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ICRAR is a partnership between The University of Western Australia and Curtin University of Technology

Mock ASKAP Catalogs

Lister Staveley-Smith

ICRAR, University of Western Australia

WALLABY Simulation Working Group

TWG1

Abate, Baugh, Bekki, **Blake***, Colless, Crain, Duffy,
Frenk, Glazebrook, Gupta, Hendry, Jarvis, Jones,
Jurek, Kilborn, Oosterloo, Popping, Power, Rawlings,
Staveley-Smith, Webster, Whiting, Zwaan

*coordinator

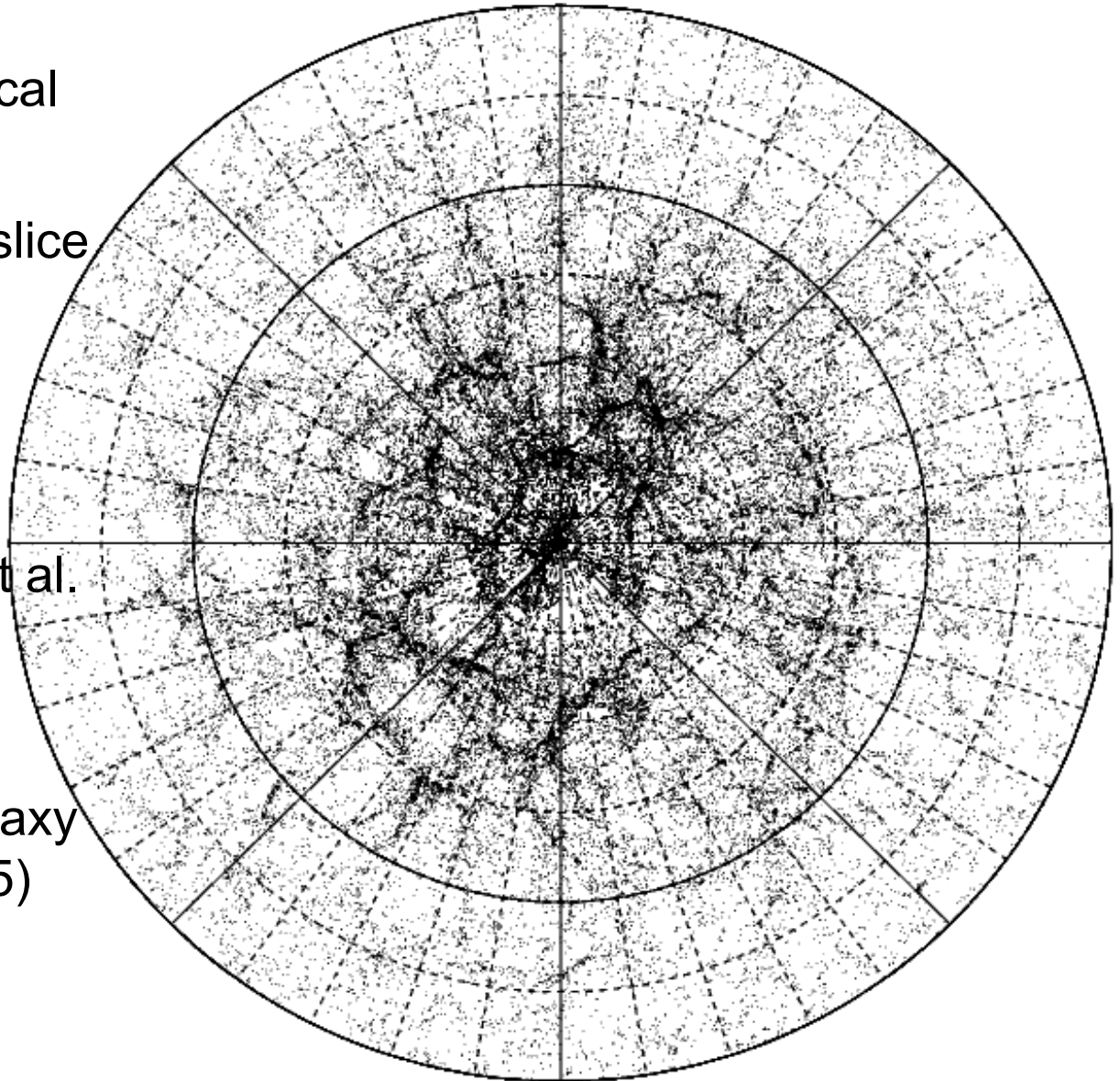
Aim

- To create mock catalogues and mock skies.
- To process these through ASKAP pipelines, adding realistic noise and telescope effects.
- To determine if scientific goals can be achieved
e.g.:
 - scale-dependent bias, correlation functions
 - density dependence of HIMF
 - power spectrum, peculiar velocities
 - physics of galaxy formation (AGN, feedback)
 - intracluster gas

WALLABY SSP proposal: simulated sky distribution

Beutler & Staveley-Smith; Zwaan

- Custom-built semi-empirical galaxy generator
- 300 Mpc radius, 50 Mpc slice
- 5- σ detection algorithm
- 2-km configuration
- HIPASS 2DSWML mass-velocity function (Zwaan et al. 2005)
- No evolution
- Millennium simulation galaxy seeds (Springel et al. 2005)



