Galaxies and ΛCDM

Halos are the basic nonlinear units of cosmic structure

Galaxies live at the centres of *sub*halos NOT halos

ΛCDM specifies the assembly history statistics of halos/subhalos

--- raw material supply for galaxy formation
--- environment (is this merely halo/subhalo mass/history?)
--- satellite/interaction/merger statistics

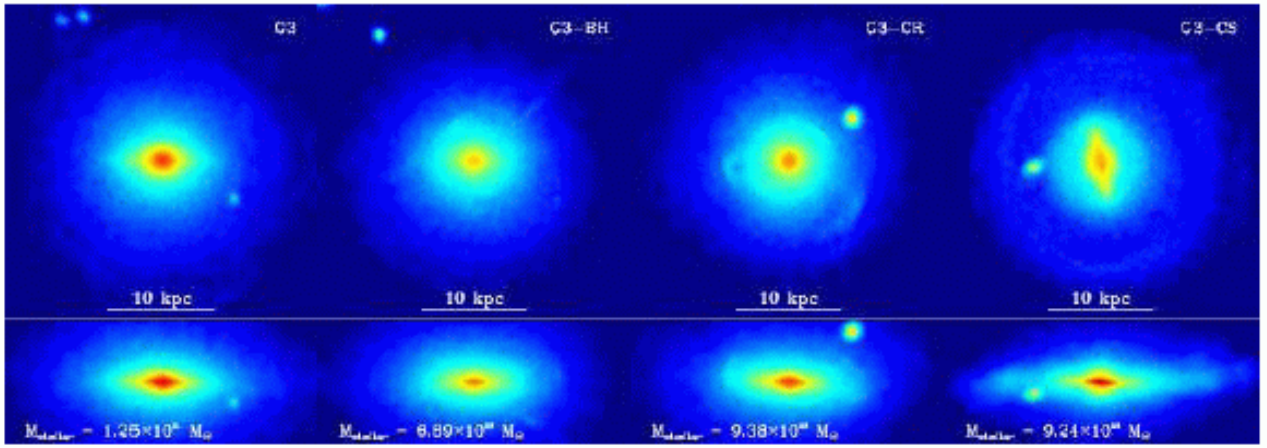
These constrain the *astrophysics* of galaxy formation/evolution

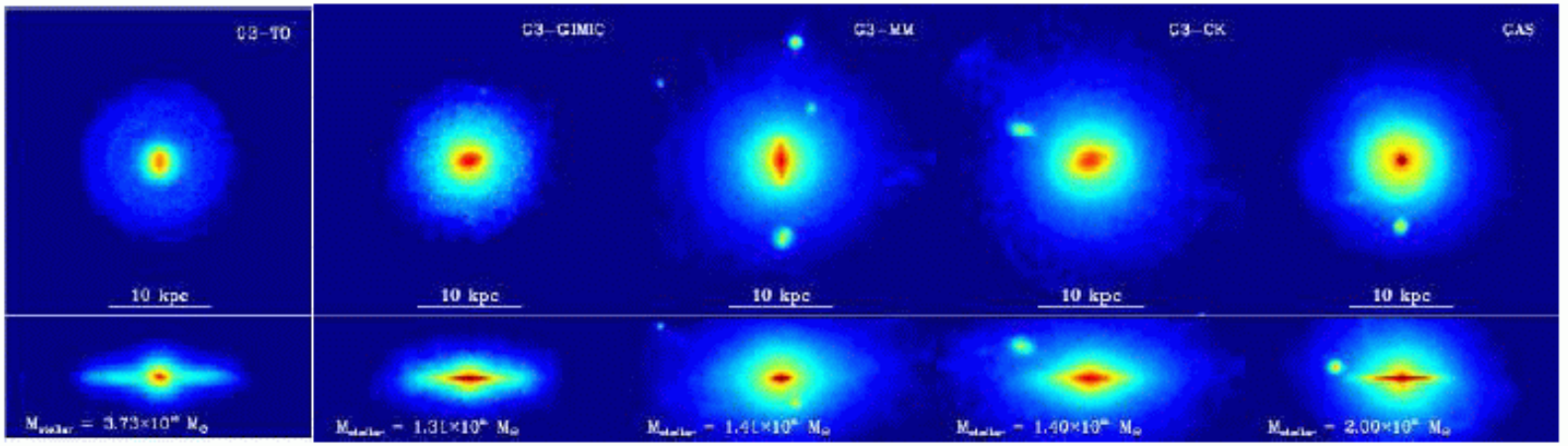
--- *why* do galaxies have the masses/sizes they do?
--- *how* does cooling and infall occur?
--- *what* are the efficiencies of star/BH formation?
--- *how* do SN/AGN regulate formation/enrichment/winds?
--- *what* sets morphology? nature/nurture? mergers?
--- *which* processes are externally driven? which internally?

