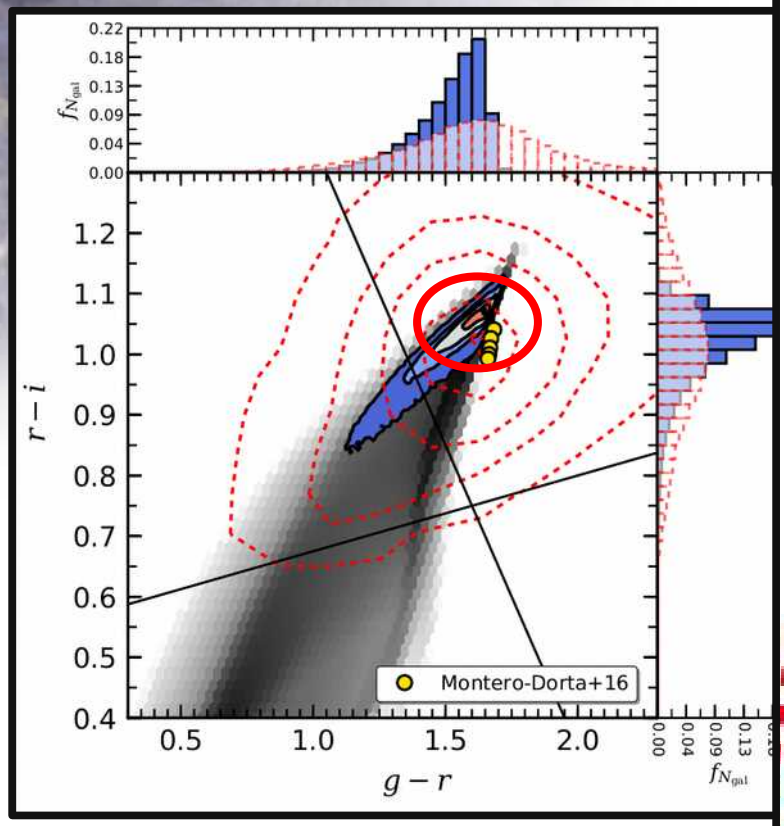
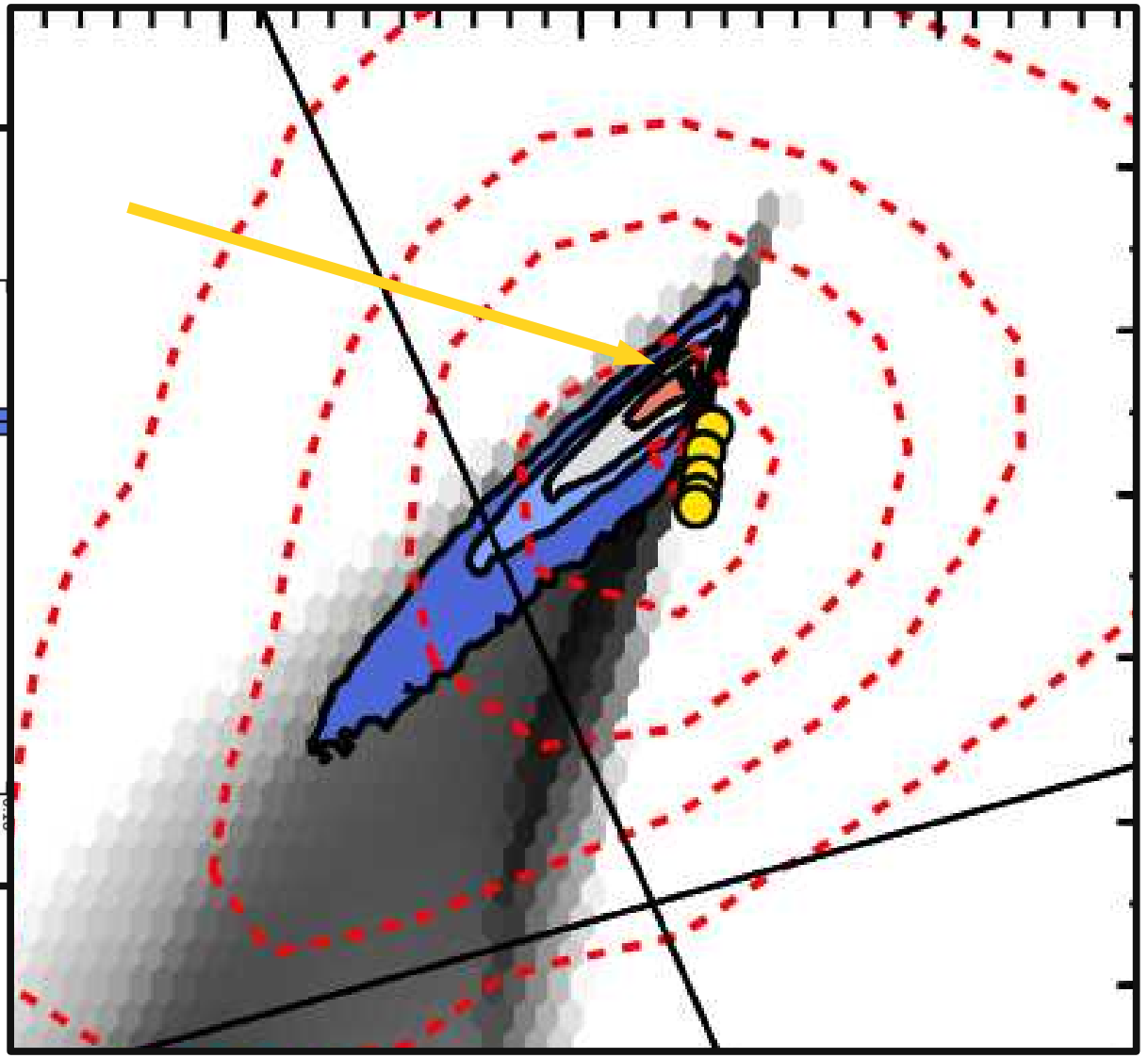
What?!