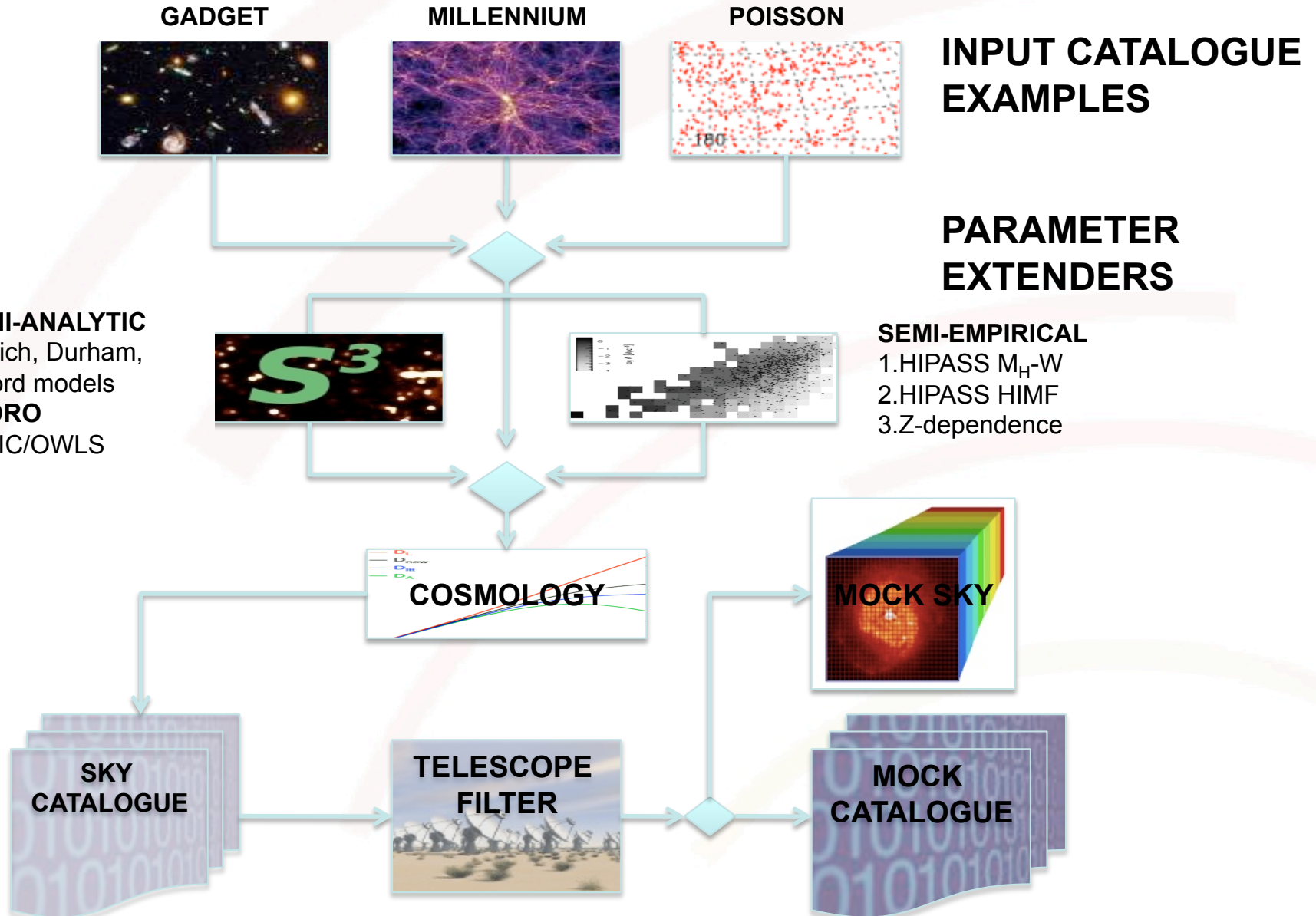
TWG1 status

- Draft 2010-2011 plan circulated by Blake (30 Oct).
- Key elements:
 - hydro cubes (Bekki, Crain, Duffy, Popping)
 - semi-analytic/empirical catalogues (e.g. Blake, Power, Rawlings)
 - telescope effects (resolution, noise, errors)
 - mock science



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Mocks





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S-cubed SAX: state-of-the-art semi-analytic database