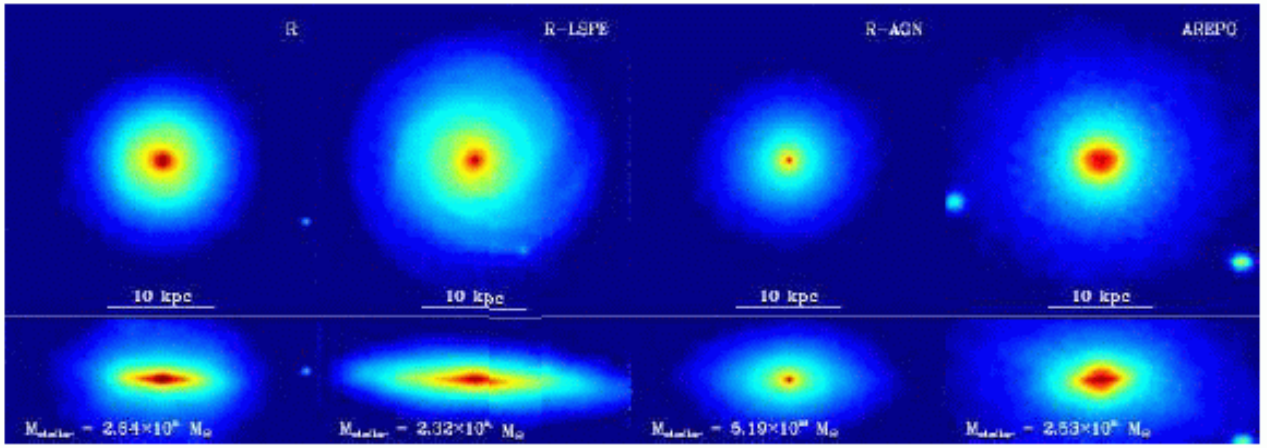
Constraints require <u>modelling</u> astrophysics in a ΛCDM context

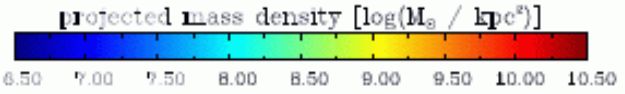
The Aquila Project

Scannapieco et al 2011









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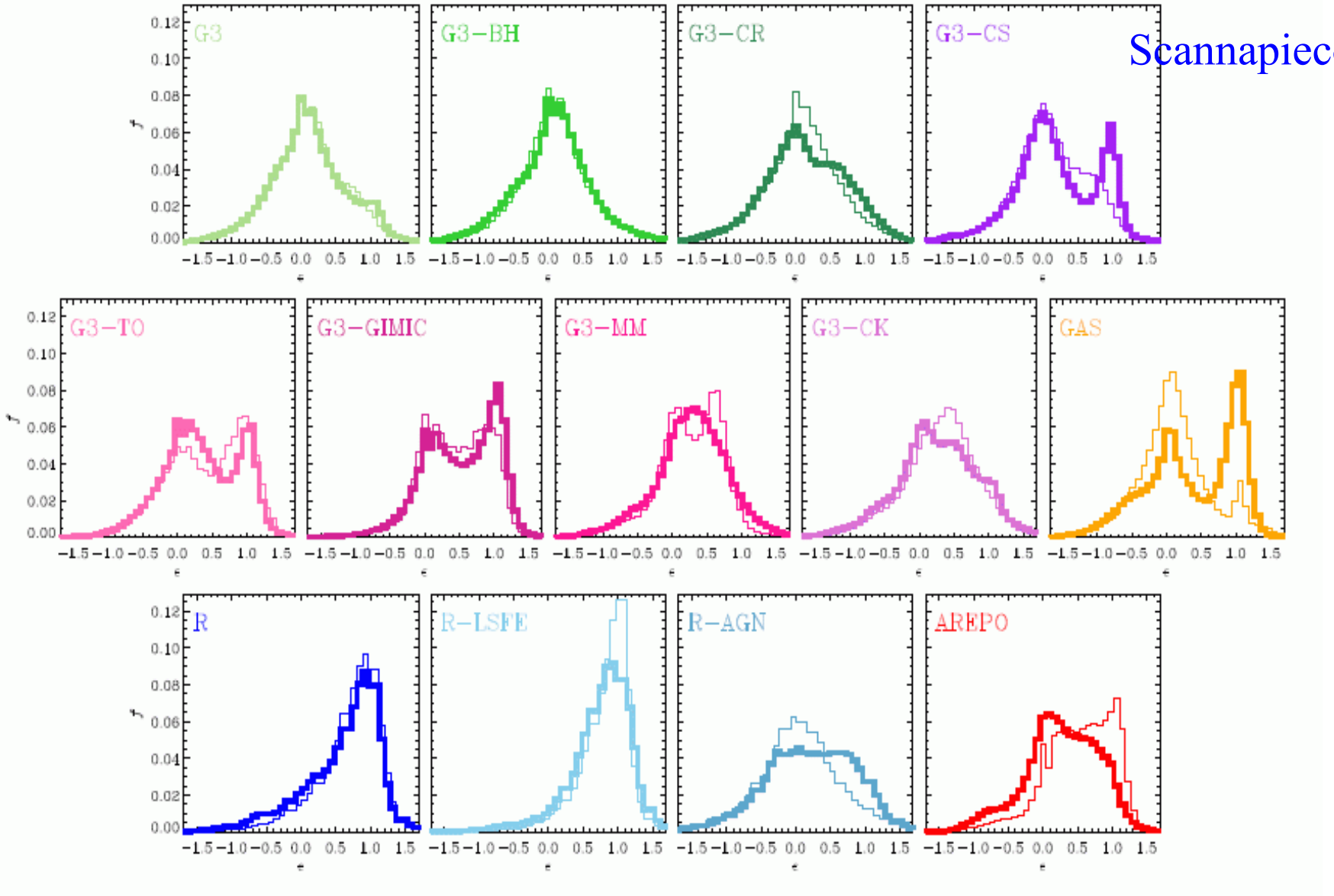

