Max-Planck-Institut
für Astrophysik

DiRAC

erc

The Henriques2015 model

AGN quenching and the trends of mass assembly and age "downsizing"

Bruno Henriques

Simon White, Peter Thomas, Raul Angulo, Qi Guo, Gerard Lemson, Volker Springel, Roderik Overzier

Galaxy Formation in the Planck Cosmology I, II, III & IV

Matching the observed evolution of star-formation rates, colours and stellar masses; B. Henriques, S. White, P. Thomas, et al.; MNRAS; 2015; in press

Star formation histories and post-processing magnitude reconstruction; S. Shamshiri, P. Thomas, B. Henriques, et al.; MNRAS; 2015; in press

The high-redshift Universe; S. Clay, P. Thomas, S. Wilkins, B. Henriques; MNRAS; 2015; in press

AGN and environmental quenching; B. Henriques, S. White, P. Thomas, et al.; MNRAS; 2015; in prep

Millennium Simulations

gavo.mpa-garching.mpg.de/MyMillennium/

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Virgo - Millennium Database

- Documentation
- CREDITS/Acknowledgments
- Registration
- News
- FAQ

Public Databases

- DGalaxies
- DHaloTrees
- Guo2010a
- Guo2013a
- Henriques2012a
- Henriques2014a
  - Tables
    - cones.MRscPlanck1_BC03_0ij
    - cones.MRscPlanck1_M05_0ij
    - MRIIscPlanck1
    - MRscPlanck1
- MField
- MillenniumII
- millimil
- miniMilII
- MMSnapshots
- MPAGalaxies
- MPAHaloTrees
- MPAMocks
- Snapshots

Private (MyDB) Databases

Welcome Bruno Henriques.
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For long duration batch queries, or file uploads into your MyDB, use the MyMillenniumTAP service in the Galformod Dashboa

Galformod Project – Henri

Bruno

galformod.mpa-garching.mpg.de/public/henriques2015a/

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Max-Planck-Institut für Astrophysik

Galformod project

Henriques2015a: Model

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L-Galaxies Workshop (4-6 January, 2016)

Workshop where we will release the Henriques2015 version of our galaxy formation model, including tutorials on running the default model and the MCMC sampling.

These webpages contain documentation for the Henriques 2015 release of the Munich model of galaxy formation. This scales the Millennium and Millennium-II simulations to the cosmology of the first PLANCK data release. MCMC methods were used to explore the full high-dimensional parameter space of the galaxy formation model in order to identify regions which could reproduce observed abundances and quenched fractions as a function of stellar mass from z=3 down to z=0. More than 4 million CPU hours were used and over 20 million models of galaxy formation in a region representative of the entire Universe evaluated.

Matching these calibrating datasets required the treatment of several astrophysical processes to be changed with respect to earlier models. Low-mass galaxies now form later than massive systems and almost all of them continue to form stars actively at z=0. Catalogues released for this model include snapshots of the (sub)halo and galaxy populations with extended photometric coverage and star formation and metallicity histories, as well as lightcones with photometry based on two different stellar population synthesis models.

MNRAS article: Henriques et al. 2015a

Download links for theoretical properties (SMFs, red fractions, color histograms, SSFR histograms, age histograms, etc) and combined observational data plotted in the paper: figures & data.
Description of the physics included in the model: description.

Chrome File Edit View History Bookmarks People Window Help 100% Mon 09:01 MPA

L-Galaxies Workshop

Bruno

galformod.mpa-garching.mpg.de/public/henriques2015a/Workshop/index.html

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L-Galaxies Workshop

Home | Programme | Participants | Venue | Registration | Henriques2015 Model

Workshop on the Munich Galaxy Formation & Evolutiom Model

During the workshop we will release the Henriques2015a version of our code and give tutorials on how to run its default version and the MCMC sampling. In addition, there will be the opportunity to learn about accessing the Millennium database and for participants to present their own work using the model.