BOSS-CMASS GALAXIES





Montero-Dorta+16

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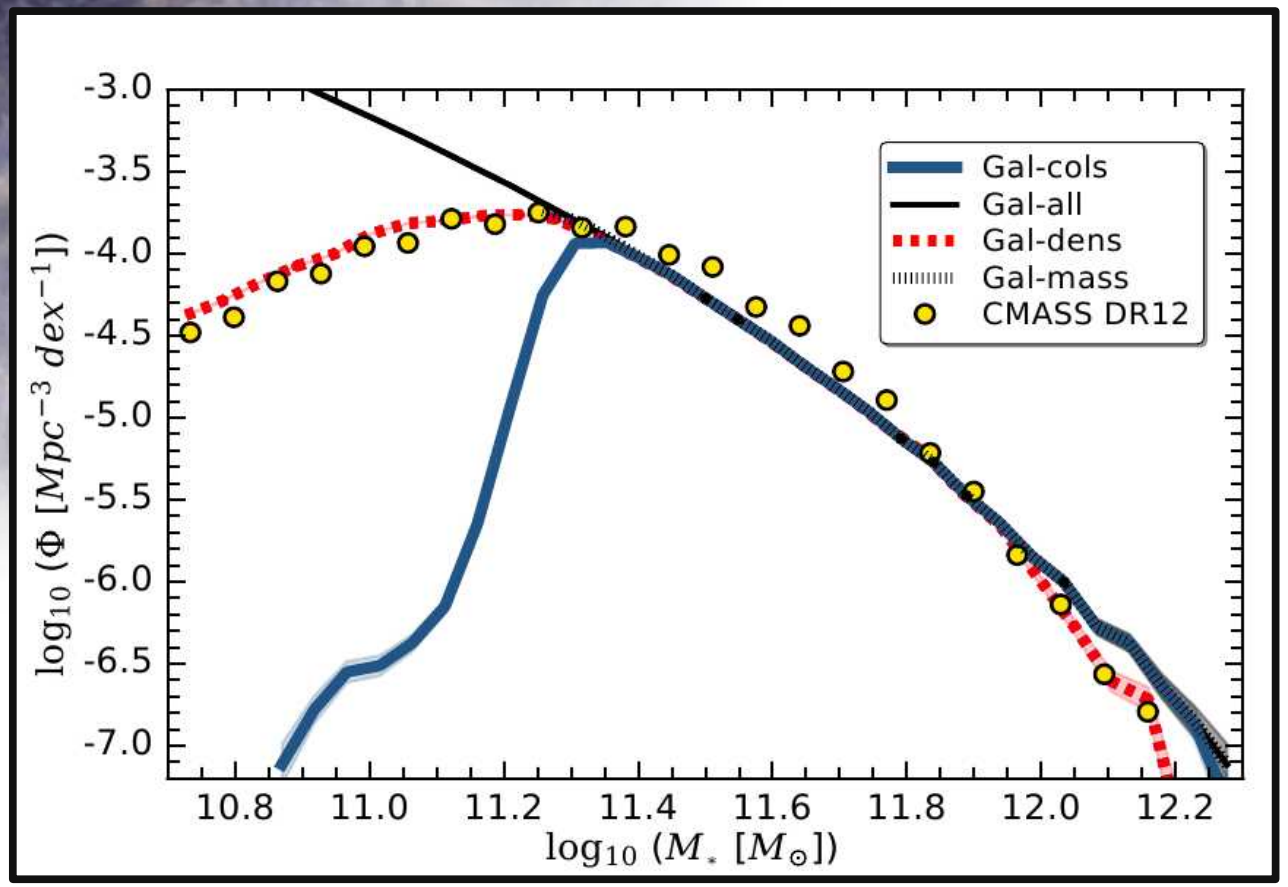
What?!

Mocking the mock



CMASS color-cut algorithm "Gal-cols"

number density $3.4 \times 10^{-4}\ h^{-3}Mpc^{-3}$ "Gal-dens"

Mstar > $10^{11.24}$ Msun "Gal-mass"

Maraston+13

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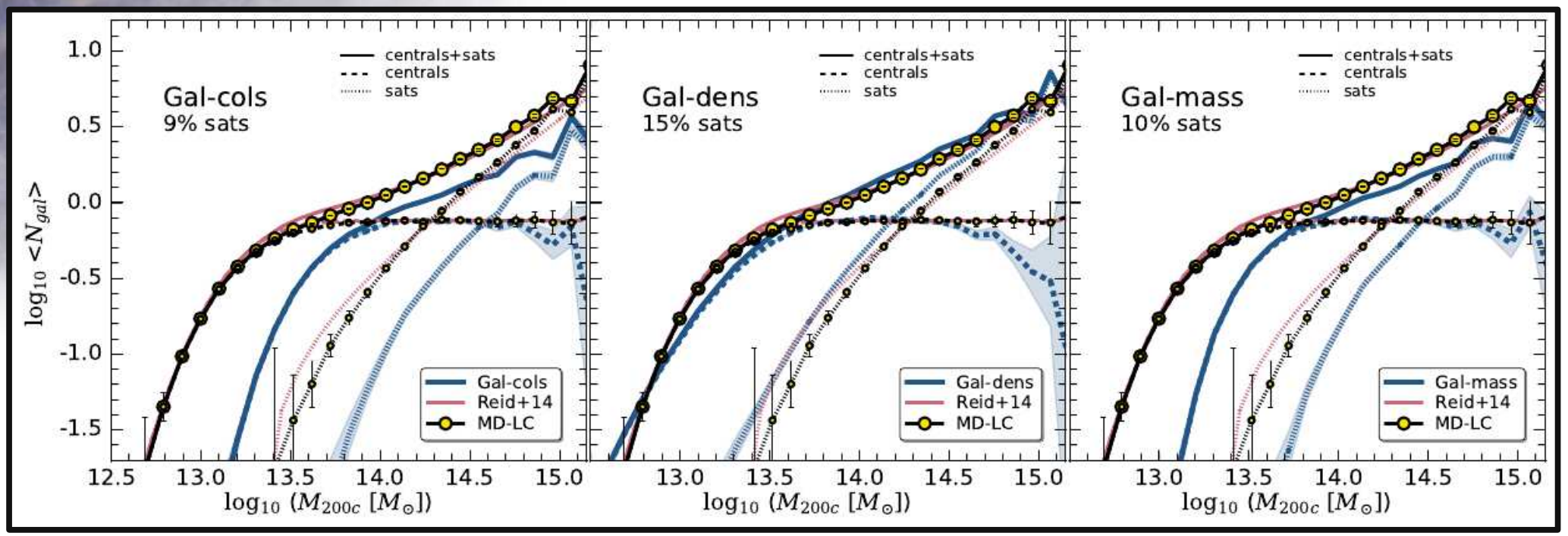
What?!

Halo Occupation Distribution

Satellites: 9% 15% 10%



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Mstar $> 10^{11.24}$ Msun "Gal-mass"

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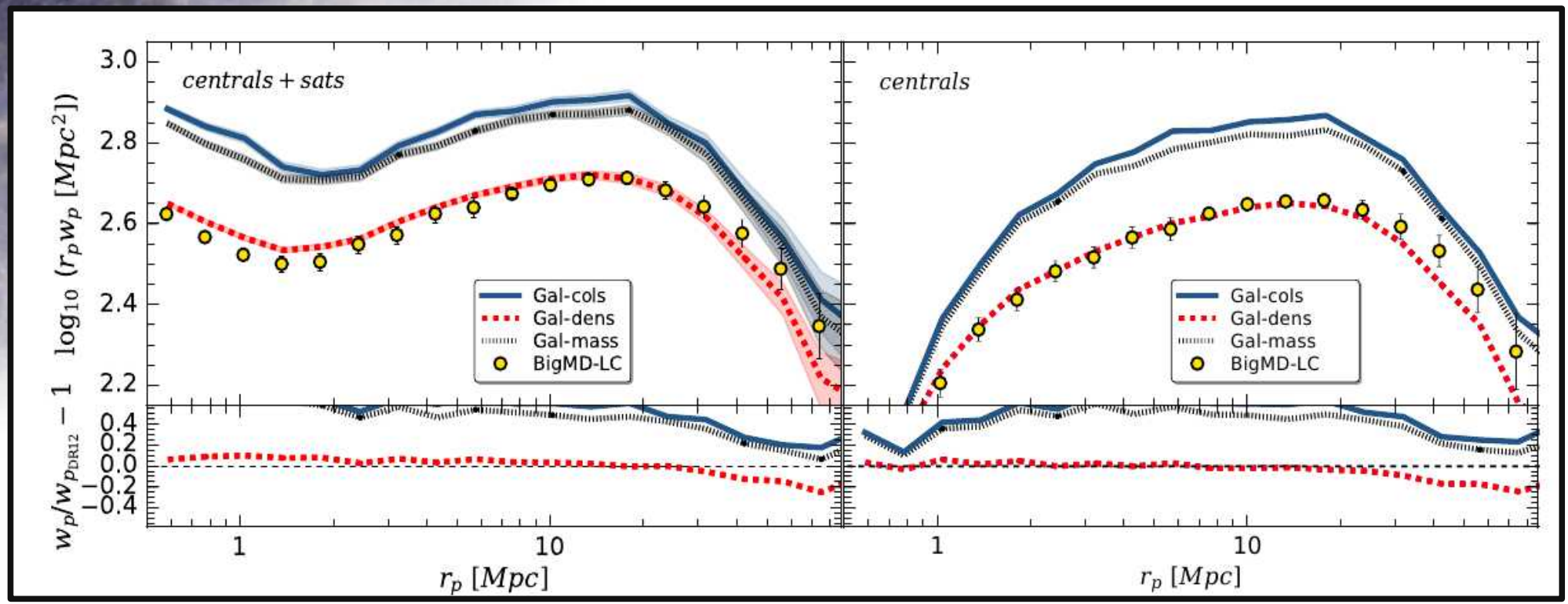
Rodriguez-Torres+16

What?!