UNIVERSITY OF
OXFORD

S³ The SKADS Simulated Skies



e-mail webmaster

Semi-Analytical Extragalactic Database

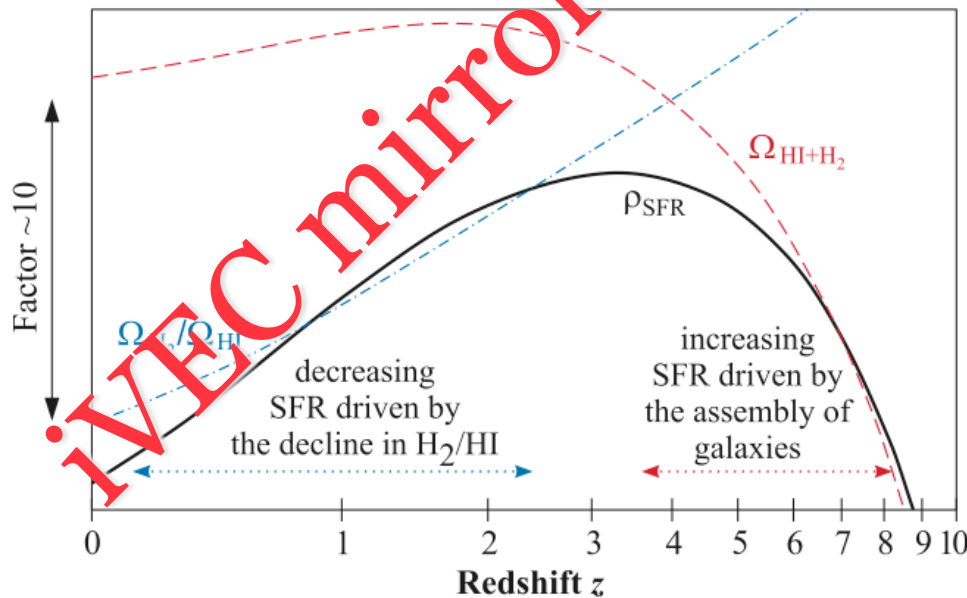
Overview

This simulation uses the Millennium dark matter simulation (Springel et al. 2005) and the semi-analytic galaxy catalogue by De Lucia et al. 2006 to reconstruct neutral hydrogen (atomic and molecular) in galaxies out to redshift $z=9.7$ in a field of view 4.1×4.1 degrees.