When & Where

Max-Planck Institute for Astrophysics

Garching Forzchungzentrum, Munich

4-6 January, 2016

Latest Update

Registration Open

Registration is now open and will close on the **1st of October**

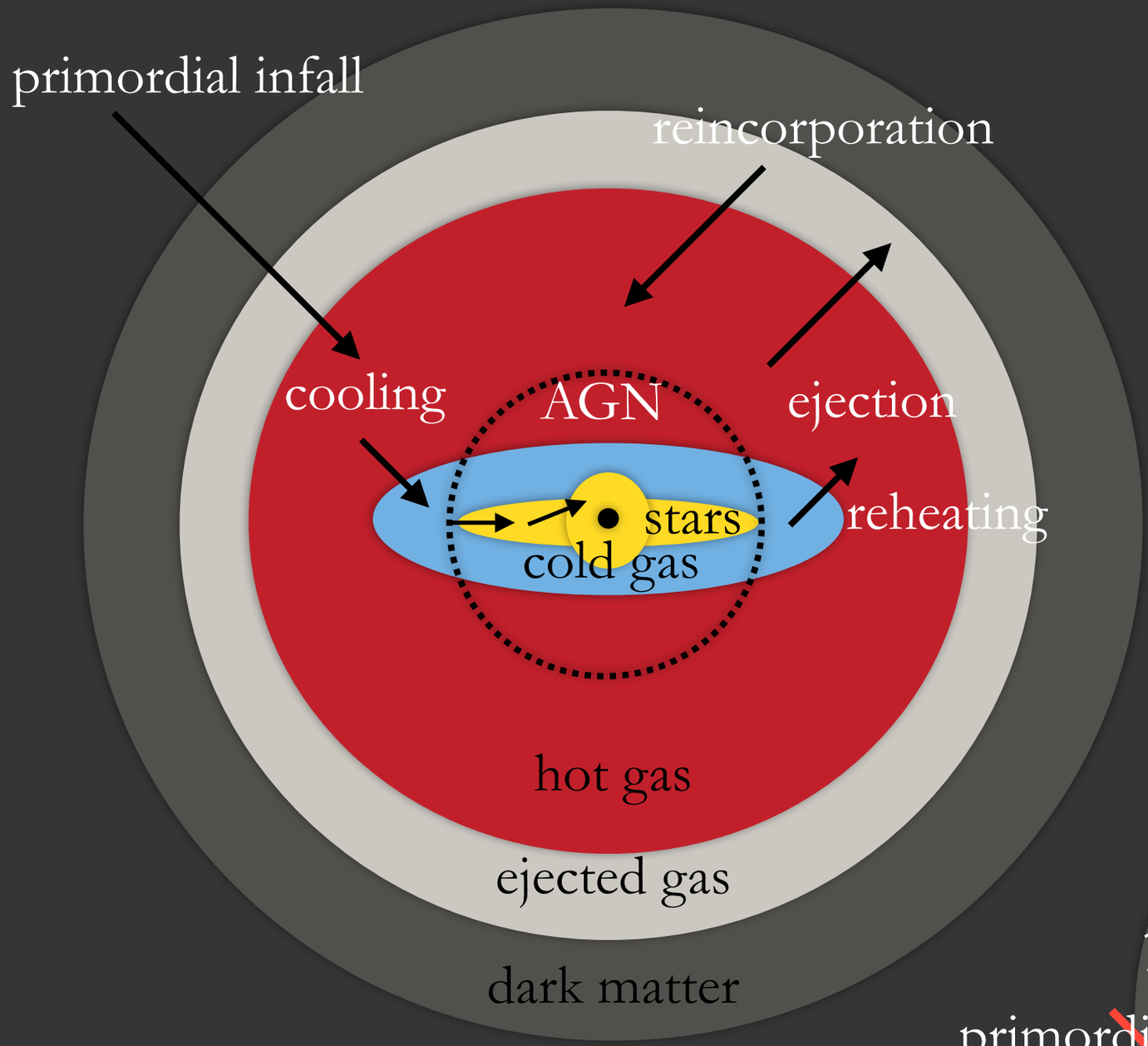
Accommodation

You can find details on accommodation **here**

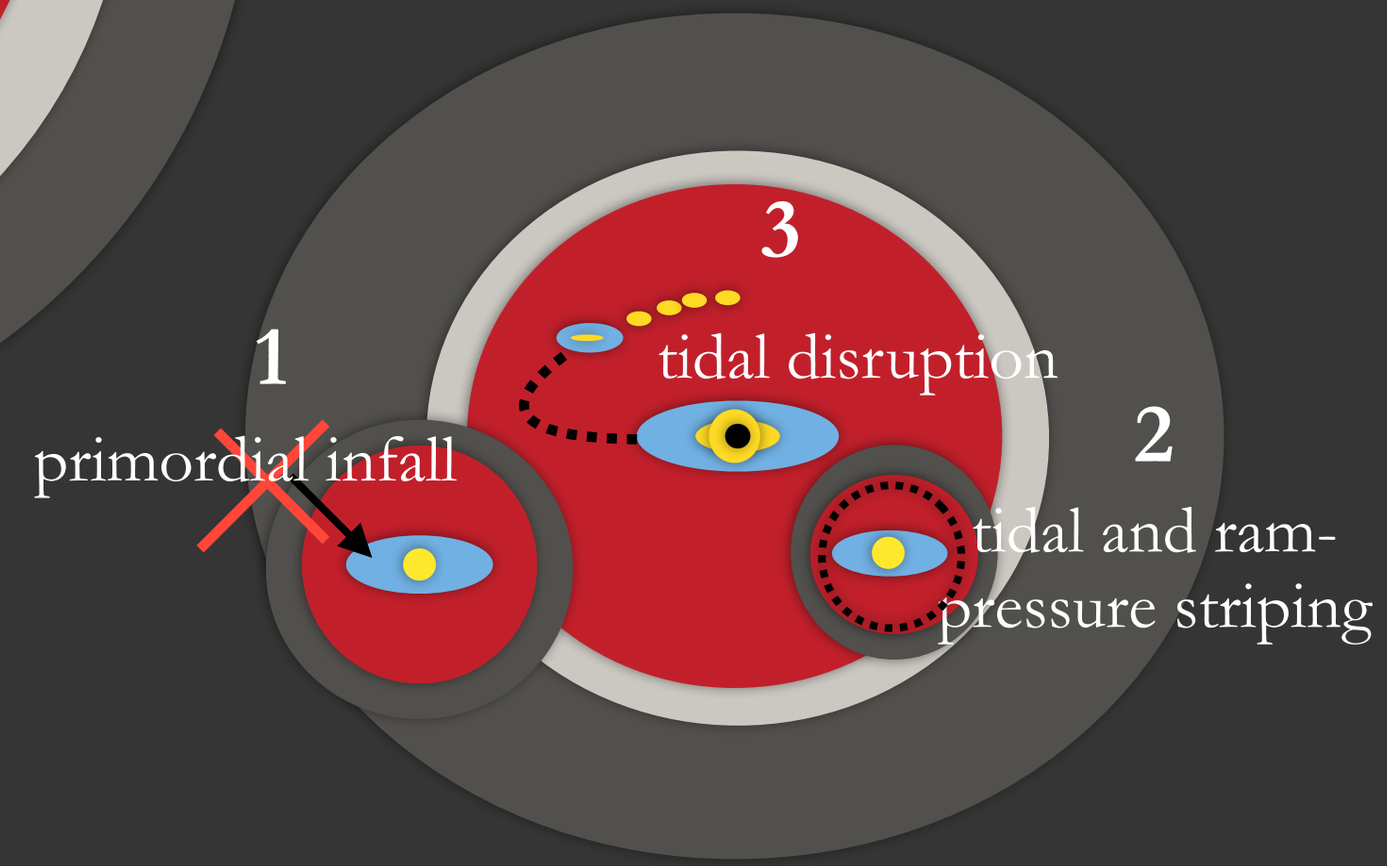
Contact

Email: **bhenriques@mpa-**

Model of Galaxy Formation

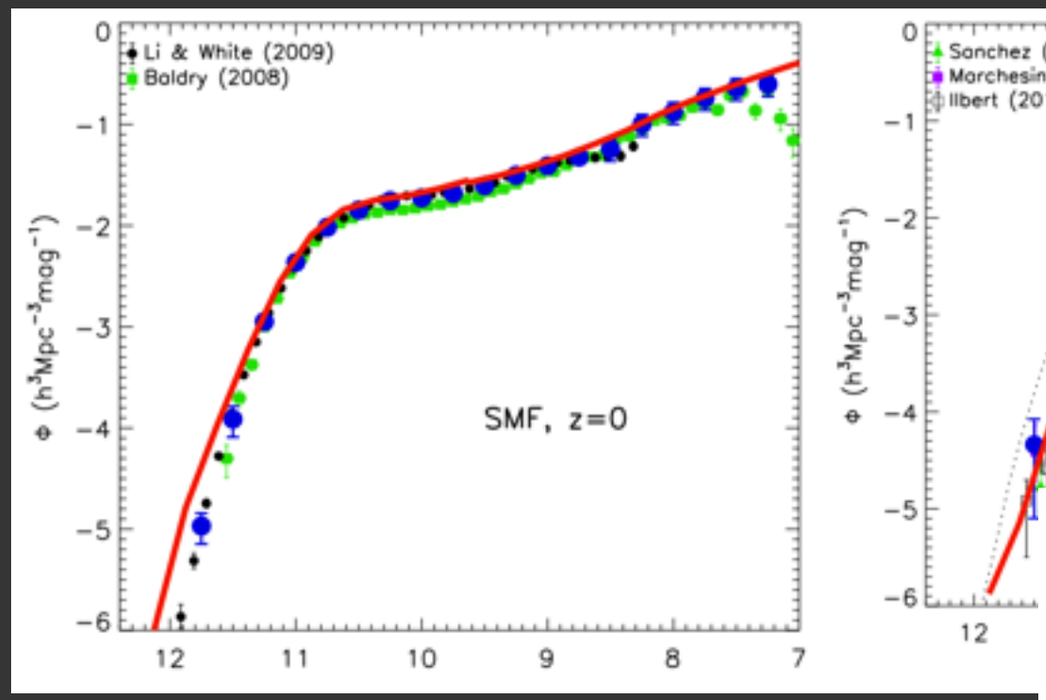


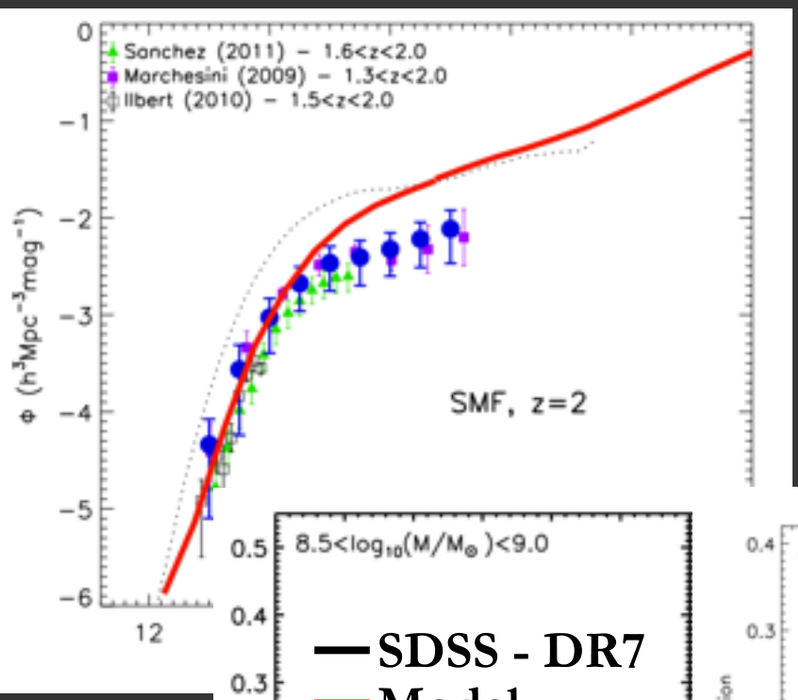
Environmental effects on satellite galaxies

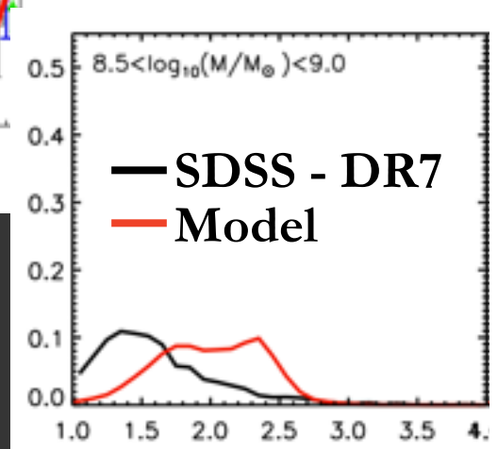


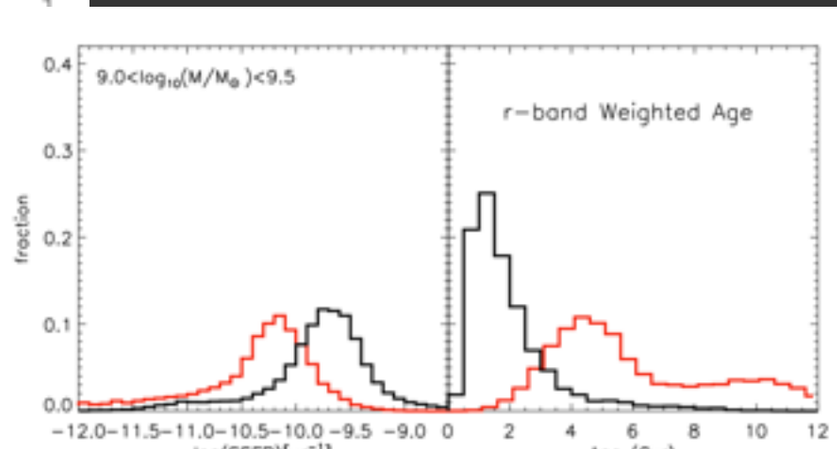
Guo2010/2013 model

Excessive number of low mass galaxies forming at high-z

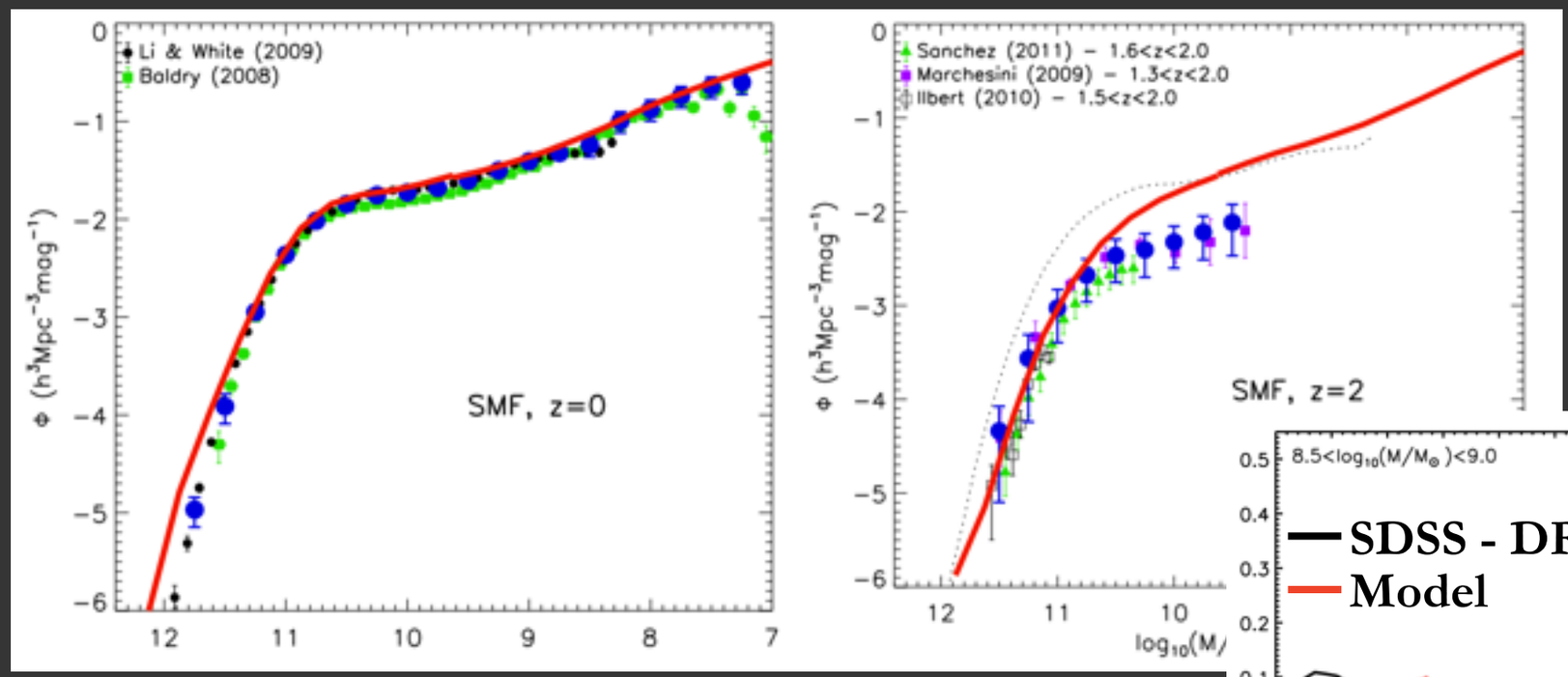


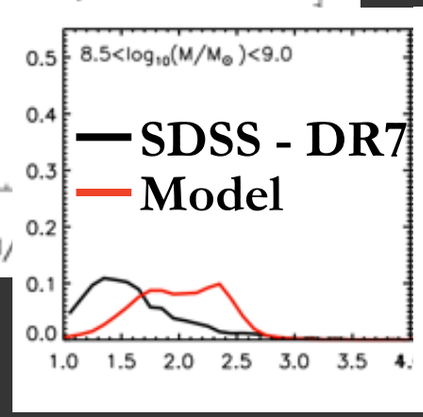


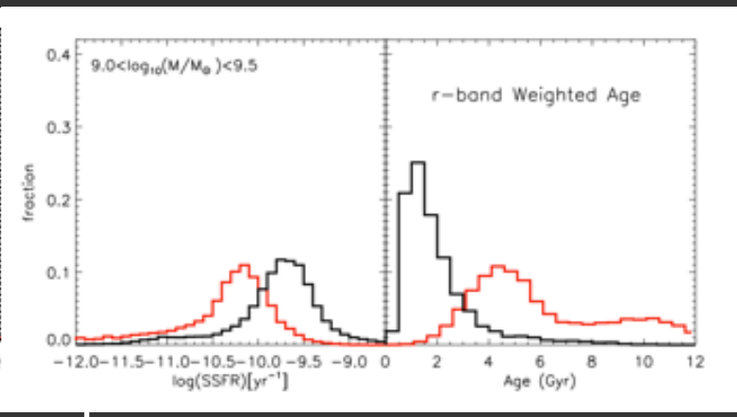




Excessive number of low mass galaxies forming at high-z







models fail to match observations because the parameters were not properly adjusted?

models fail to match observations because physics are wrong?