2-point Correlation Functions



CMASS color-cut algorithm "Gal-cols"

number density $3.4 \times 10^{-4}\ h^{-3}Mpc^{-3}$ "Gal-dens"

Mstar $> 10^{11.24}$ Msun "Gal-mass"

CORRFUNC Shinha+17

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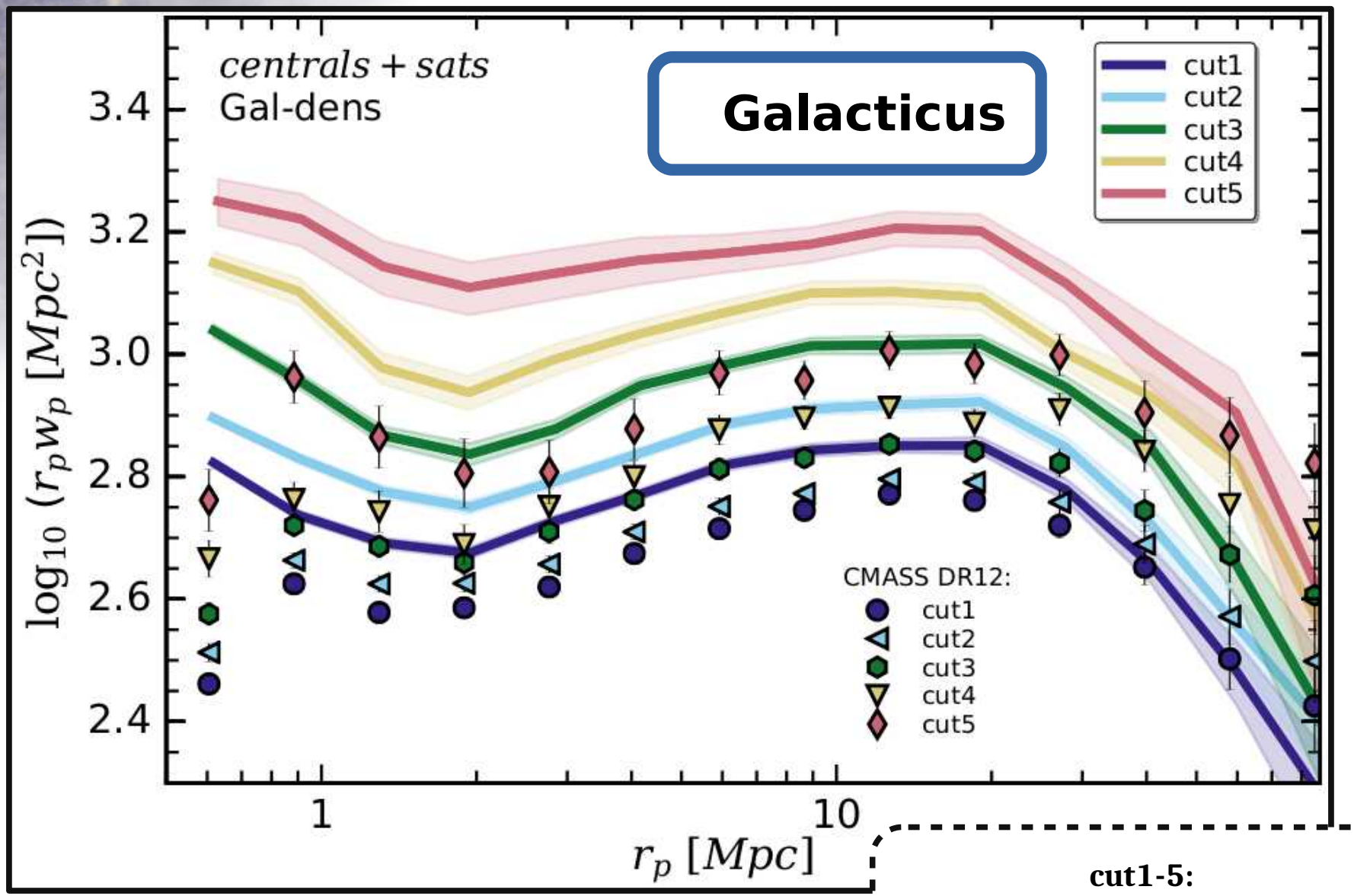
https://pypi.python.org/pypi/Corrfunc
https://manodeep.github.io/Corrfunc/

What?!

2-point CFs Stellar Mass Cuts



cut1-5:
log10(Mstar [Msun]):
11.21, 11.31, 11.41, 11.51, 11.61

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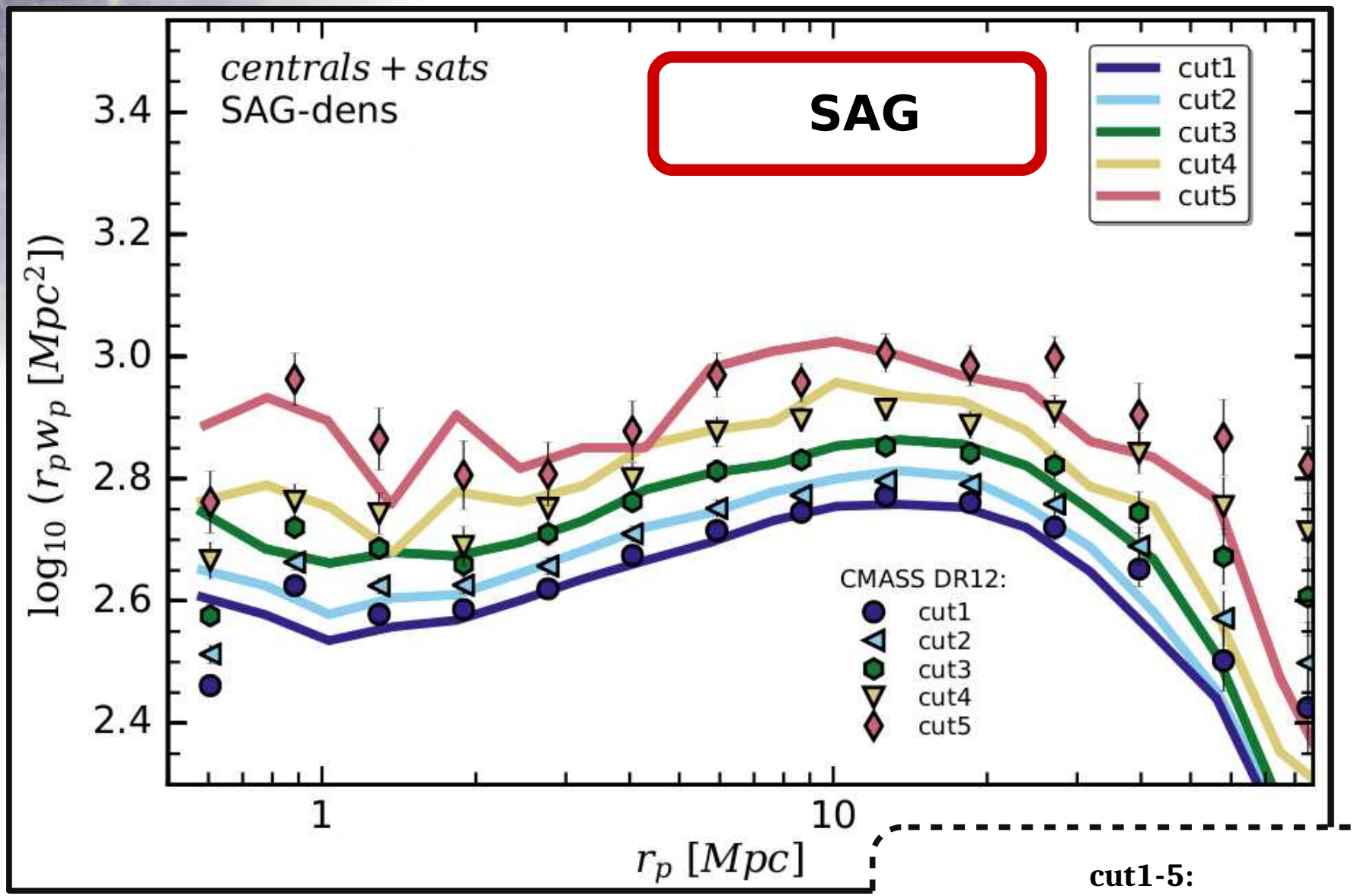
What?!