Mass range of atomic hydrogen ($H I$): $> 5 \times 10^7 M_{\odot}$

Mass range of molecular hydrogen (H_2): $> 5 \times 10^7 M_{\odot}$

A detailed description of the simulation can be found in Obreschkow et al. 2009 (submitted to the Astrophysical Journal)

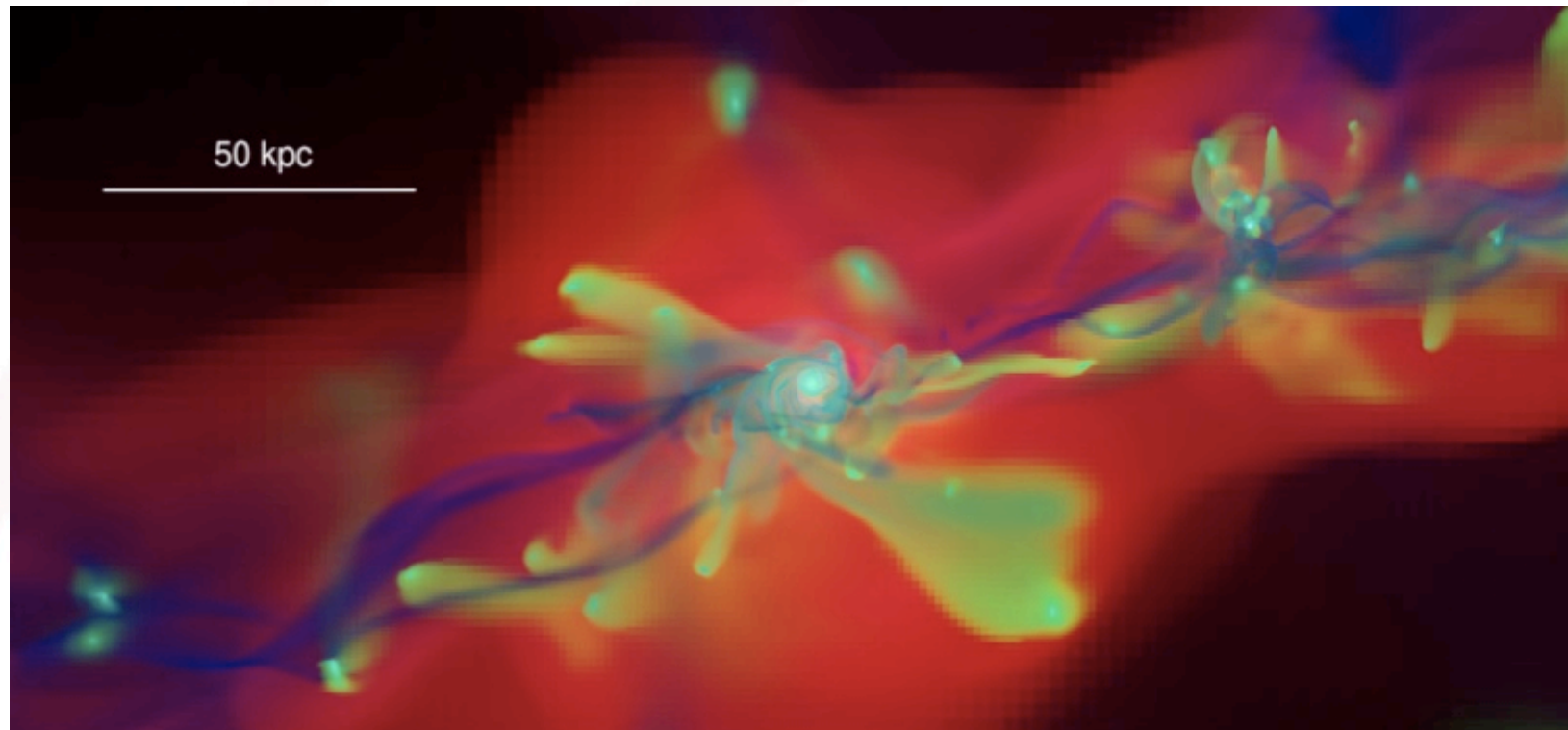


Obreschkow et al.
(2009)



