The role of environment in galaxy evolution
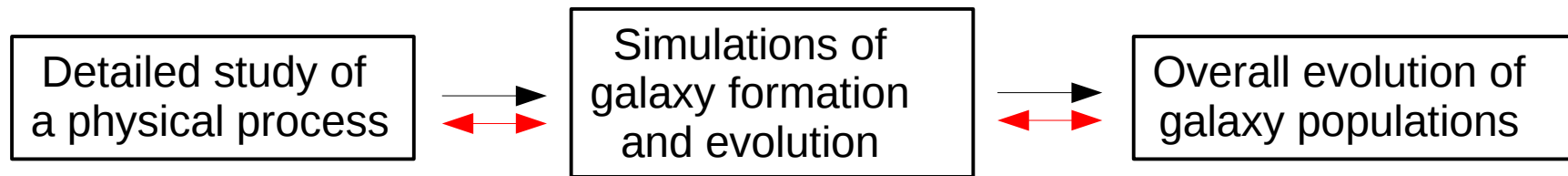
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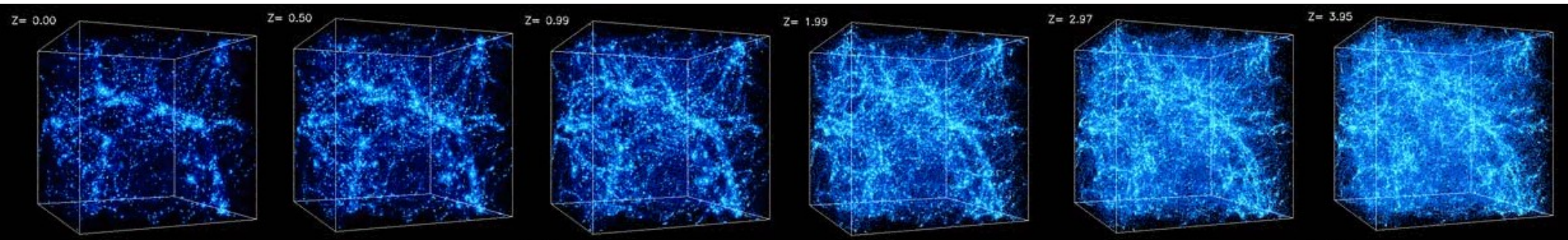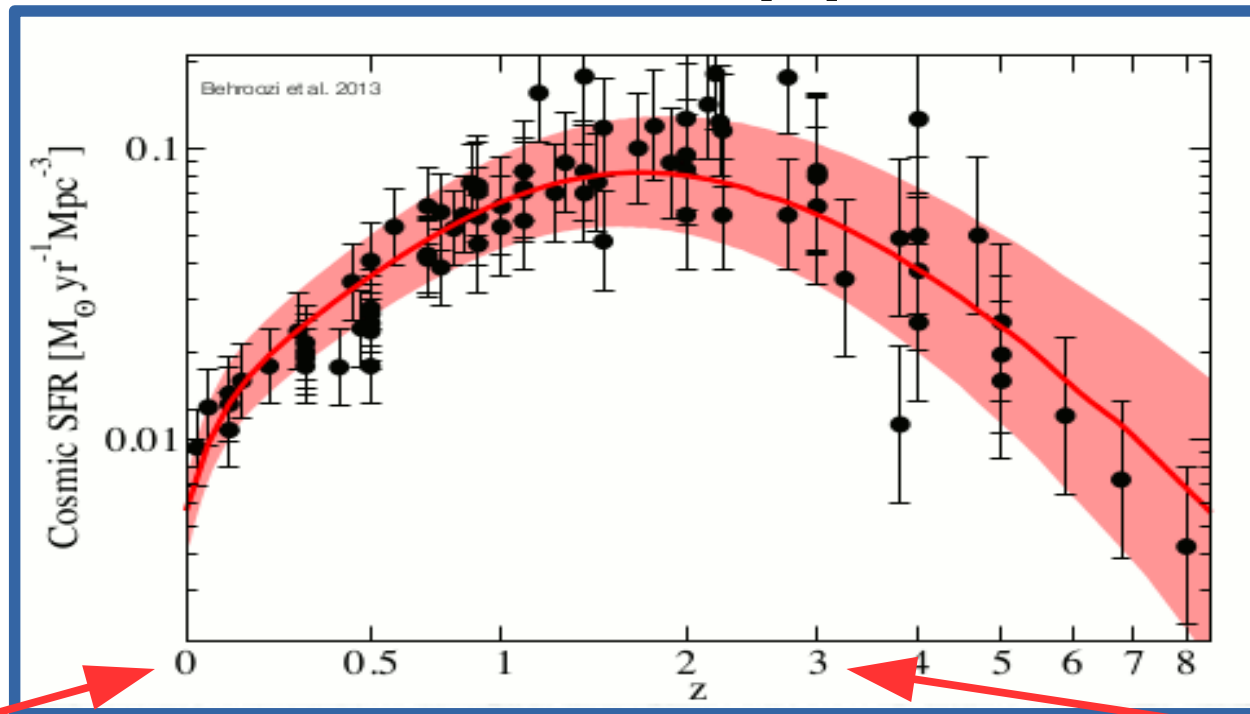# [How environment affects] galaxy evolution