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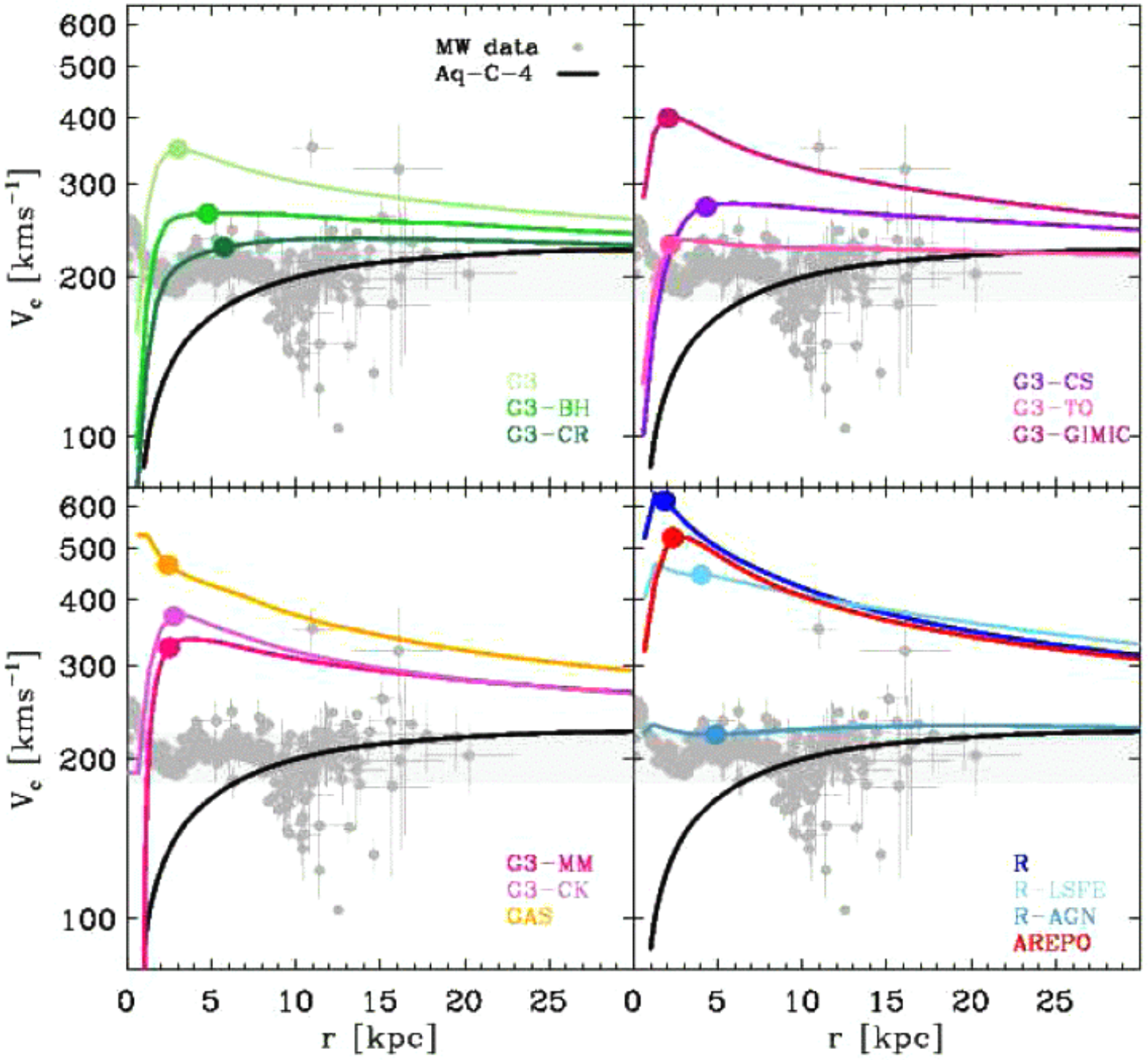