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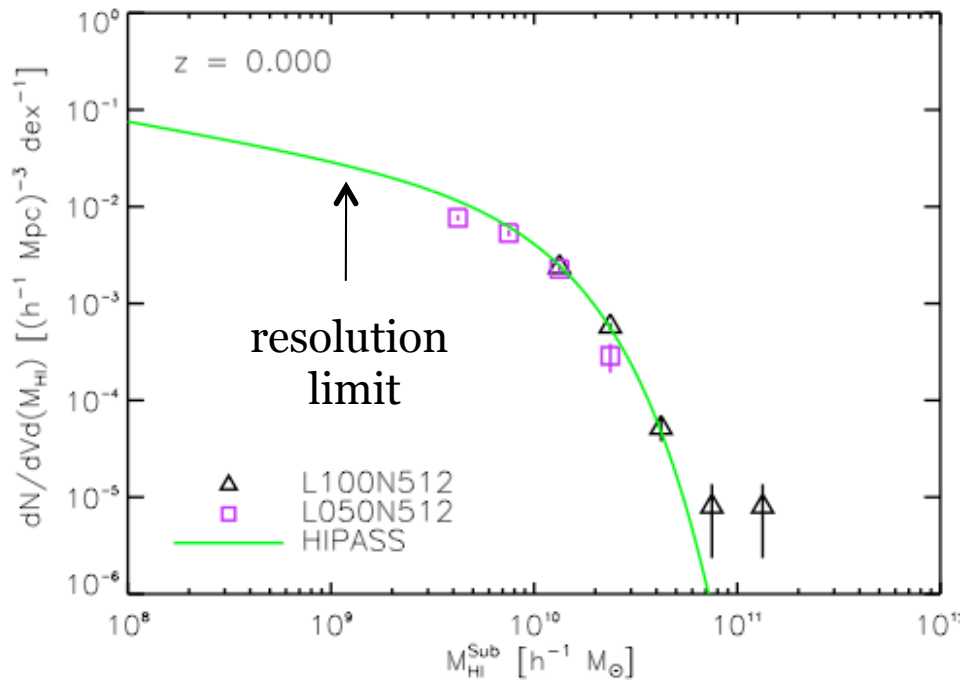
Hydro Simulations



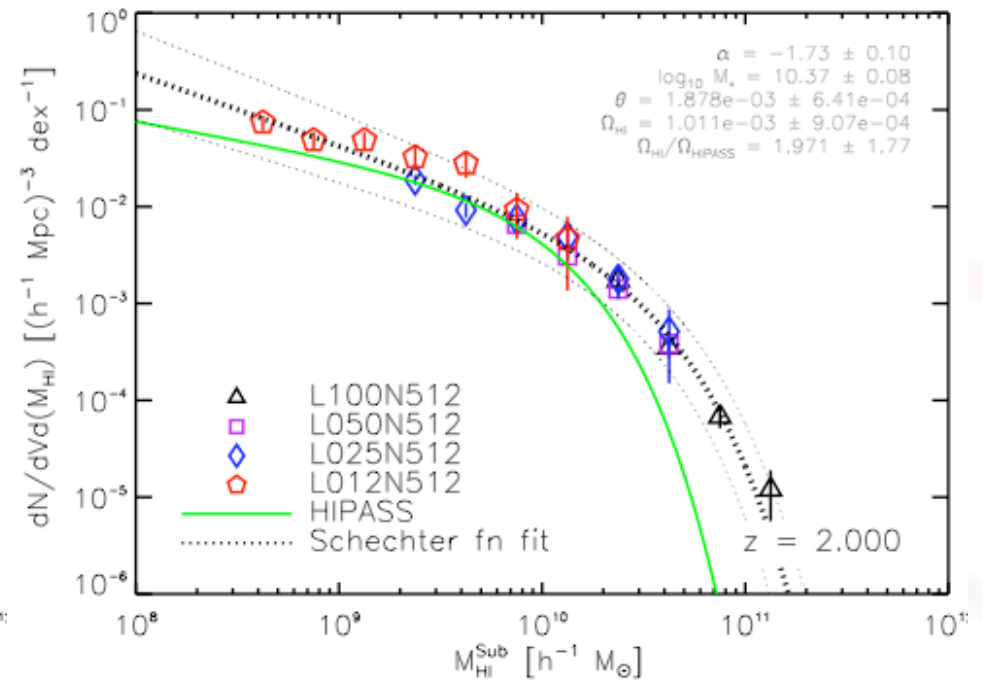
‘Cold’ gas (blue) flowing into a galaxy at $z=3$ (Agertz, Teyssier & Moore 2009)

HI mass function from OWLS

Duffy et al. (2009)