Beyond SDSS (very simplistic view):

- In-depth study of single objects or relatively small samples of galaxies

- Large (and deep) galaxy surveys, to analyse global trends

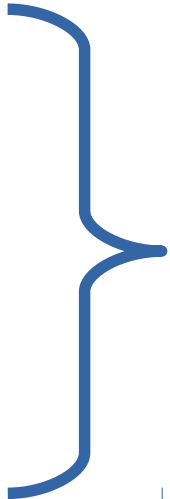→ complementary approaches, linked by models of galaxy evolution:

| Detailed study of a physical process | → | Simulations of galaxy formation and evolution | → | Overall evolution of galaxy populations |

Statistical approach

Behroozi et al. 2013

Is the SFRD decline due to environmental processes?
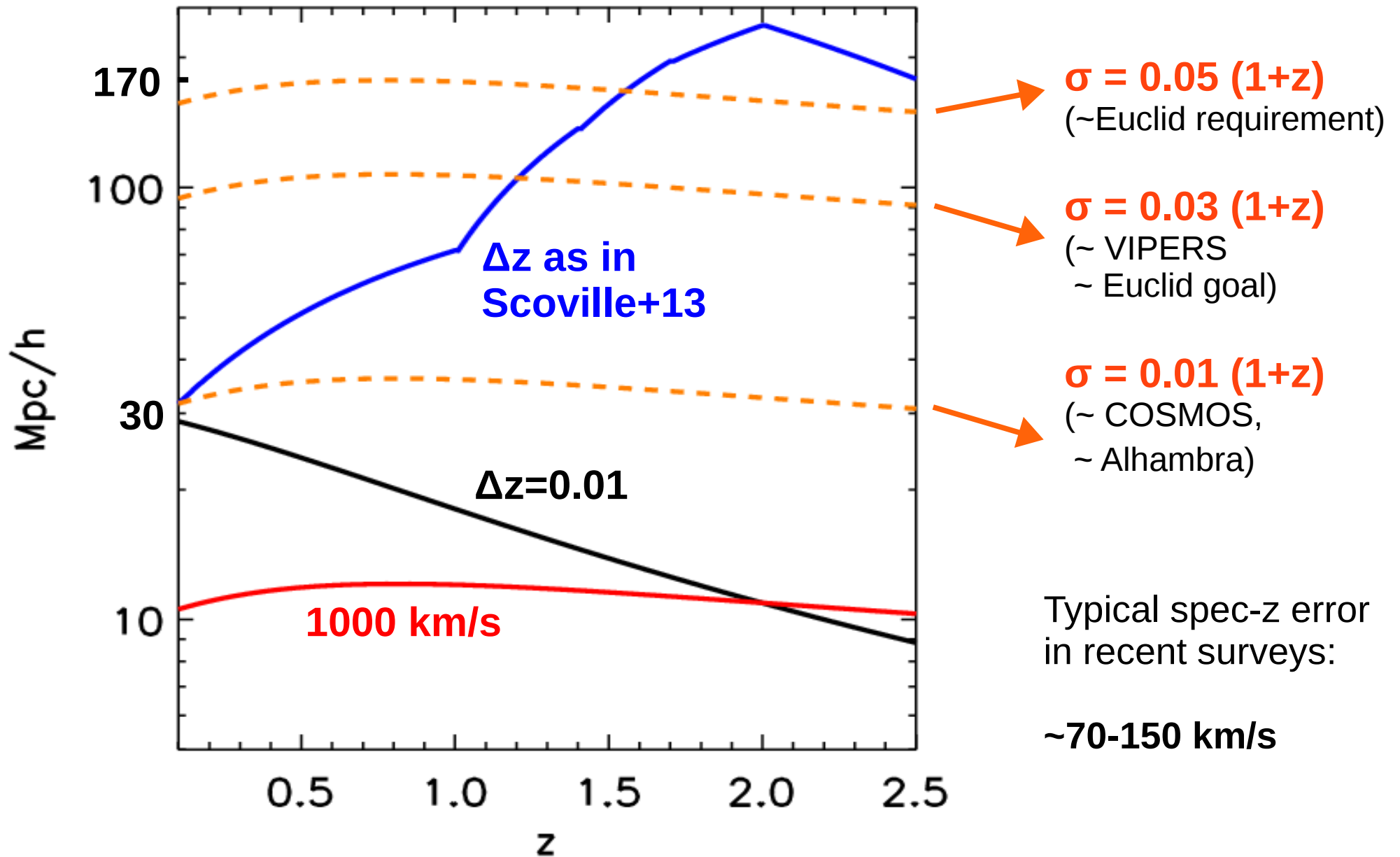WHEN do we see the onset of environmental effects on galaxy evolution?

Statistical approach on
Environmental effects on galaxy evolution

- Observational issues:

  – Galaxies as tracers of local environment

  – Spectroscopic vs photometric redshifts

  – Cosmic variance

  – Complete census of (all) galaxy populations