2-point CFs Stellar Mass Cuts



cut1-5:
log10(Mstar [Msun]):
11.21, 11.31, 11.41, 11.51, 11.61

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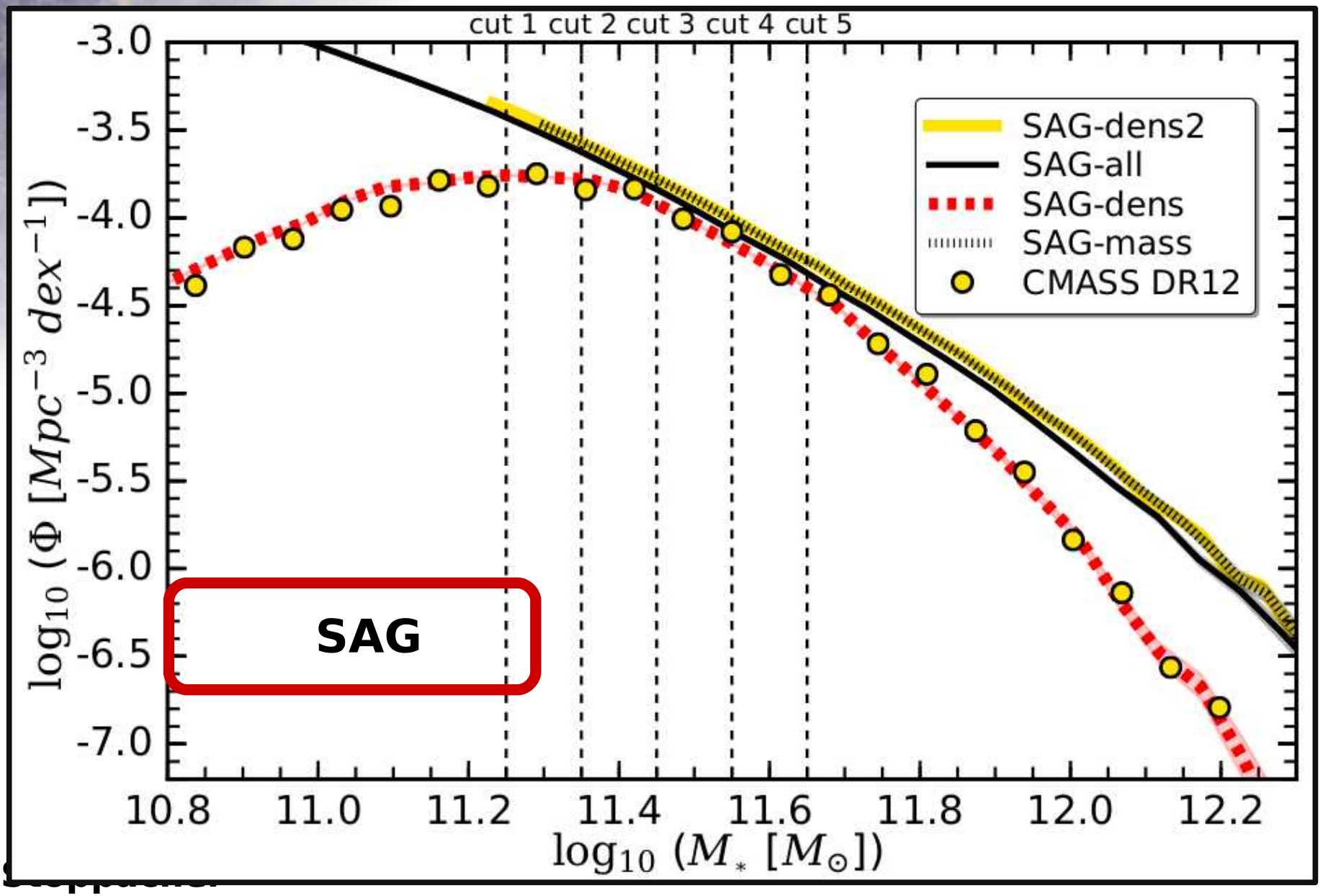
What?!

Stellar Mass Function



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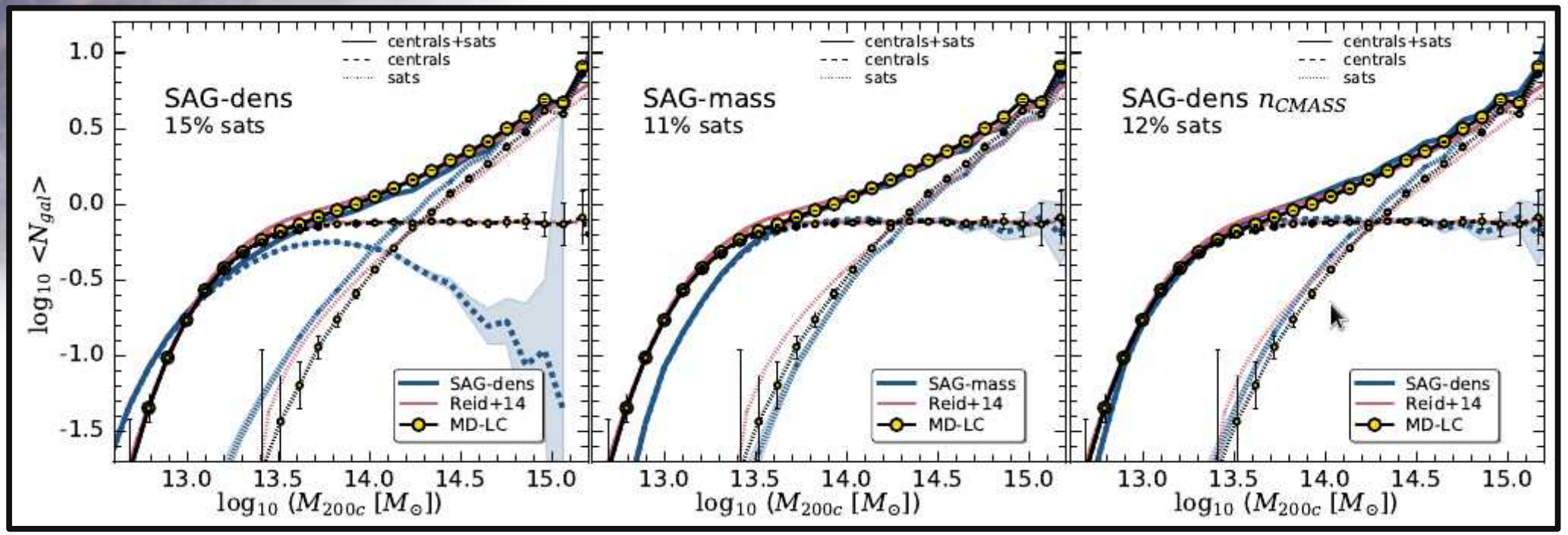
What?!