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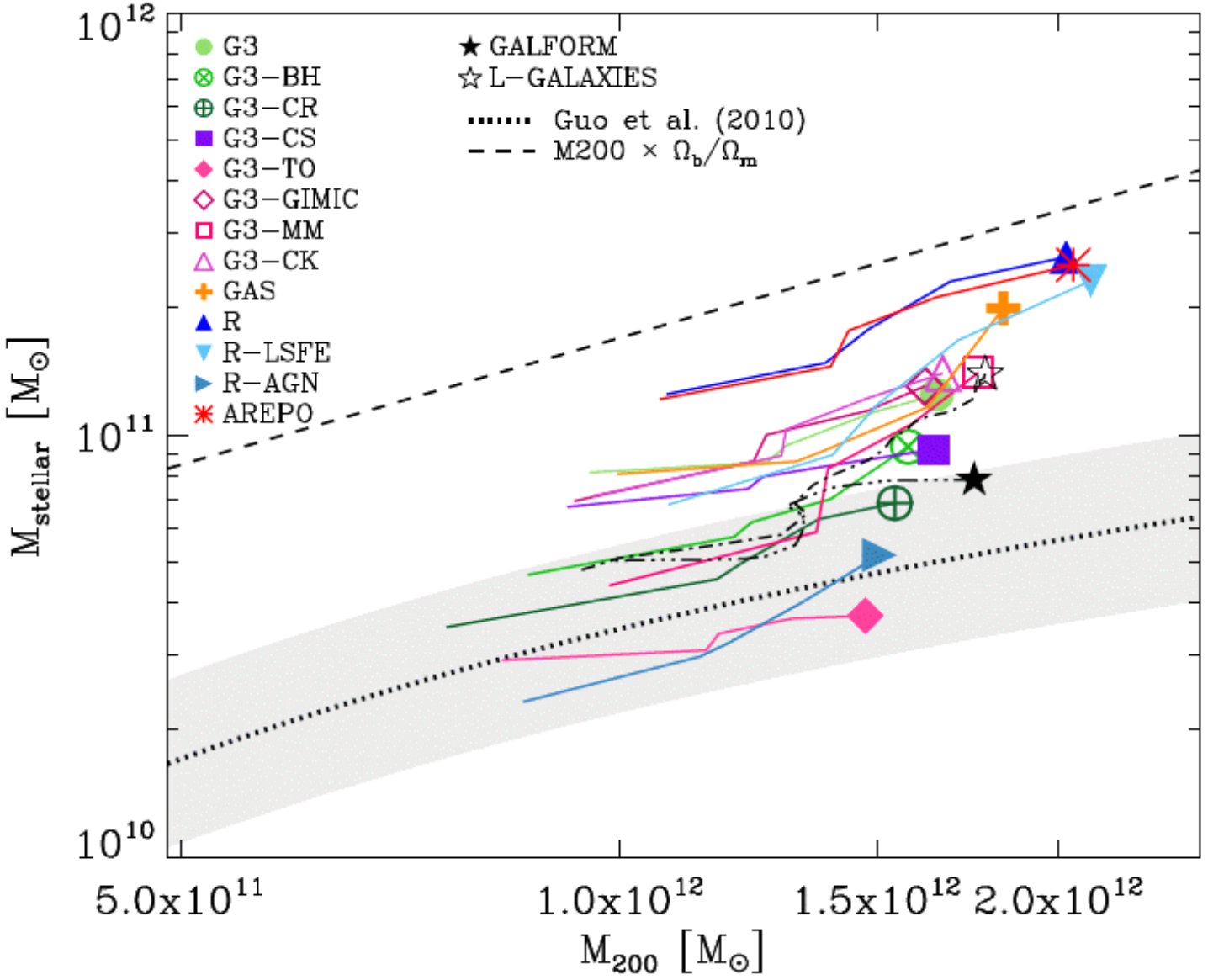
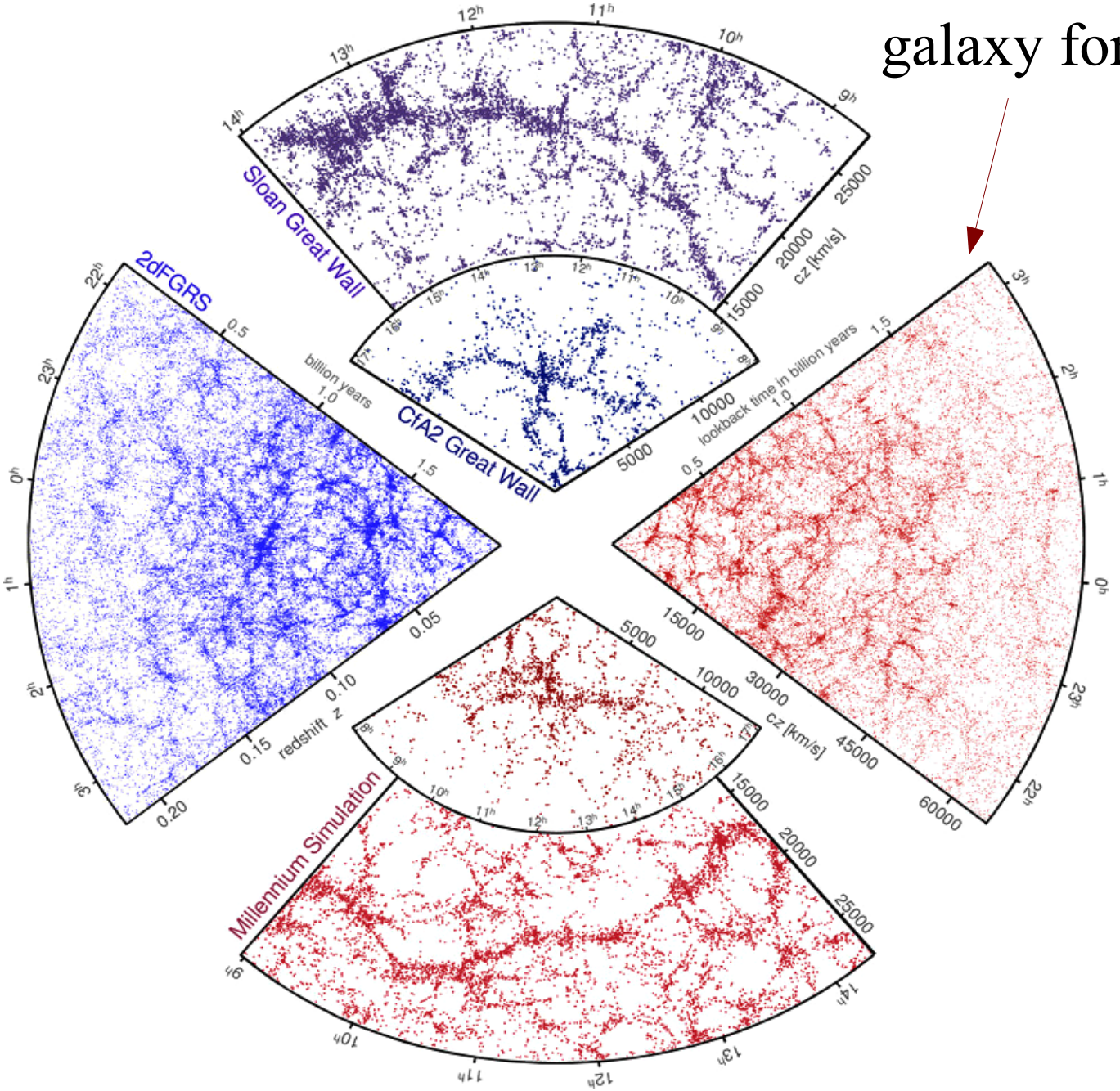