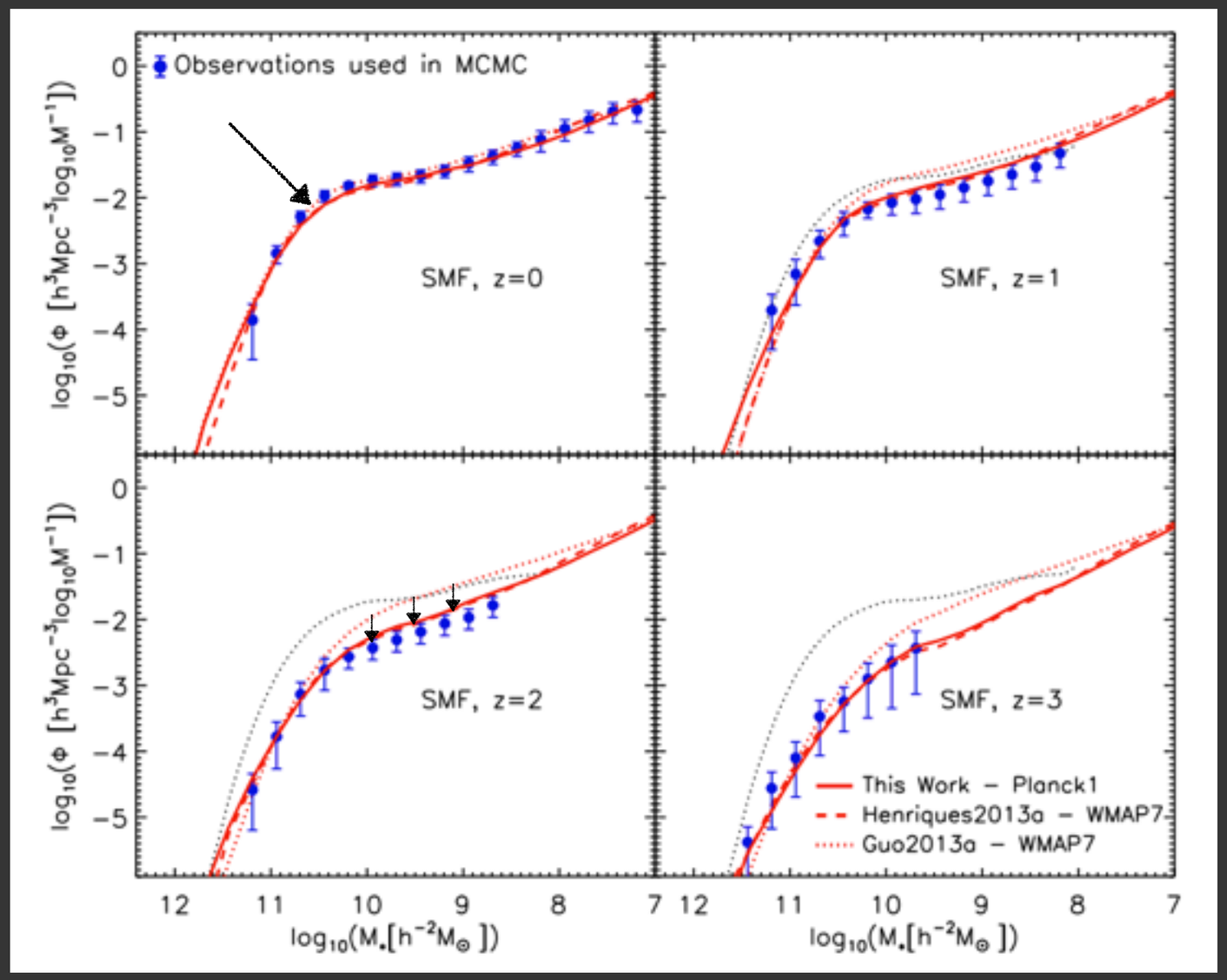
Full sampling of the parameter space (e.g. MCMC)

Henriques, Thomas et al. (2009), Henriques & Thomas (2010),
Henriques et al. (2013), Henriques et al. (2014)

1 - Changes in the SN feedback

1 - longer reincorporation time-scales for gas ejected by SN in low mass galaxies

lower number density at early times, stronger build up at later times



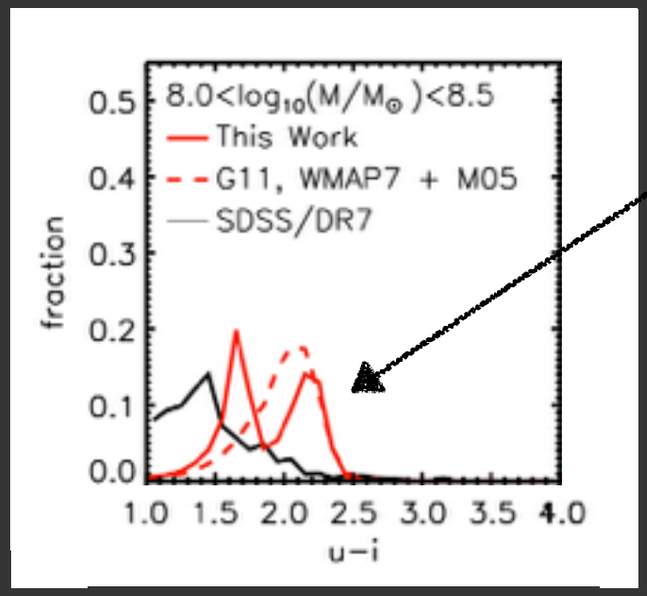
$$t_{\rm reinc} = -\gamma' \frac{10^{10}\,{\rm M}_\odot}{M_{\rm vir}},$$

Henriques et al. 2013

scaling in agreement with Oppenheimer & Dave 2008

hydro should correctly follow the gas flows

2 & 3 - Changes in the SF threshold and in the ram-pressure stripping



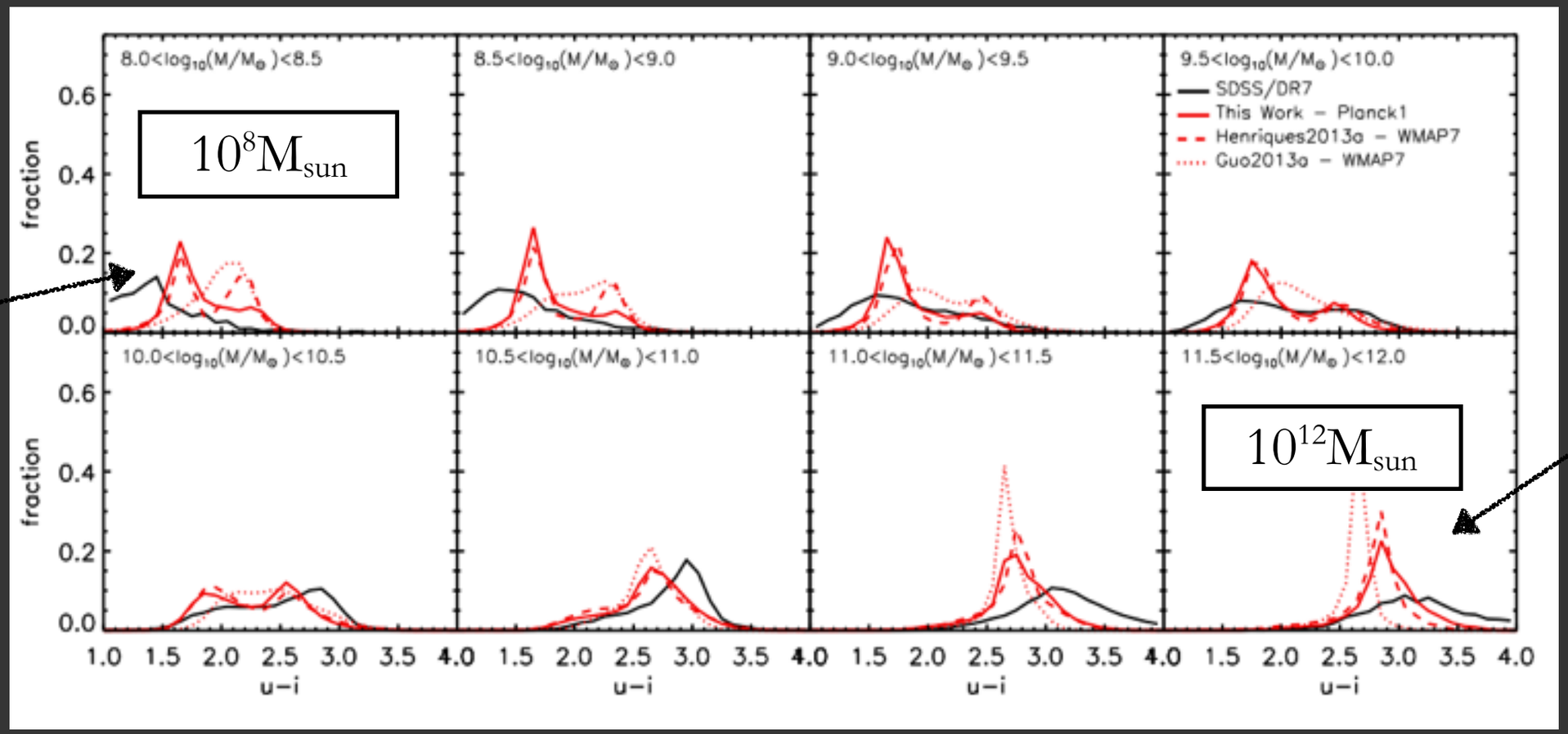
despite the later build up a population of low mass red satellites remained at z=0

2 - lower the cold gas surface density threshold for star-formation

$$\dot{m}_\star = \alpha_{\rm SF} \frac{(m_{\rm cold} - m_{\rm crit})}{t_{\rm dyn,disk}},$$

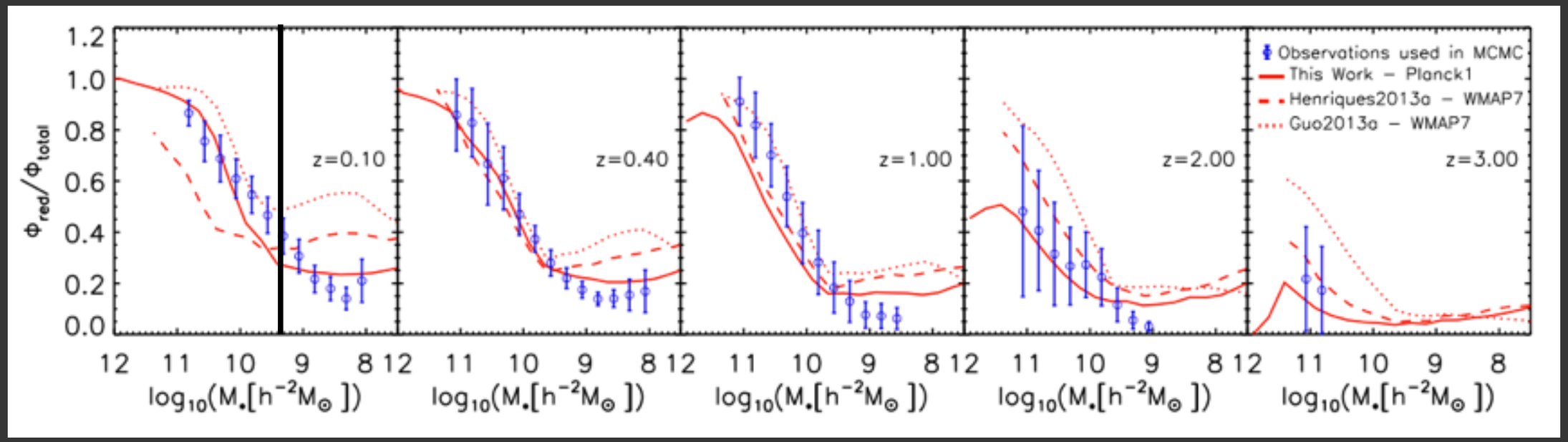
3 - ram-pressure only in clusters ($M_{vir}>10^{14}$)