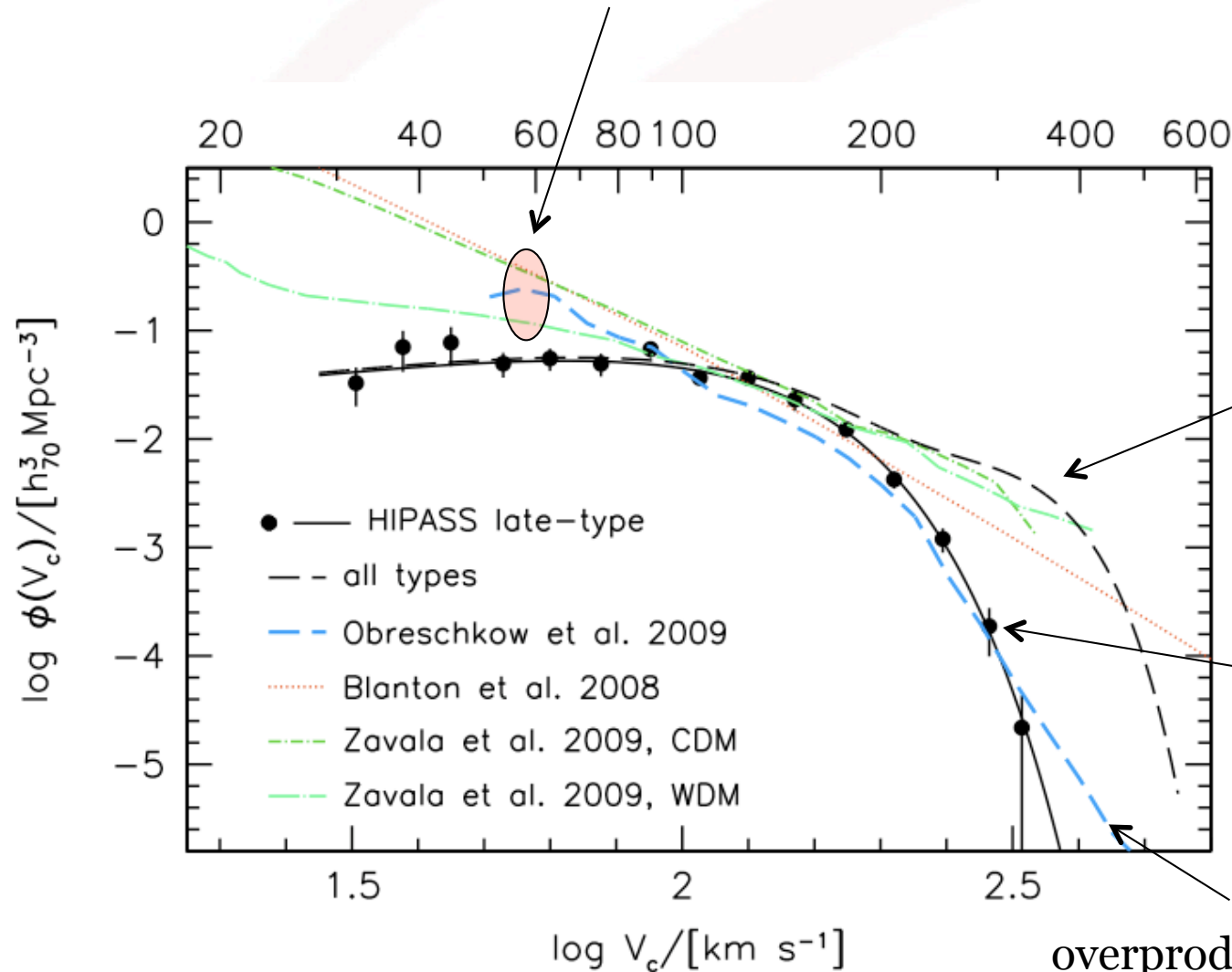
$z=0$



$z=2$



ΛCDM+semi-analytic simulations overproduce low mass galaxies



HIPASS+SDSS
(late and early
types; Chae
2008)