This *is* a simulation of ΛCDM galaxy formation and evolution



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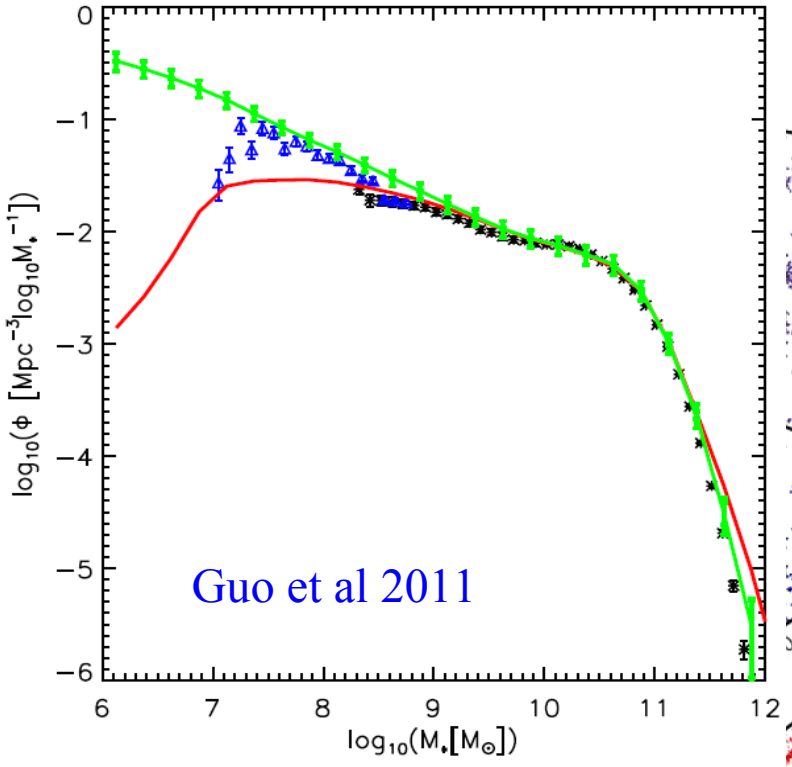