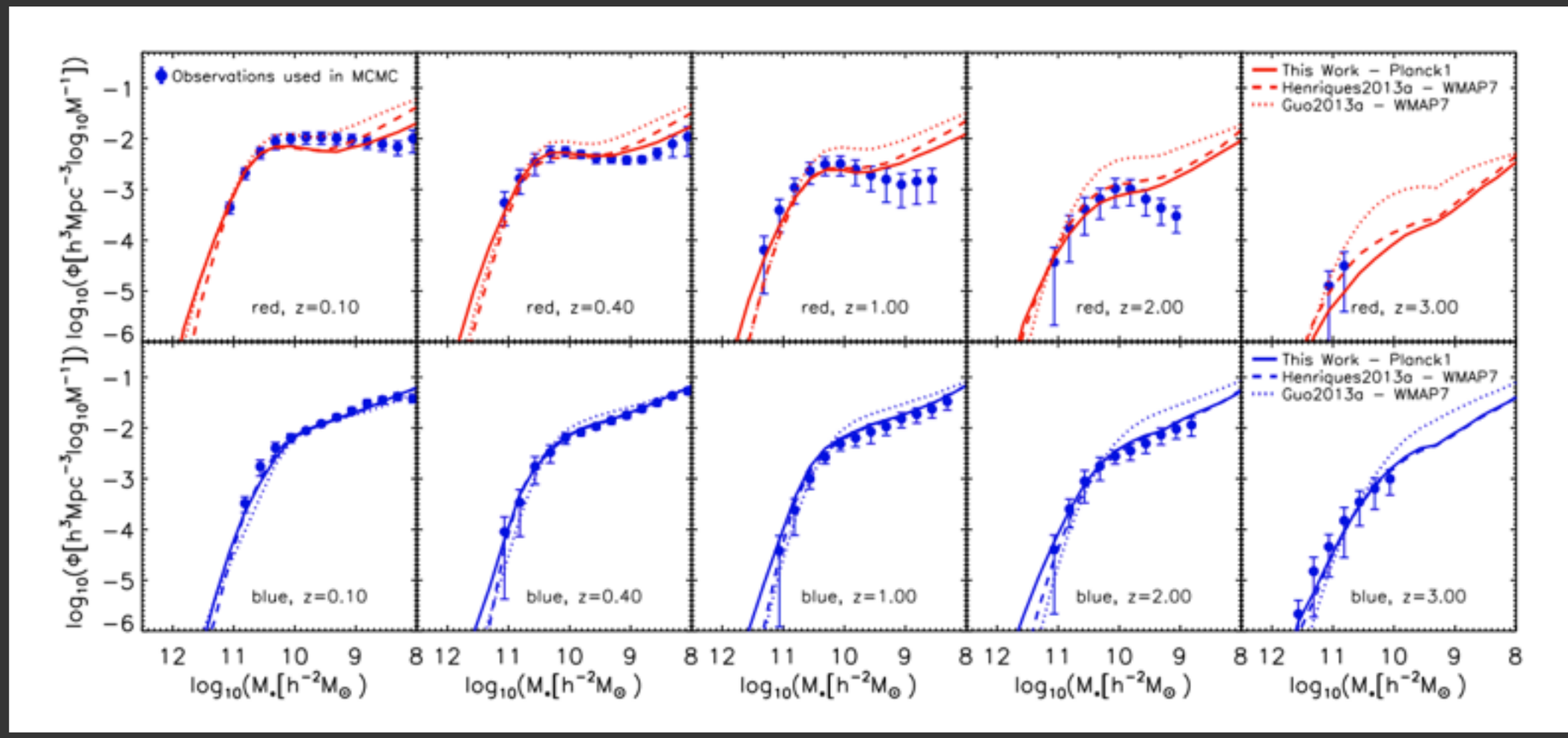
low mass galaxies are blue



massive galaxies are red

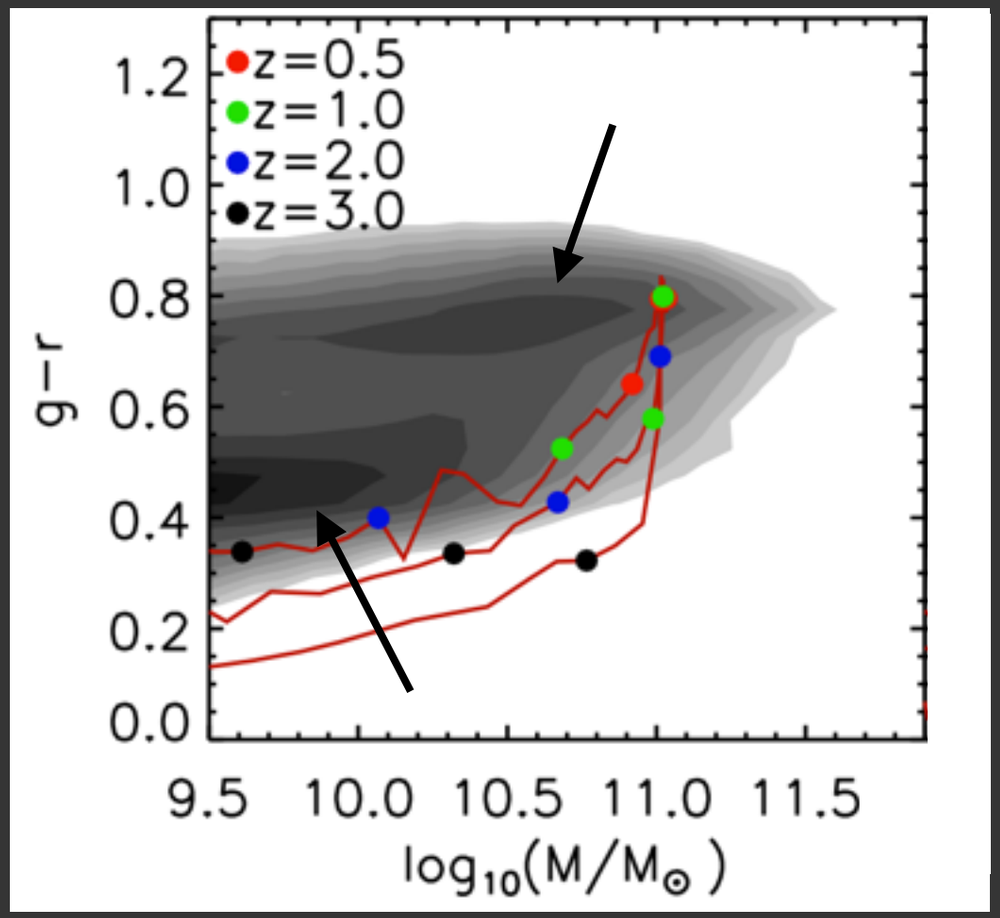
Stellar Mass Function by Colour





The physics affecting massive galaxies

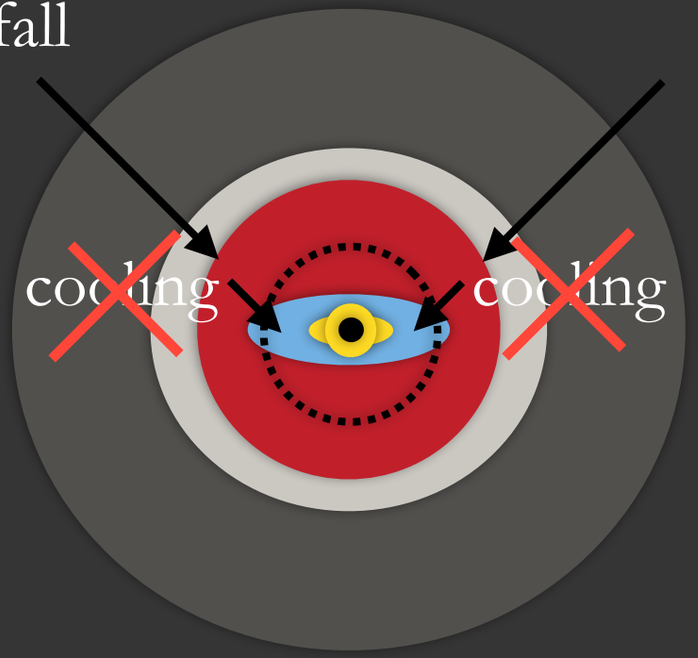
colour - stellar mass relation



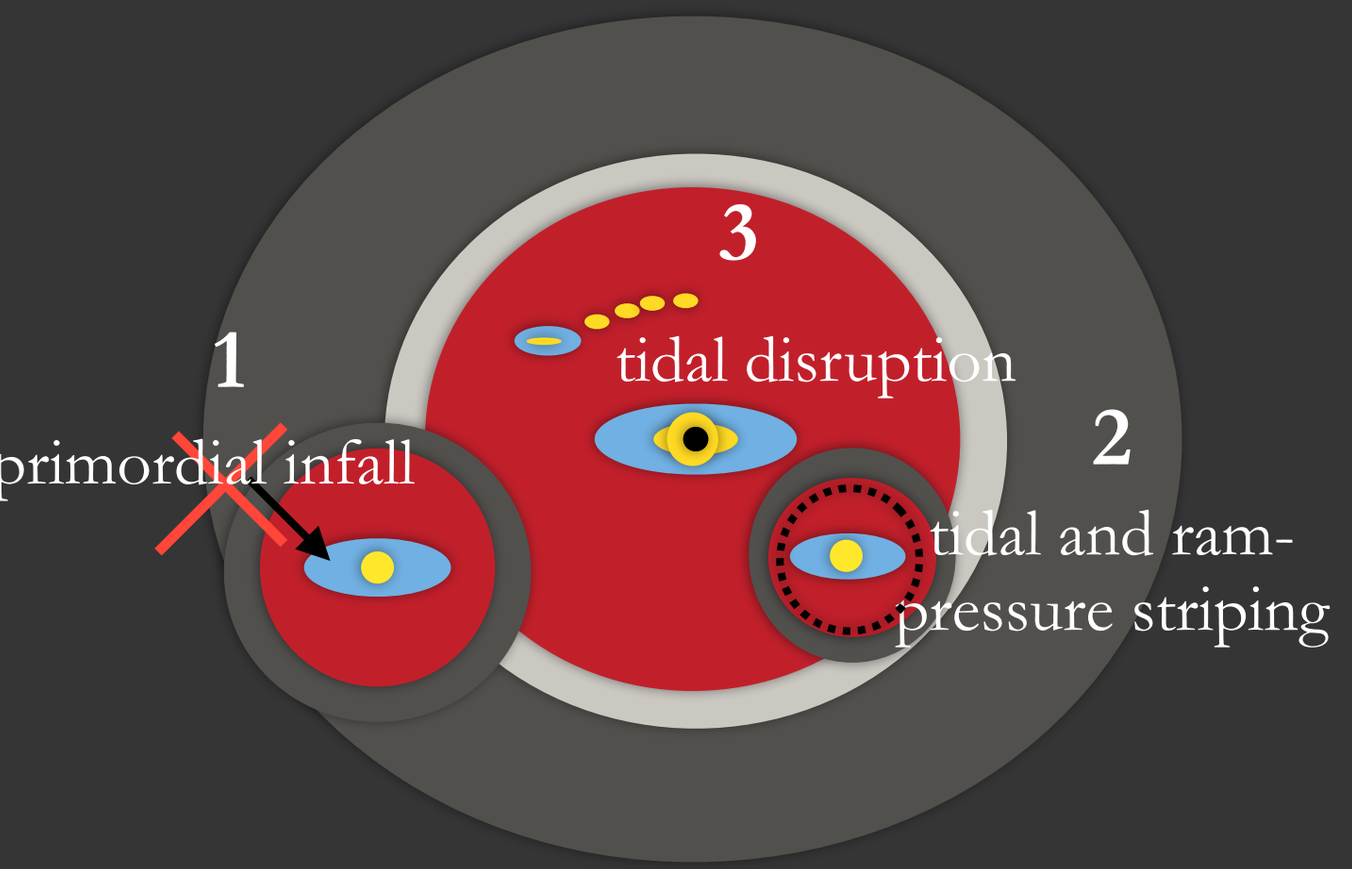
Galaxy Formation in the Planck Cosmology IV; Henriques, White, Thomas, et al.; 2015; in prep