HIPASS
(late-types)
Zwaan et al.
(2009)

overproduction of high-mass
galaxies in simulations



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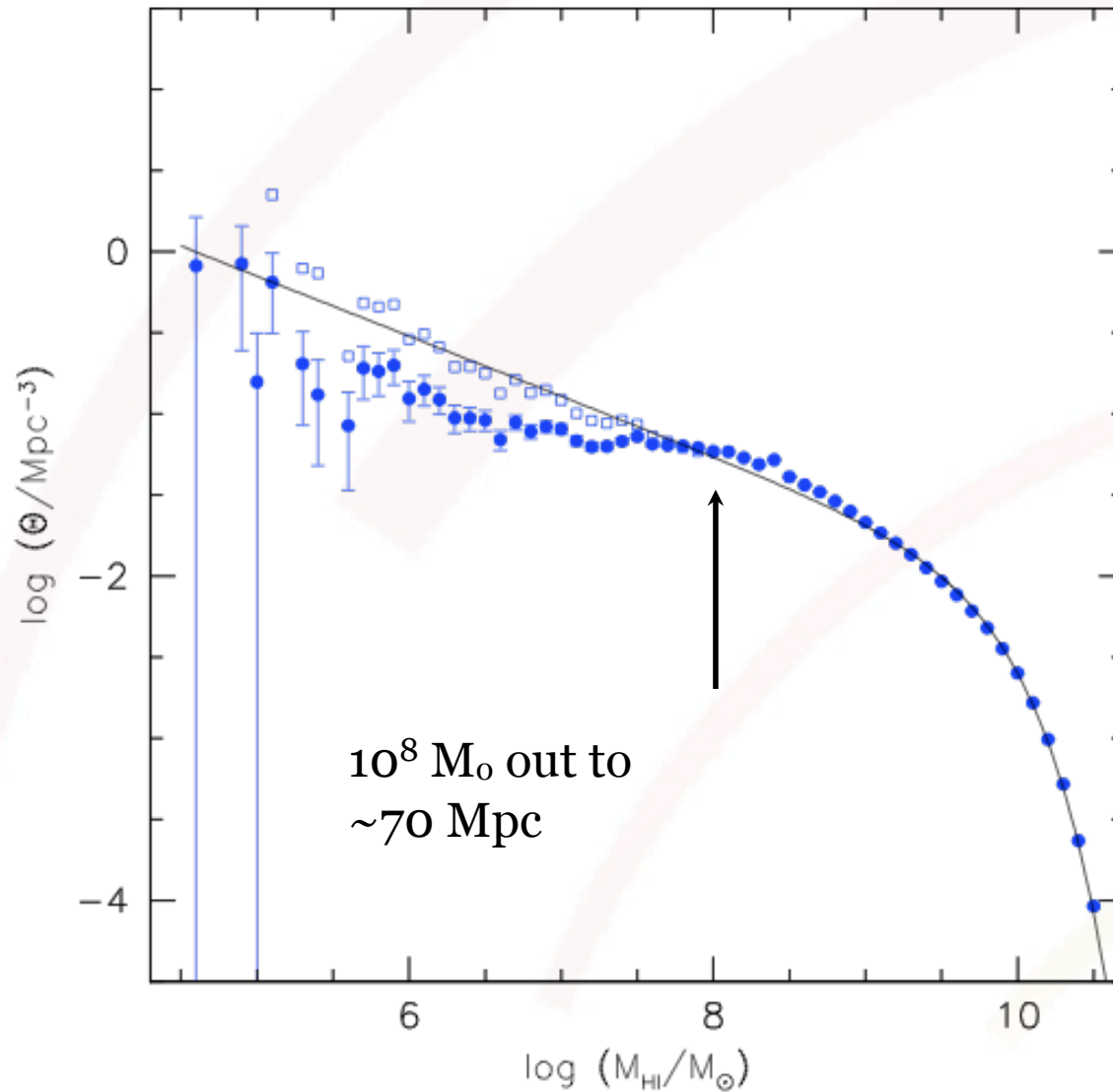
SIMULATION TYPE	STRENGTHS	WEAKNESSES
Hydro	Physics-based	Small volumes; critical parameters uncertain
Semi-analytic	Piggy-backs successful N-body sims; predicts evolution	Resolution; uncertain 'recipes'
Semi-empirical	Can easily tie to $z=0$ observations; can use HOD from hydro	Little physics