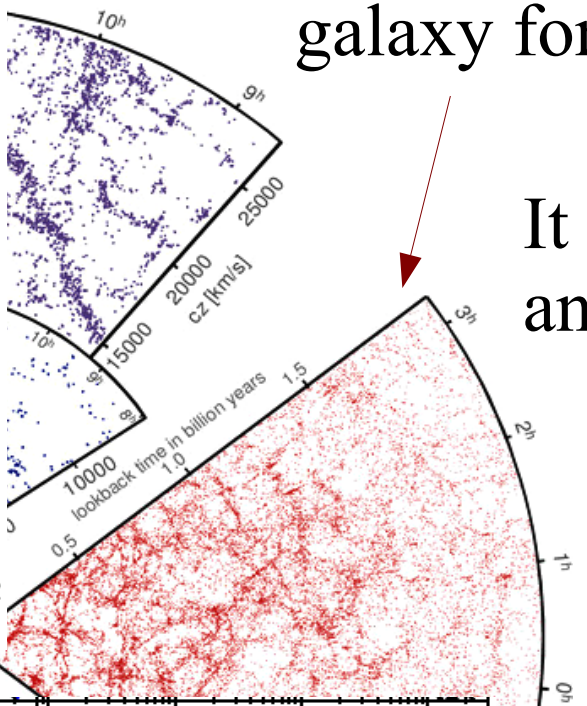
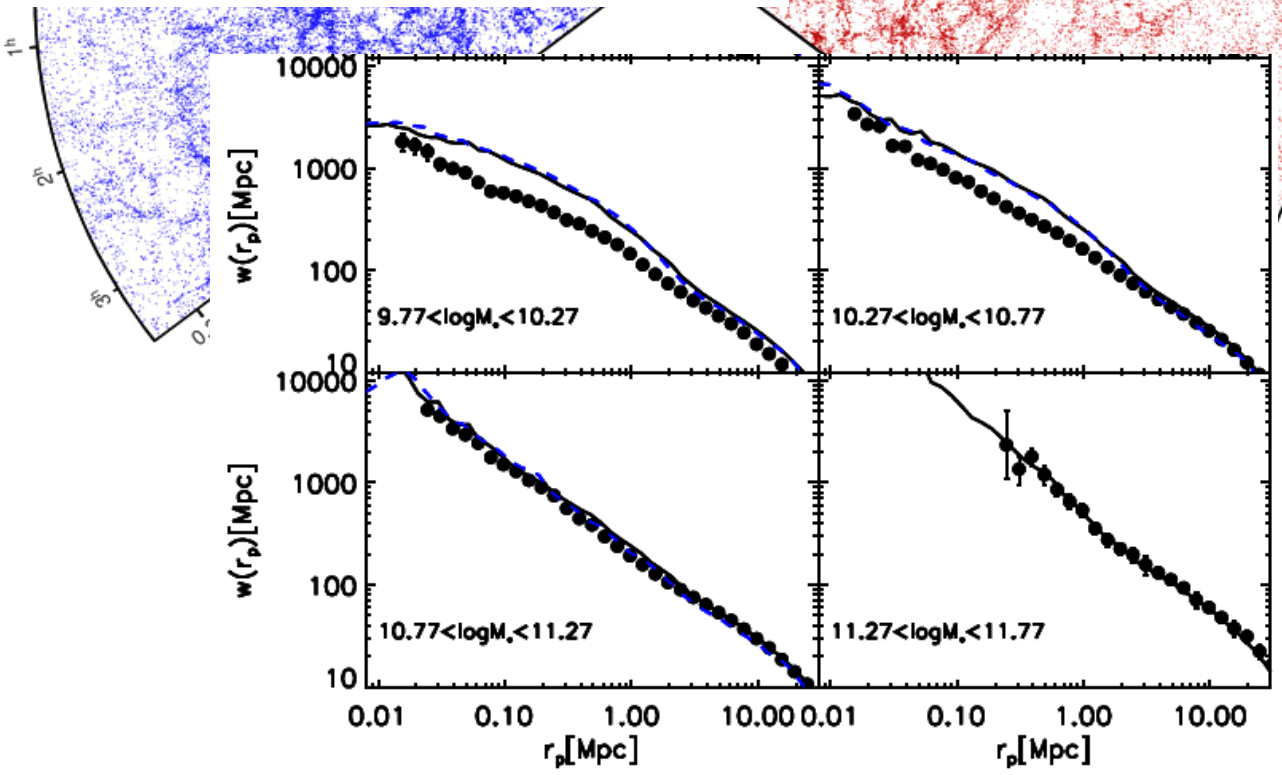
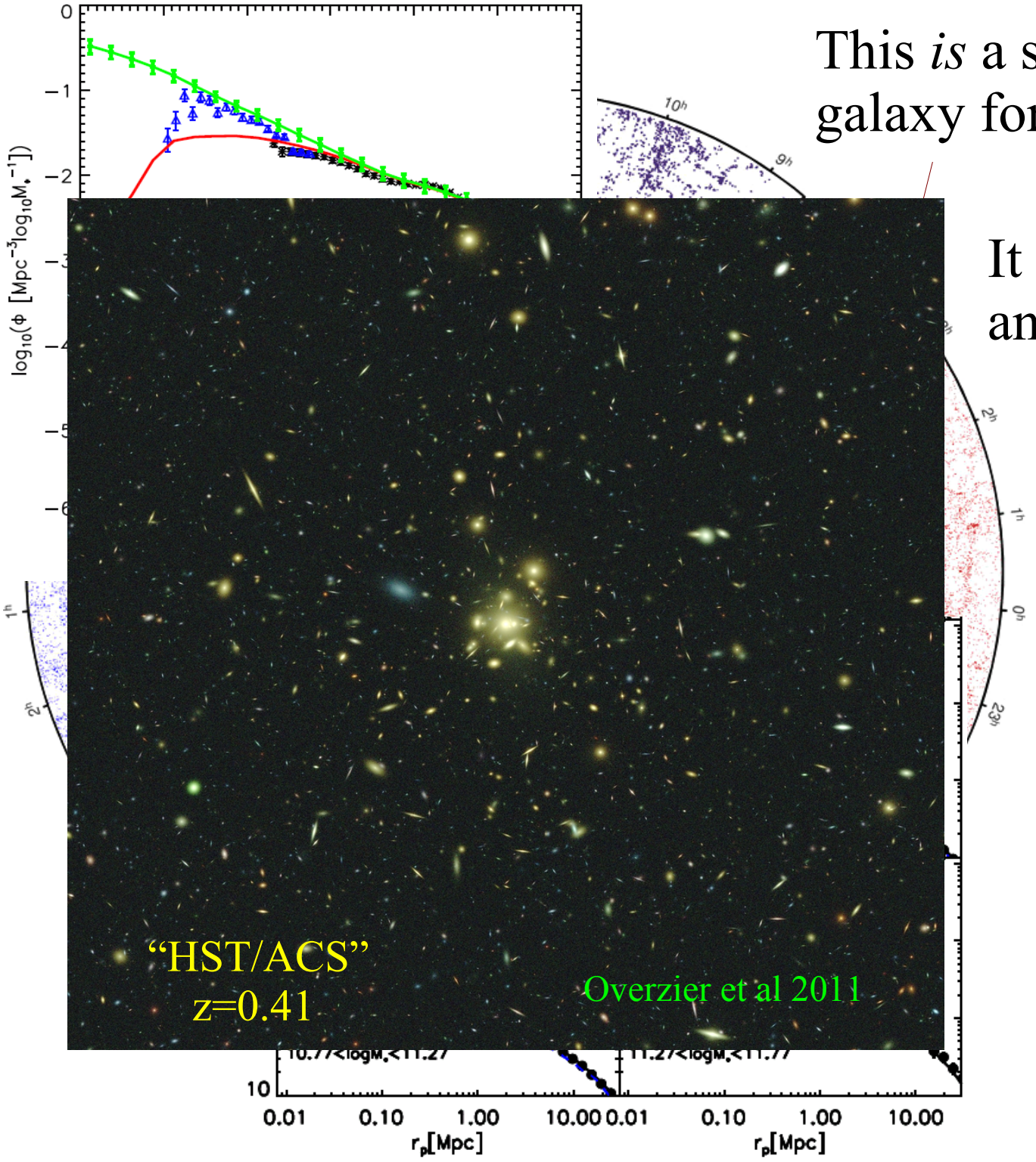
It fits galaxy abundances and clustering at low-z