AGN feedback

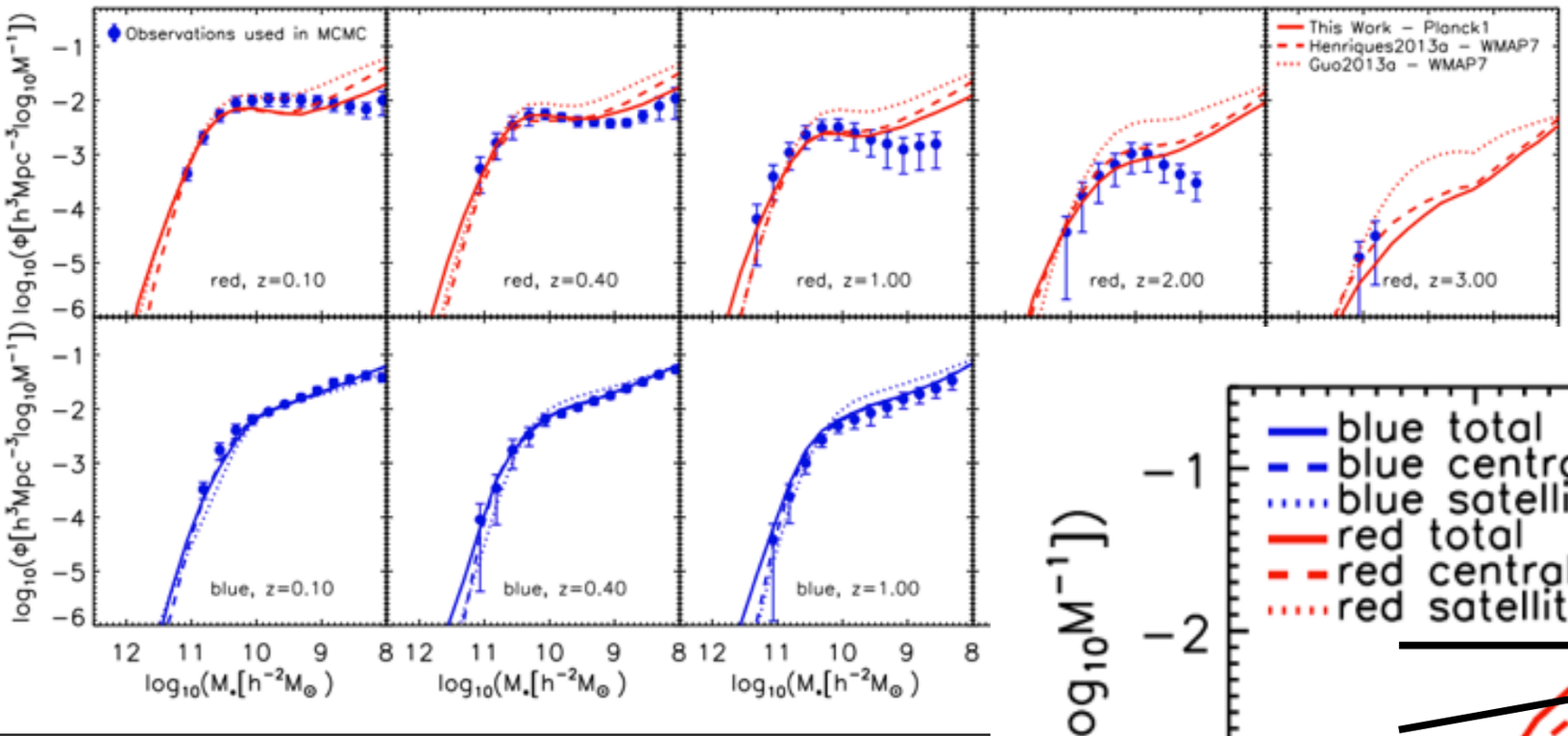
primordial infall

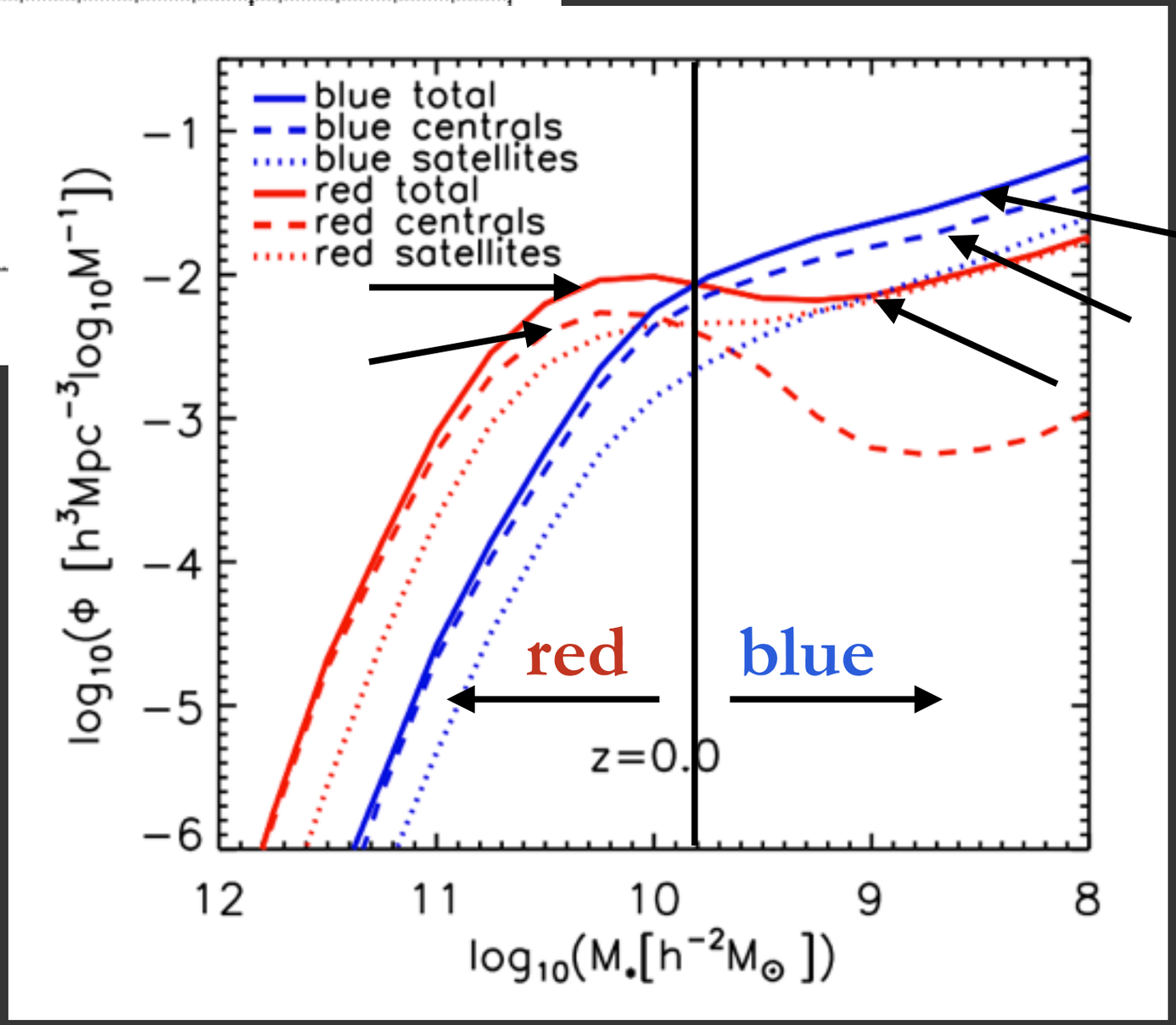


Environmental effects



Stellar Mass Function by Colour





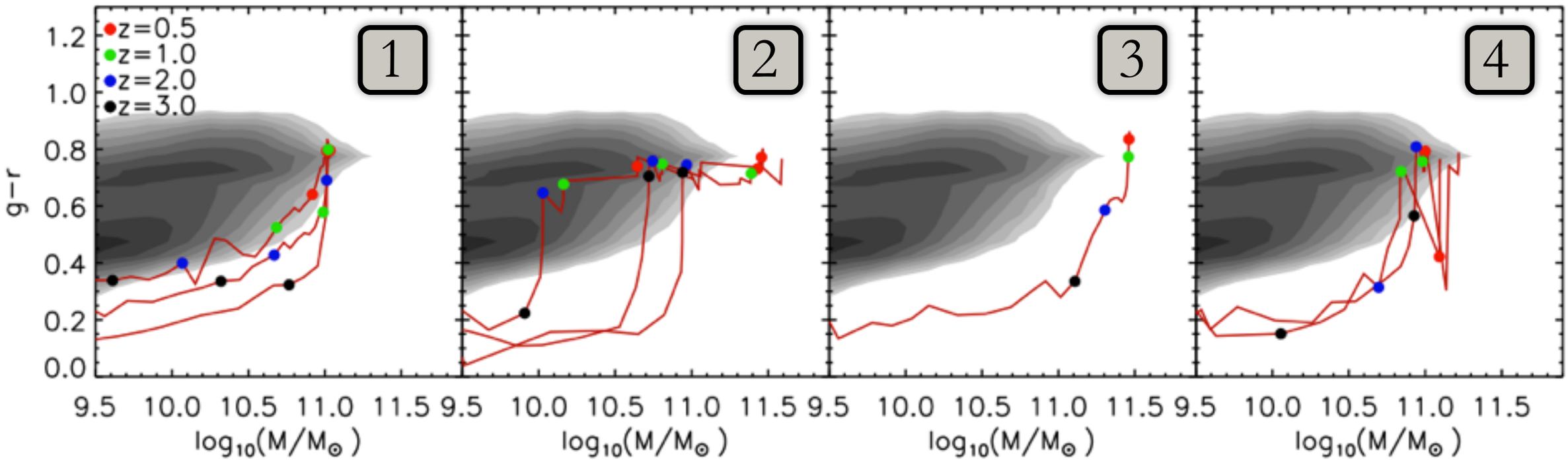
most massive galaxies are red
most low mass galaxies are blue