Halo Occupation Distribution

Satellites: 15% 11% 12%



Down sampled
3.4 x 10^{-4} $h^{-3}Mpc^{-3}$
"SAG-dens"

Mstar > $10^{11.24}$
Msun
"SAG-mass"

Number density
3.4 x 10^{-4} $h^{-3}Mpc^{-3}$
"SAG-dens n_{CMASS}"

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SAG

Why?!

Galaxy Assembly Bias in SAMs

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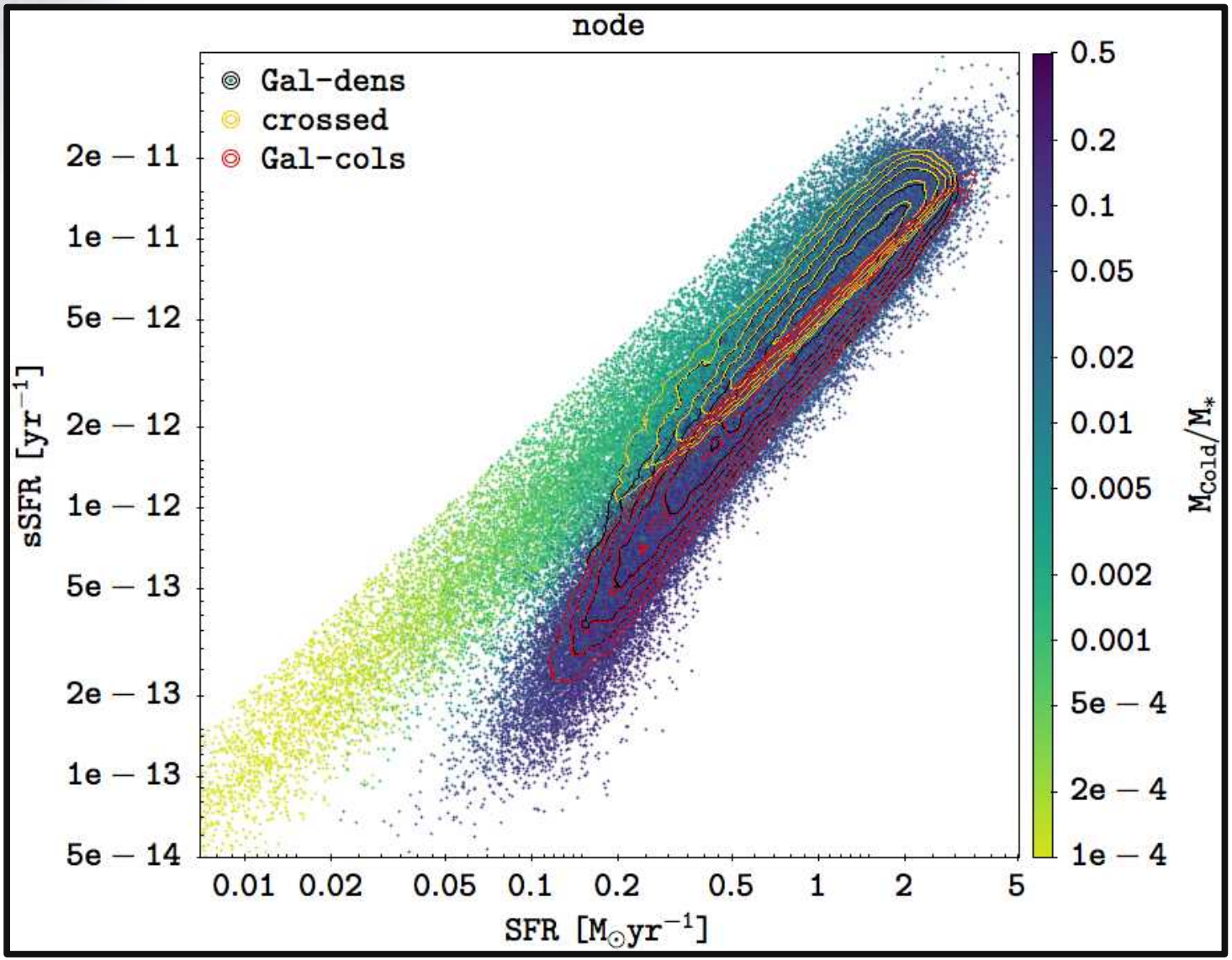
Observations	Cooper et al. (2010, SDSS NYU-VAGC, significant bias on red sequence) Lacerna et al. (2014, small on centrals) Gallart et al. (2015, local group, dwarf galaxies), Lin et al. (2015, no signal) Guo et al. (2015, BOSS-CMASS), Zentner et al. (2016) on cluster Miyatake et al. (2016); Zu et al. (2017) Dvornik et al. (2017, no signal of halo assembly bias in GAMA) Montero-Dorta et al. (2017, BOSS-CMASS SF-history), Tinker et al. (2018) small: Zu & Mandelbaum (2016); Niemiec et al. (2018); Xu & Zheng (2018)
Simulations	
Dark Matter	Artale, Pedrosa, et al. (2019) Salcedo et al. (2018, Las Damas) Vakili & Hahn (2016, sMDPL) Sunayama et al. (2016, Vmax scale dependency, Bolshoi, and MD) Chue et al. (2018, in massive halos MD), Sato-Polito et al. (2018, comparison MDs)
Hydro	Bray et al. (2016, Illustris, galactic conformity), Xu & Zheng (2018, Illustris) Chaves-Montero et al. (2016); Artale et al. (2018, Eagle)
HOD and HAM	Zentner et al. (2014, assembly bias in HOD are highly affected by systematic errors) Saito et al. (2016, BOSS-CMASS) Paranjape and Padmanabhan (2017, Separate Universe-technique) Zehavi et al. (2018, occupation variation)
SAMs	Lacerna & Padilla (2011, SAGv2 by Lagos, Cora, and Padilla (2008)), Wang et al. (2013) Jung et al. (2014, ySAM, small galaxy assembly bias) Pujol & Gaztañaga (2014, small galaxy bias, at low Mhalo halo bias take over) Tojeiro et al. (2017, LGALAXIES and GAMA, halo assembly bias) Lacerna et al. (2018, LGALAXIES and Galform) Padilla et al. (2018, LGALAXIES, BOSS-CMASS, RSD) Raouf et al. (2018, Radio-SAGE, major merger, clustering, halo mass assembly) Contreras et al. (2019, LGALAXIES, redshift evolution)

Environmental Dependency

Why?!