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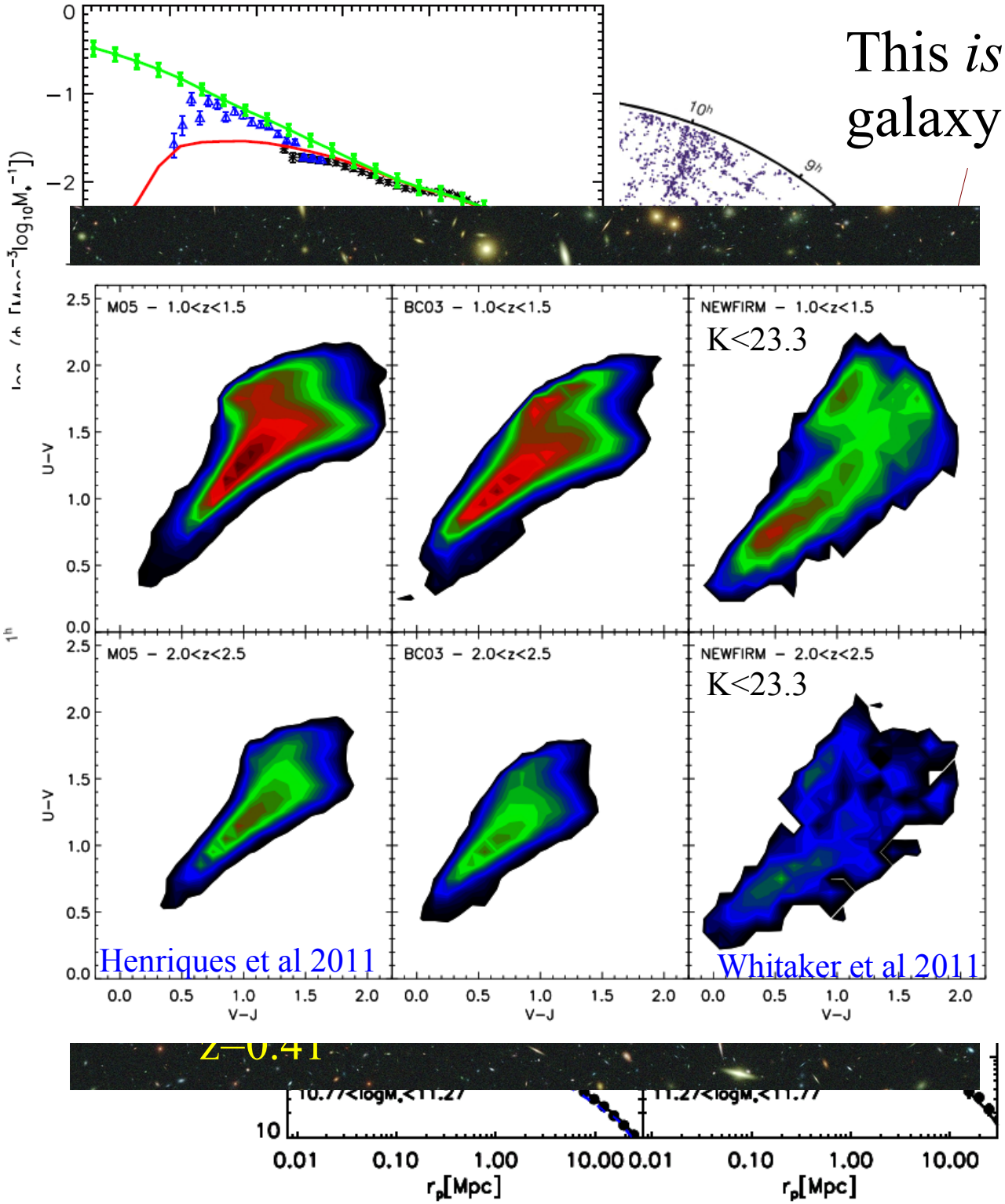