centrals dominate everywhere

red high mass centrals (AGN), blue low mass centrals

low mass red galaxies are satellites

Colour evolution of massive galaxies



1 - standard evolution of massive galaxies with quenching at $2<z<0.5$

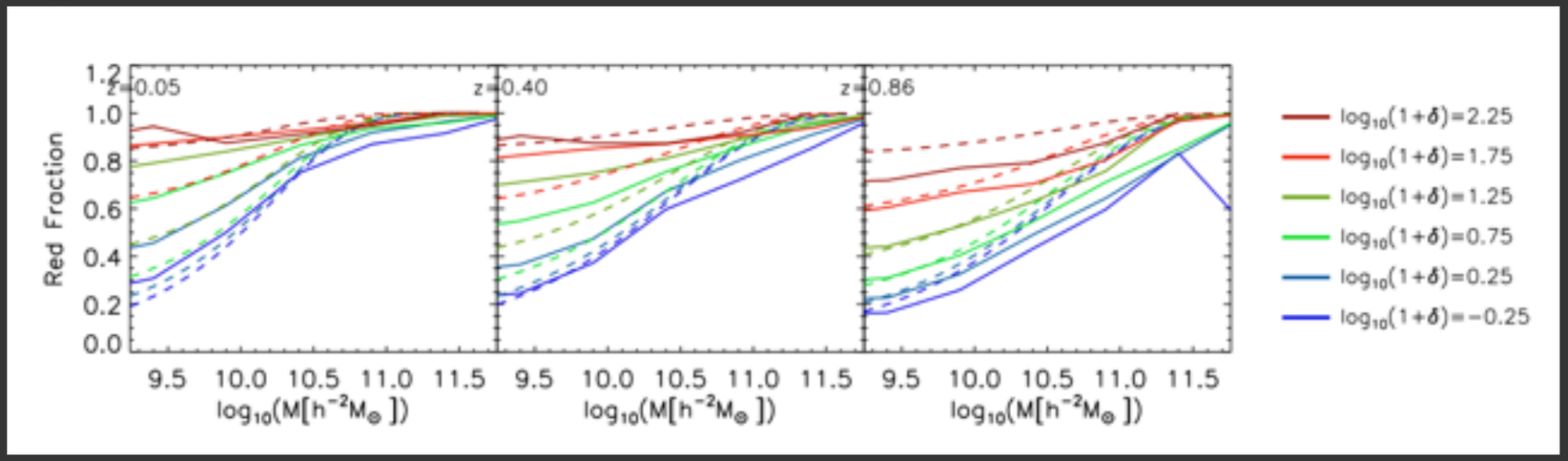
2 - extreme age “downsizing” with quenching at $z\sim3$

3 - extreme mass-assembly “downsizing” ($10^{11}M_{sun}$ at $z\sim3$)

4 - return to the star-forming sequence

AGN Quenching

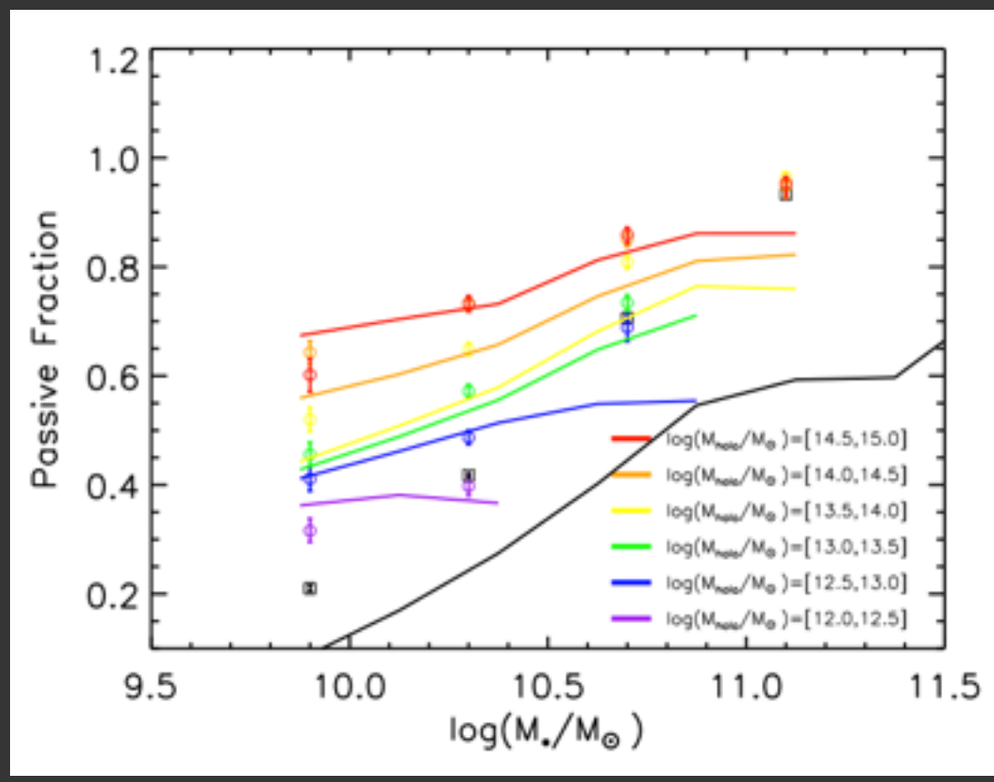
passive fraction vs stellar mass over time



data from Peng et al. 2010

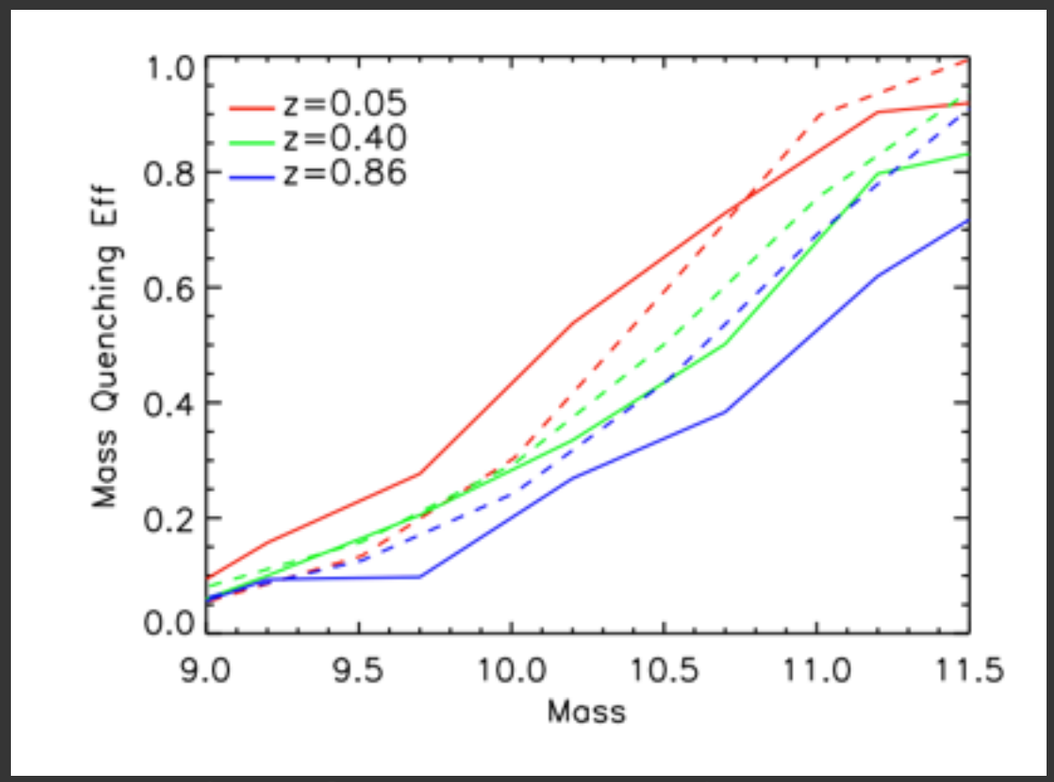
Galaxy Formation in the Planck Cosmology IV; Henriques, White, Thomas, et al.; 2015; in prep