Vweb Cui+19

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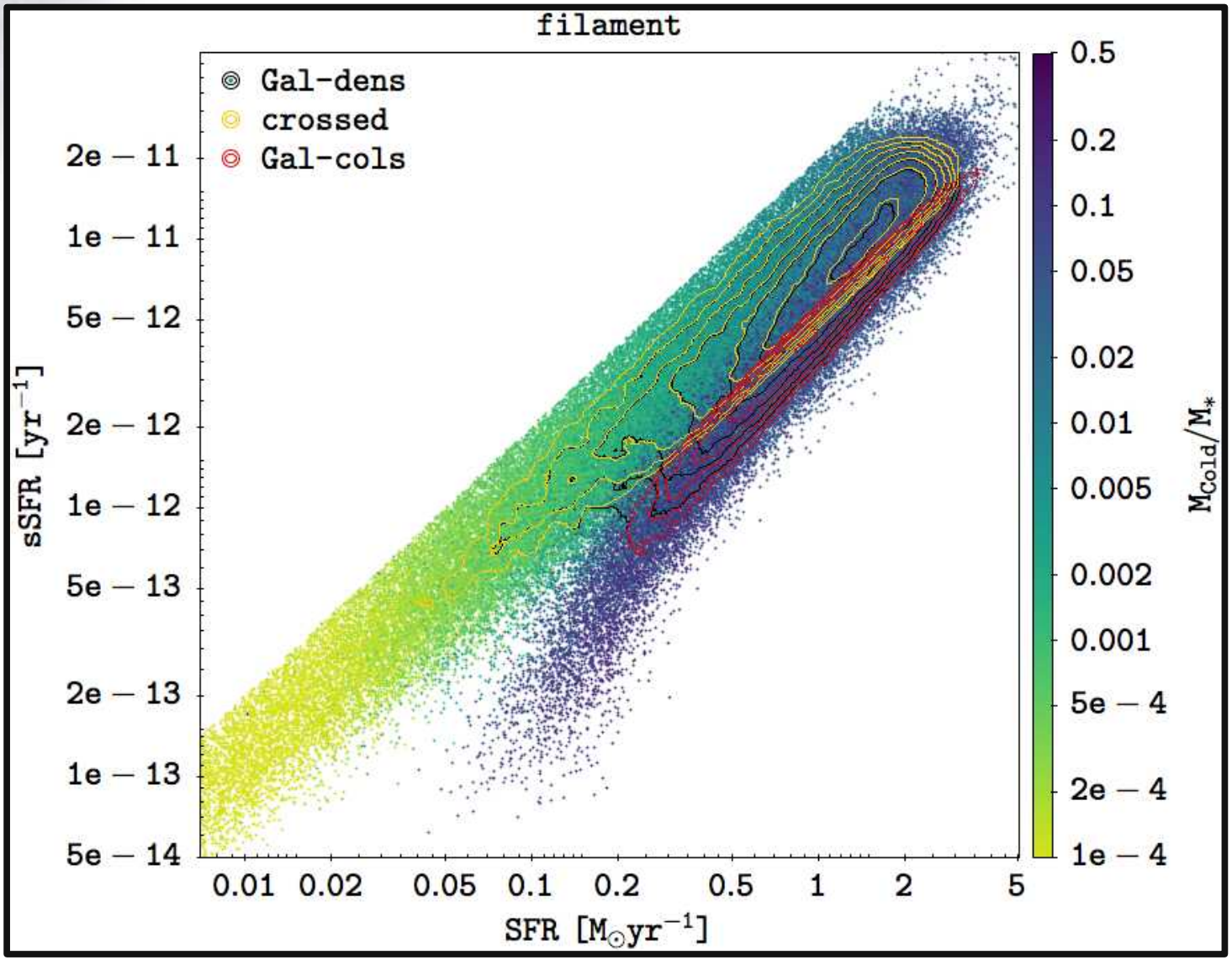
Why?!

Environmental Dependency



Vweb Cui+19

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Why?!

Environmental Dependency

sample name & population	environment	fraction of galaxies	$\log_{10}(M_{200c}\ [M_\odot])$	$\log_{10}(M_*\ [M_\odot])$	$\log_{10}(sSFR\ [yr^{-1}])$	Z_{Cold}
Gal-cols	knot	0.61	$13.79^{+0.21}_{-0.19}$	$11.44^{+0.11}_{-0.09}$	$-11.77^{+0.35}_{-0.37}$	$9.10^{+0.18}_{-0.16}$
Gal-cols	filament	0.37	$13.57^{+0.19}_{-0.17}$	$11.37^{+0.09}_{-0.05}$	$-11.52^{+0.30}_{-0.34}$	$9.18^{+0.21}_{-0.17}$
Gal-dens	knot	0.52	$13.55^{+0.27}_{-0.28}$	$11.28^{+0.15}_{-0.14}$	$-11.53^{+0.36}_{-0.42}$	$9.25^{+0.36}_{-0.23}$
Gal-dens	filament	0.41	$13.22^{+0.23}_{-0.26}$	$11.14^{+0.13}_{-0.14}$	$-11.36^{+0.32}_{-0.44}$	$9.55^{+0.30}_{-0.35}$
Gal-dens Pop (A)	knot	0.26	$13.13^{+0.32}_{-0.34}$	$11.05^{+0.07}_{-0.09}$	$-11.40^{+0.38}_{-0.53}$	$9.76^{+0.19}_{-0.29}$
Gal-dens Pop (A)	filament	0.62	$13.01^{+0.22}_{-0.22}$	$11.02^{+0.08}_{-0.11}$	$-11.40^{+0.39}_{-0.58}$	$9.80^{+0.19}_{-0.25}$
Gal-dens Pop (B)	knot	0.54	$13.69^{+0.23}_{-0.21}$	$11.36^{+0.13}_{-0.09}$	$-11.58^{+0.35}_{-0.40}$	$9.13^{+0.21}_{-0.17}$
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(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)

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(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)