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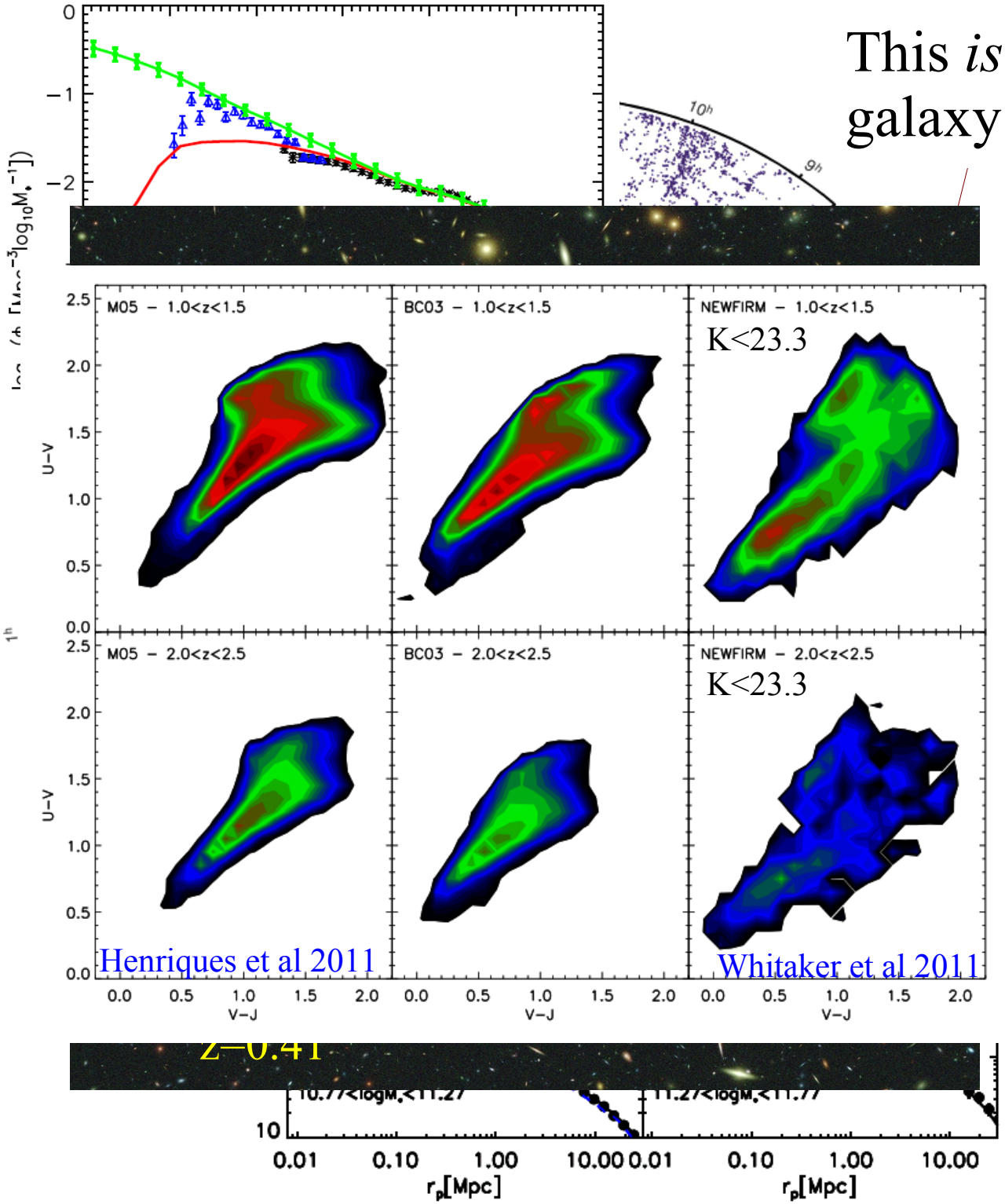

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Many things "fit", but some don't, indicating incomplete/incorrect astrophysics

What aspects of galaxy formation and early evolution are most effectively probed using the halo connection?

formation efficiencies?
merger rates/modes?
environment effects?

What observations give the most robust route to making the connection?

abundances? as functions of mass? SFR?
clustering?
scaling relations?
kinematics?

What are the questions we are trying to answer?

galaxy/BH formation issues?
DM/DE issues?
paradigm tests?