passive fraction vs stellar mass



data from Wetzel et al. 2012

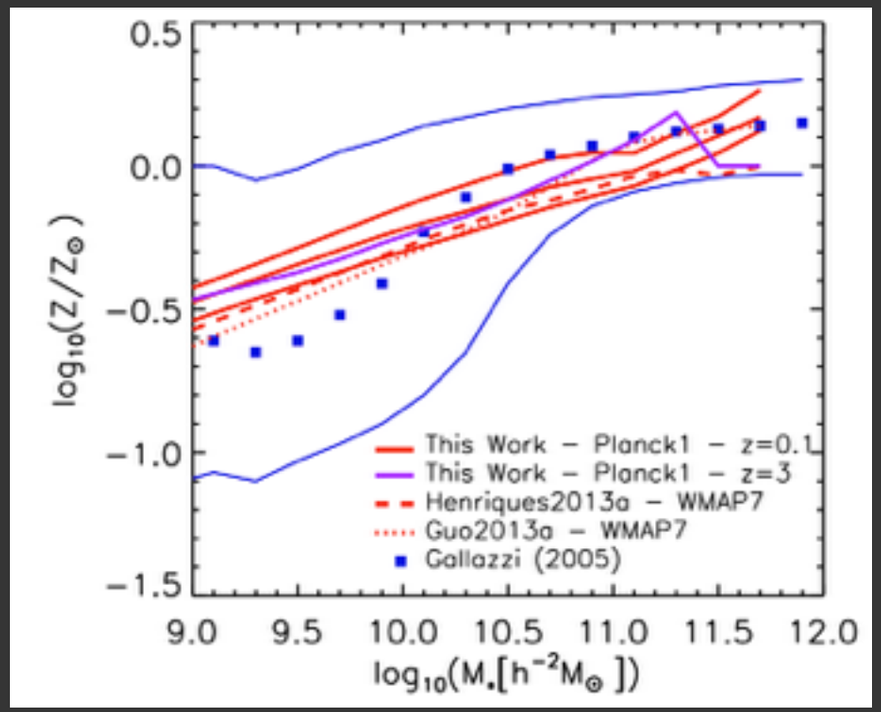
evolution of mass quenching efficiency



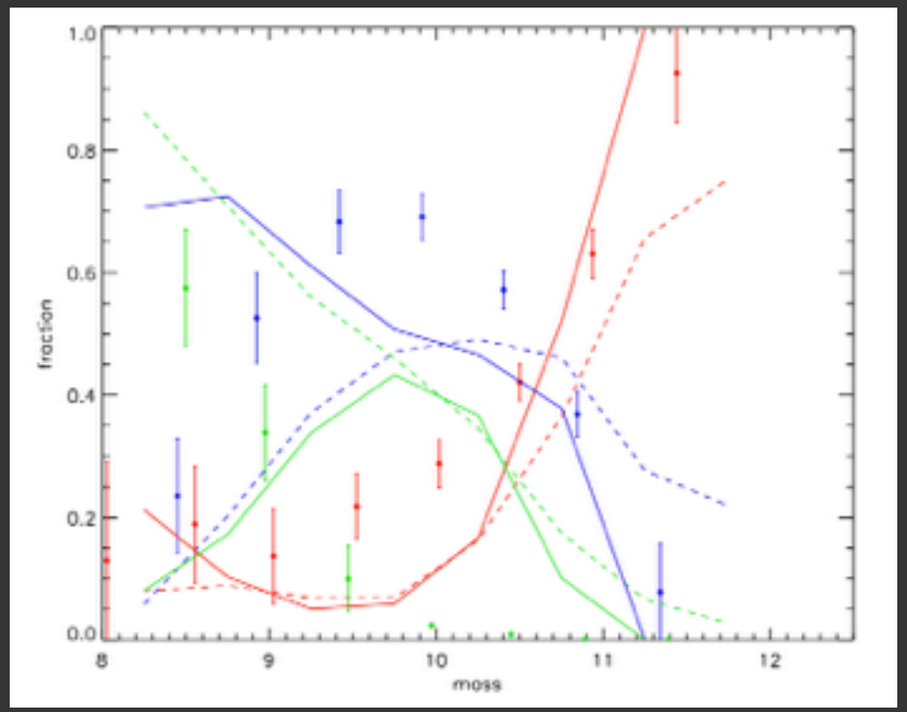
data from Peng et al. 2010

Additional Predictions

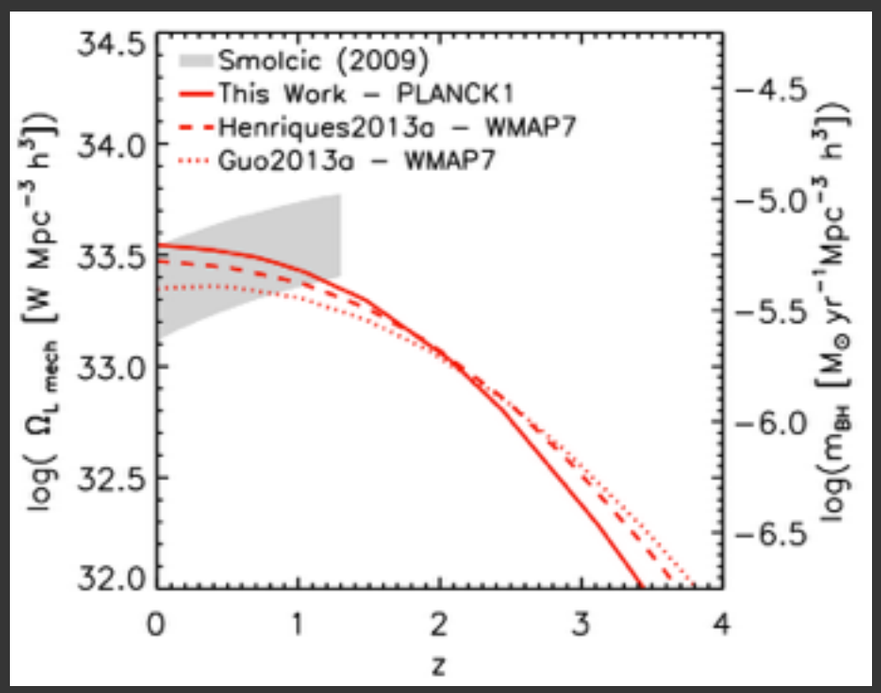
mass-metallicity relation



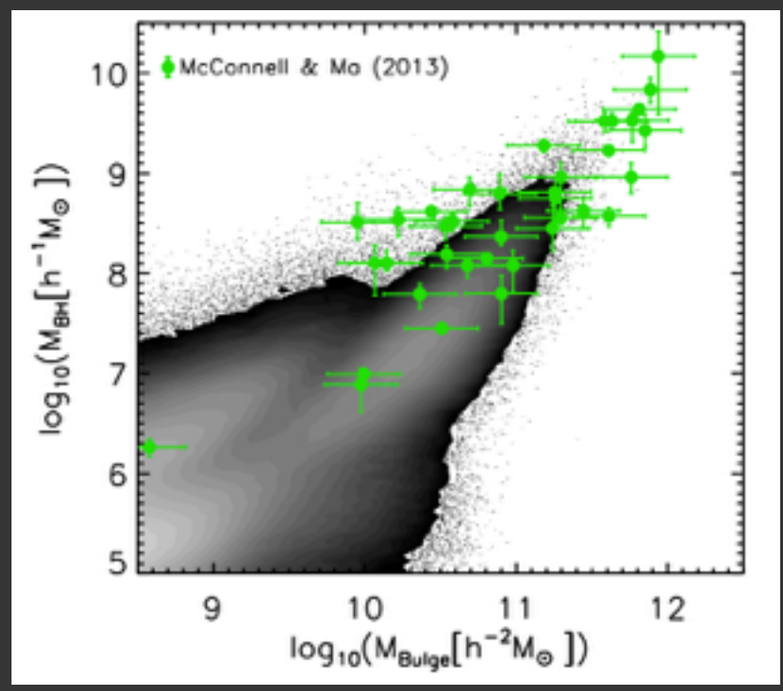
mass-morphology relation



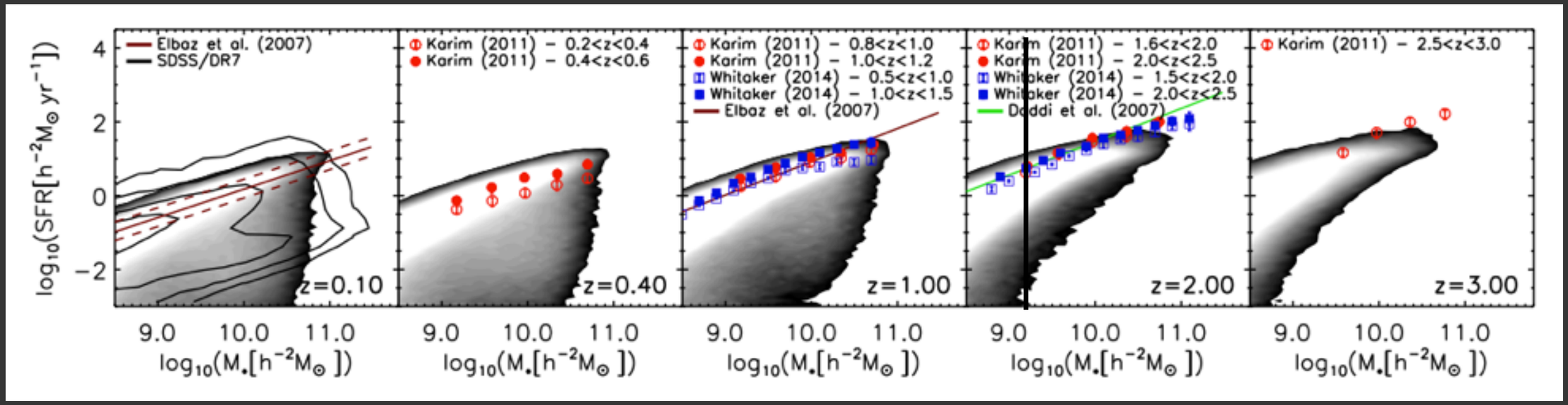
radio mode accretion vs redshift

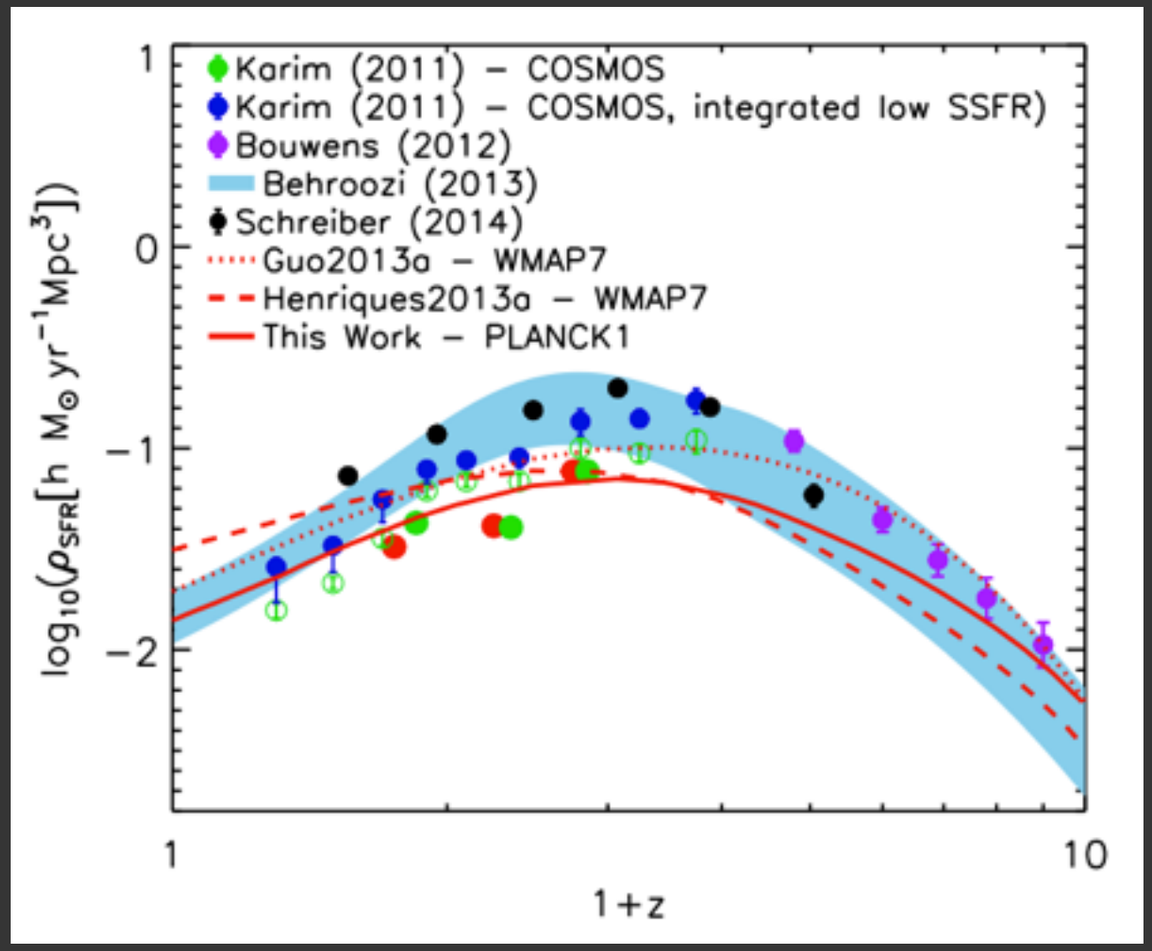


black hole-bulge mass relation



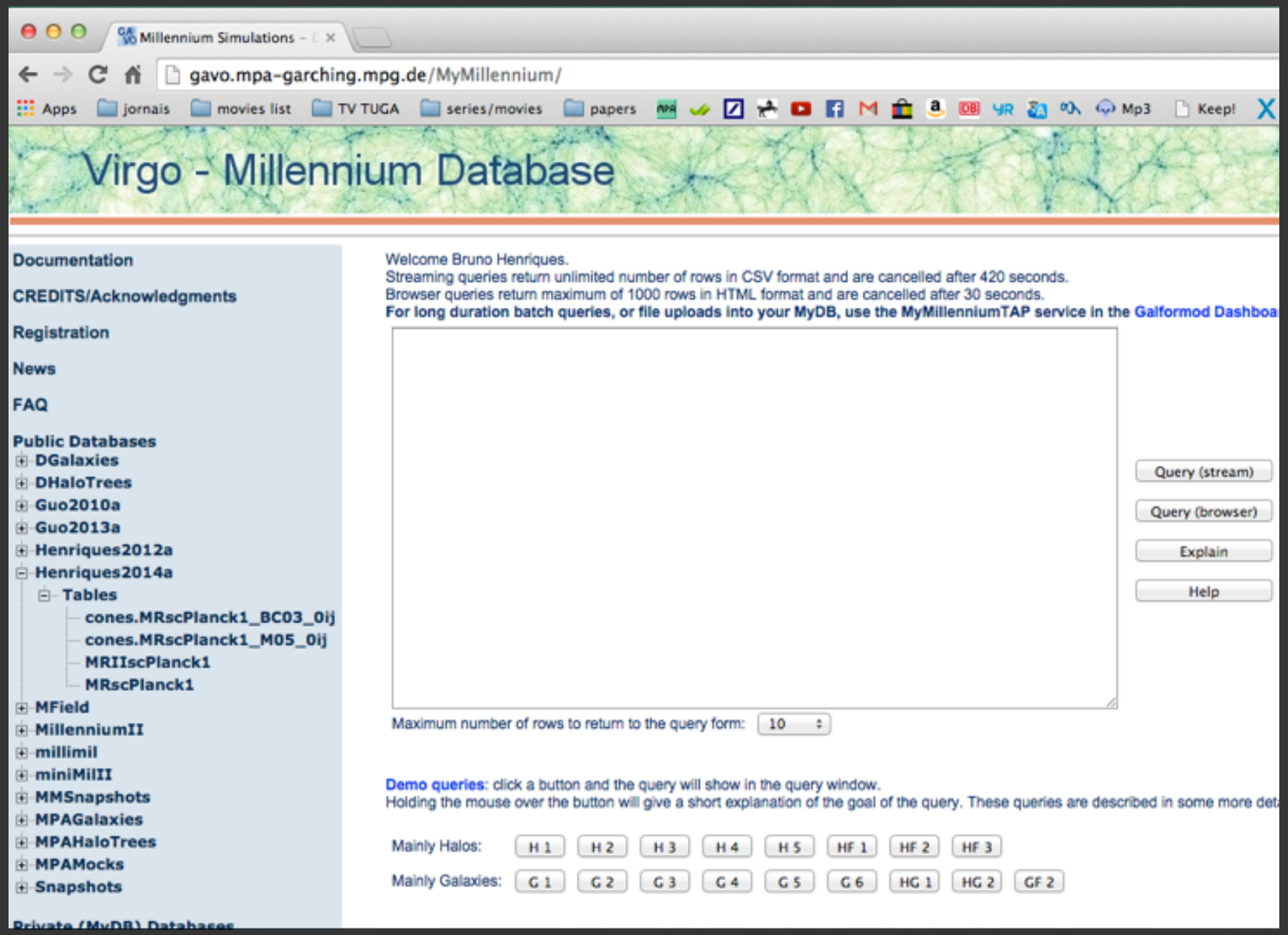
Star Formation Rates





decrease in the normalisation of the main sequence due to a reduction in cosmic accretion

overall SFRD reduced due to a population of quenched objectes at $z<2$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DHaloTrees
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Guo2013a
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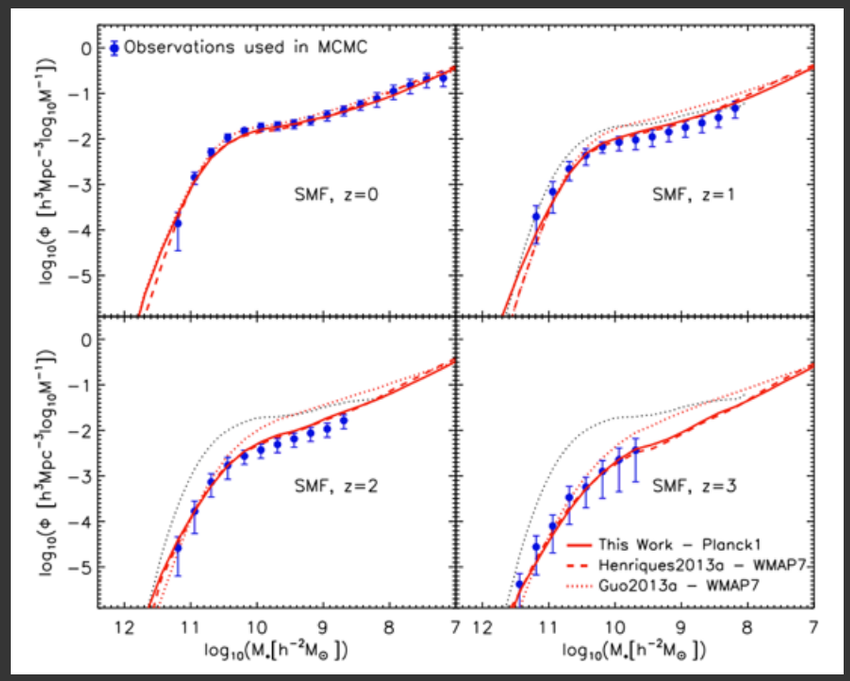
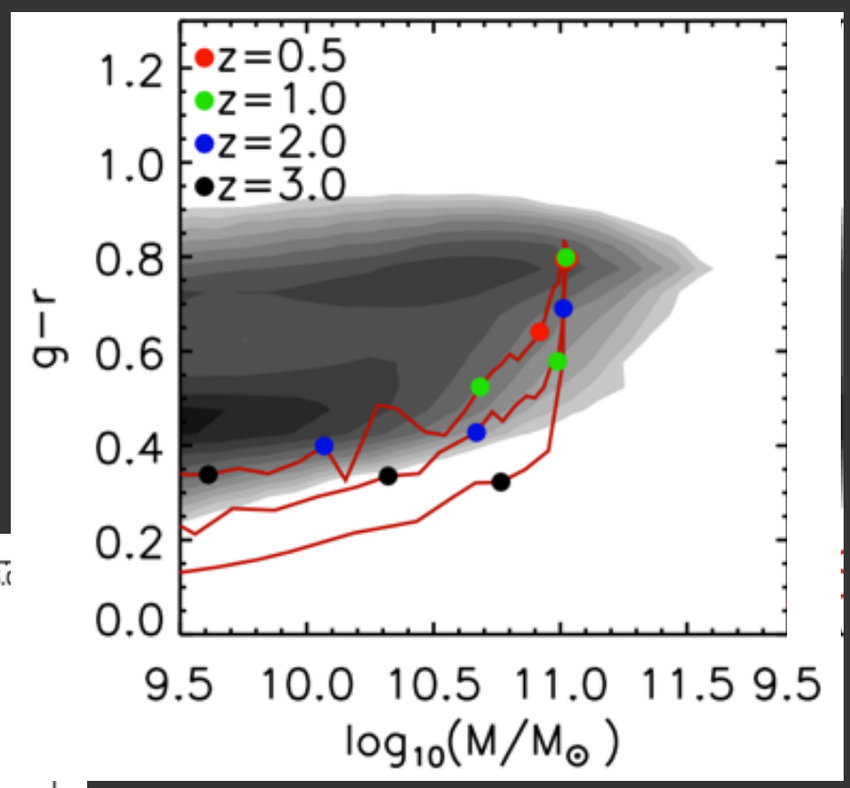
Query (stream)
Query (browser)
Explain
Help