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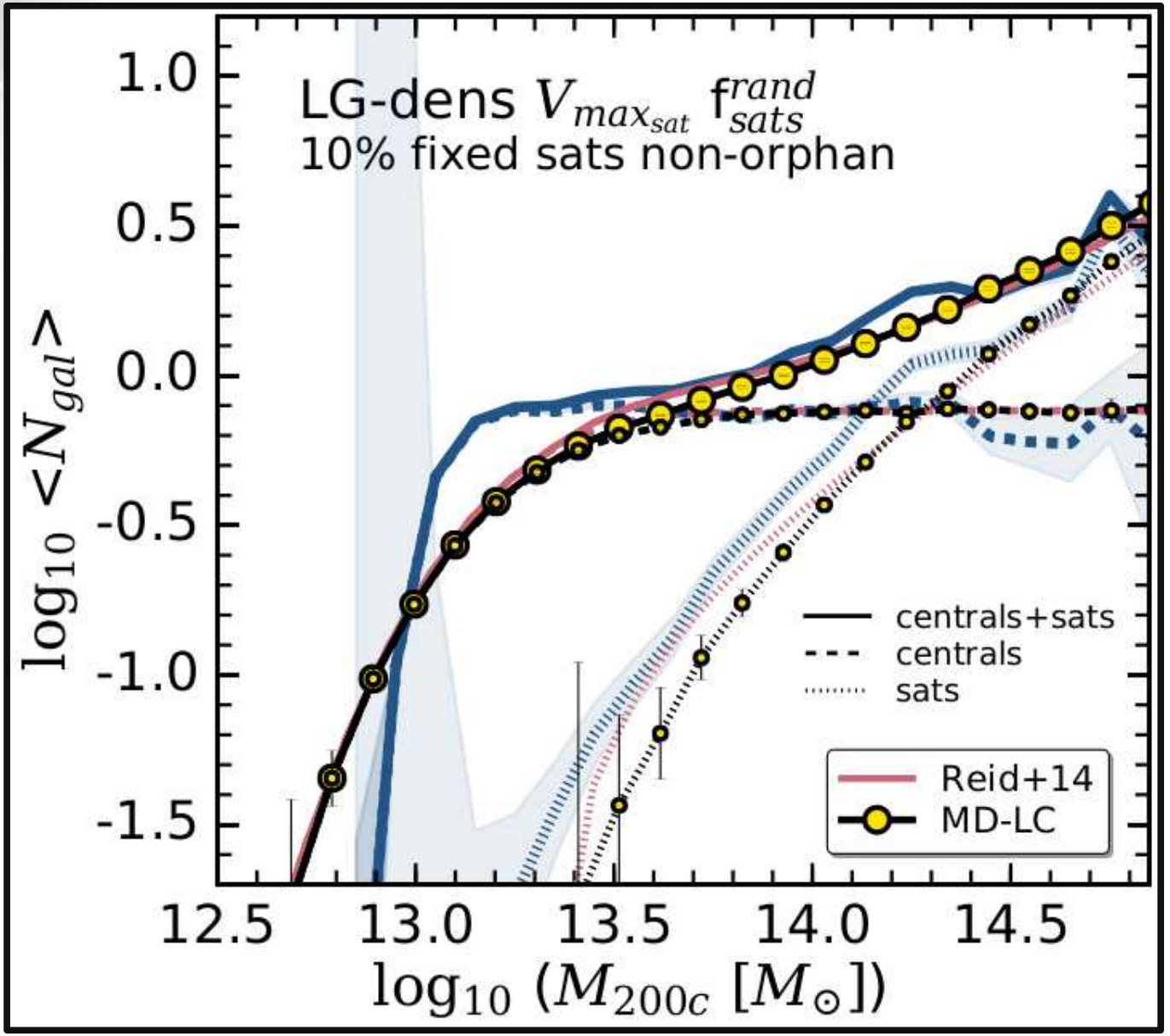
L-GALAXIES
Guo+13

Outlook



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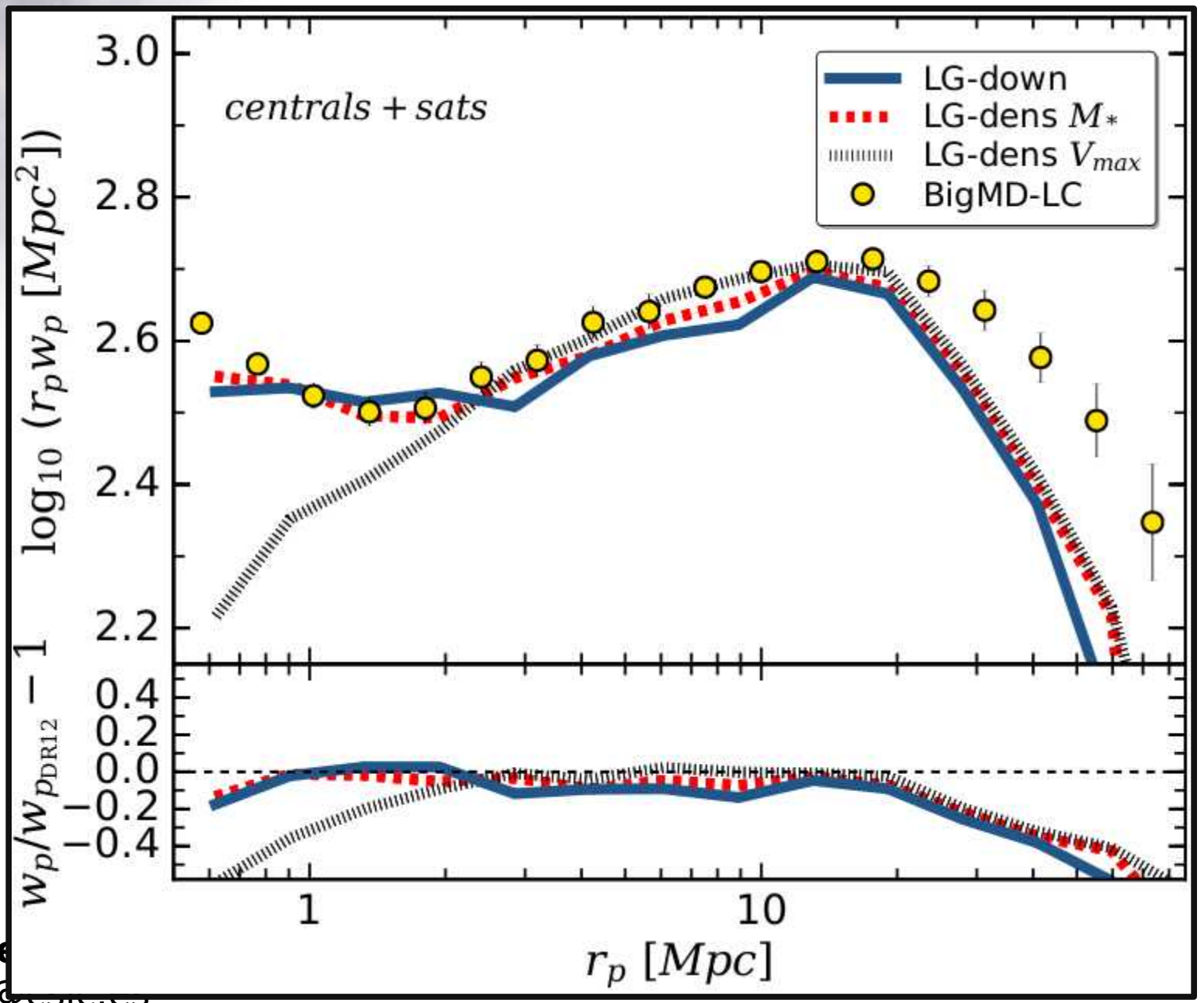
Outlook

L-GALAXIES
Guo+13



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Conclusions

Who?! CMASS hard to model with SAMs – alternatives: density samples / down sampling

What?! Dependencies of certain properties on environment: halo mass / star forming properties

Why?! Could provide tracers for the galaxy assembly bias! Stay tuned for further results ...