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HI Mass Function recovery

Zwaan



WALLABY

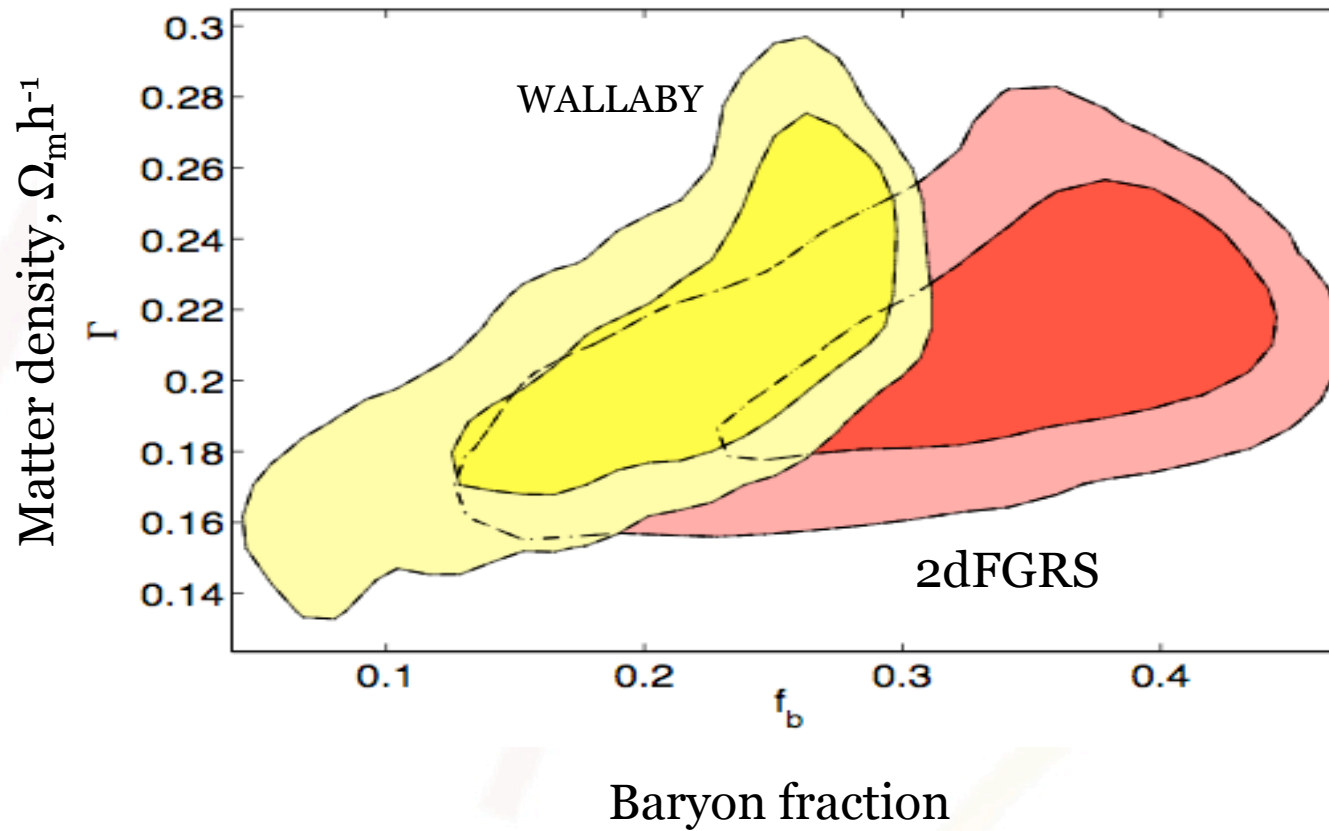
Solid: $1/V_{\text{max}}$ method

Open: 2DSWML

(ran 2DSWML only on
galaxies $M_{\text{HI}} < 10^8 M_{\odot}$)

WALLABY and 2dFGRS

Duffy & Moss



Summary

- Wallaby TWG1 simulation plan taking shape.
- Builds on tremendous activity by others in this field:
 - cutting edge of galaxy formation studies
- Possible resource for other HI surveys (Dingo, Apertif, MeerKAT)