Maximum number of rows to return to the query form: 10
Demo queries: click a button and the query will show in the query window.
Holding the mouse over the button will give a short explanation of the goal of the query. These queries are described in some more deta
Mainly Halos: H 1 H 2 H 3 H 4 H 5 HF 1 HF 2 HF 3
Mainly Galaxies: G 1 G 2 G 3 G 4 G 5 G 6 HG 1 HG 2 GF 2


Observations used in MCMC
SMF, z=0
SMF, z=1
SMF, z=2
SMF, z=3
This Work – Planck1
Henriques2013a – WMAP7
Guo2013a – WMAP7
log10(Φ [h3Mpc−3log10M−1])
log10(M*[h−2M⊙])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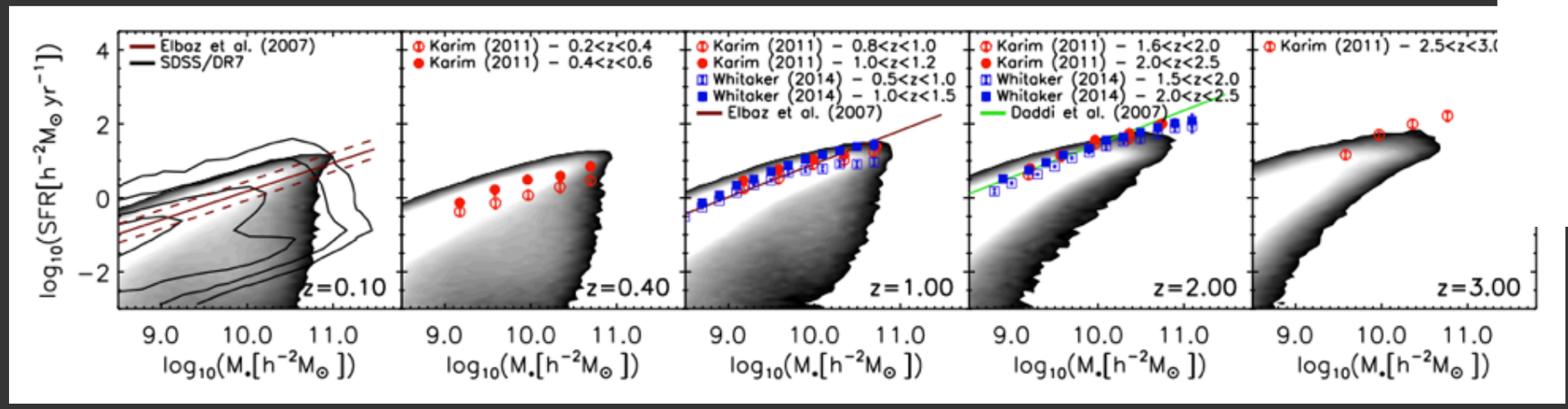
z=2.0
z=3.0
g−r
log10(M/M⊙)


Elbaz et al. (2007)
SDSS/DR7
Karim (2011) – 0.2<z<0.4
Karim (2011) – 0.4<z<0.6
Karim (2011) – 0.8<z<1.0
Karim (2011) – 1.0<z<1.2
Whitaker (2014) – 0.5<z<1.0
Whitaker (2014) – 1.0<z<1.5
Karim (2011) – 1.6<z<2.0
Karim (2011) – 2.0<z<2.5
Whitaker (2014) – 1.5<z<2.0
Whitaker (2014) – 2.0<z<2.5
Daddi et al. (2007)
Karim (2011) – 2.5<z<3.0
z=0.10
z=0.40
z=1.00
z=2.00
z=3.00
log10(SFR[h−2M⊙ yr−1])
log10(M*[h−2M⊙])