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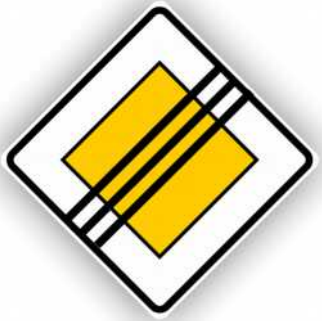
Collaborations and Credits

Knebe+18
arXiv: 1710.08150



Stoppacher+19
arXiv: 1902.05496

F. Prada, A. Montero-Dorta, S. Rodriguez-Torres,
G. Favole, A. Knebe, W. Cui,
A. Orsi, S. Contreras, A. Benson, C. Behrens,
S. Cora, C. Vega, V. Gonzalez-Perez,
D. Croton, A. Stevens, M.L.L. Dantas ++

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Extra-Slides

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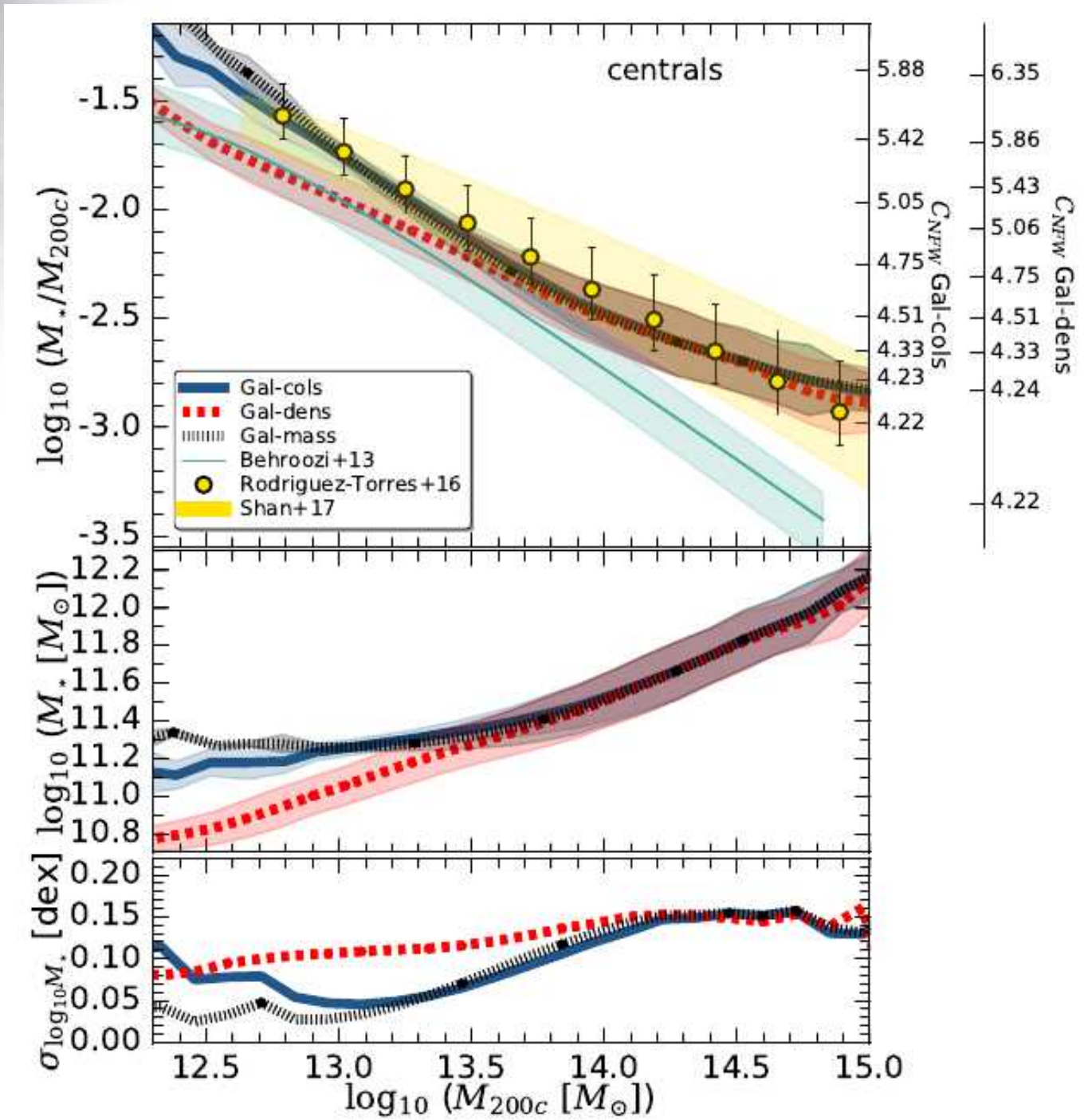

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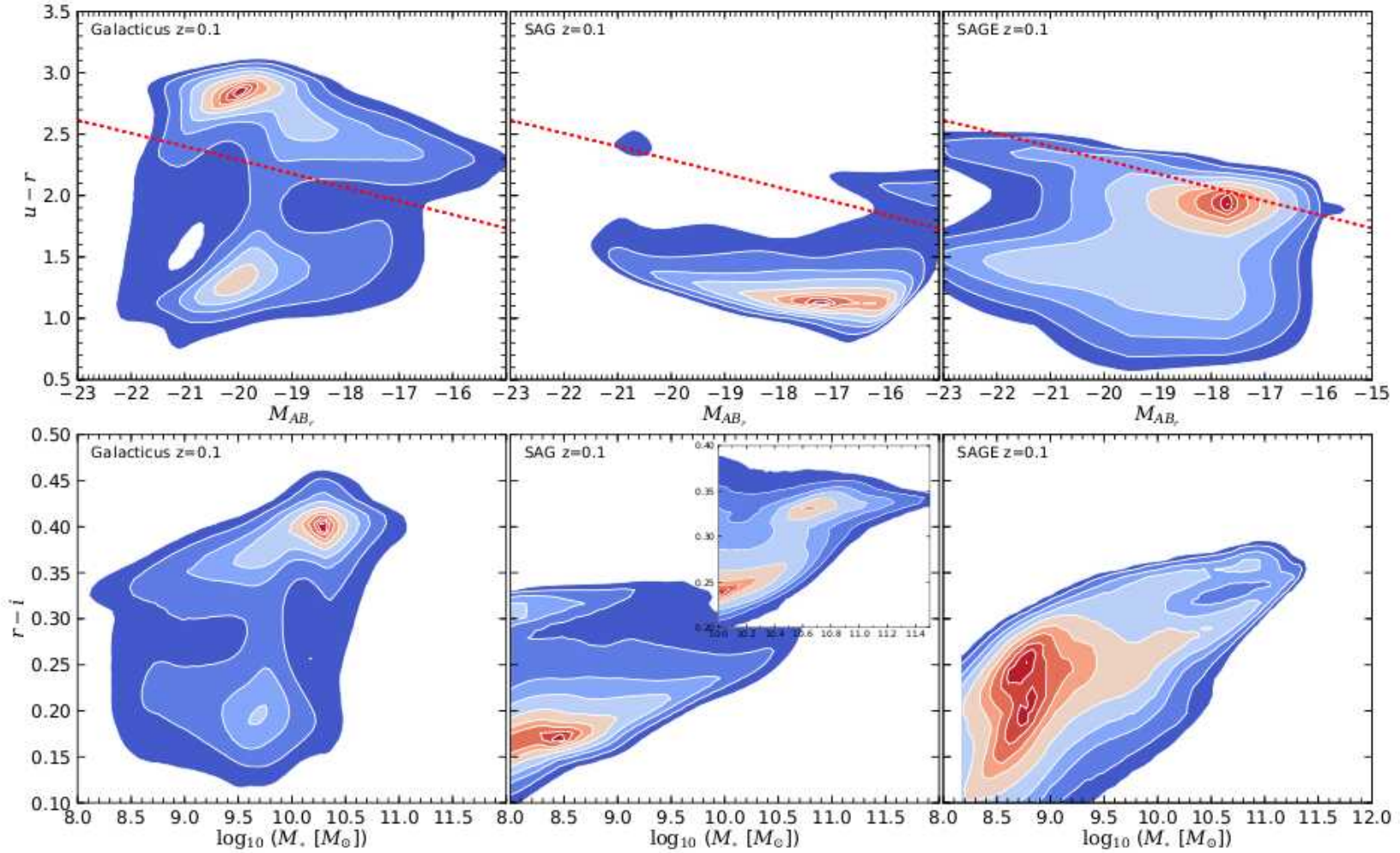
Luminosities



Knebe et al. 2018 (1710.08150v1)