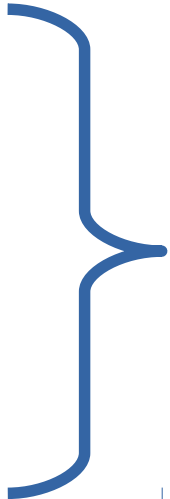Large and deep (spectroscopic) surveys, with smart selection functions

Photo-z vs spec-z

σ = 0.05 (1+z)
(~Euclid requirement)

σ = 0.03 (1+z)
(~ VIPERS
 ~ Euclid goal)

σ = 0.01 (1+z)
(~ COSMOS,
 ~ Alhambra)

Δz as in
Scoville+13

Δz=0.01

1000 km/s

Mpc/h

Typical spec-z error
in recent surveys:

~70-150 km/s

Statistical approach on Environmental effects on galaxy evolution
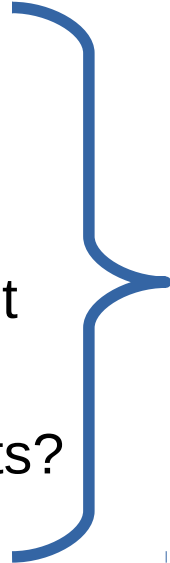
- Observational issues:

  - Galaxies as tracers of local environment

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  - Cosmic variance

  - Complete census of (all) galaxy populations

Large and deep (spectroscopic) surveys, with smart selection functions

- Astrophysical issues

  - What is environment?

  - Which physical mechanisms are at work?

  - How much time do galaxies spend in different environments?

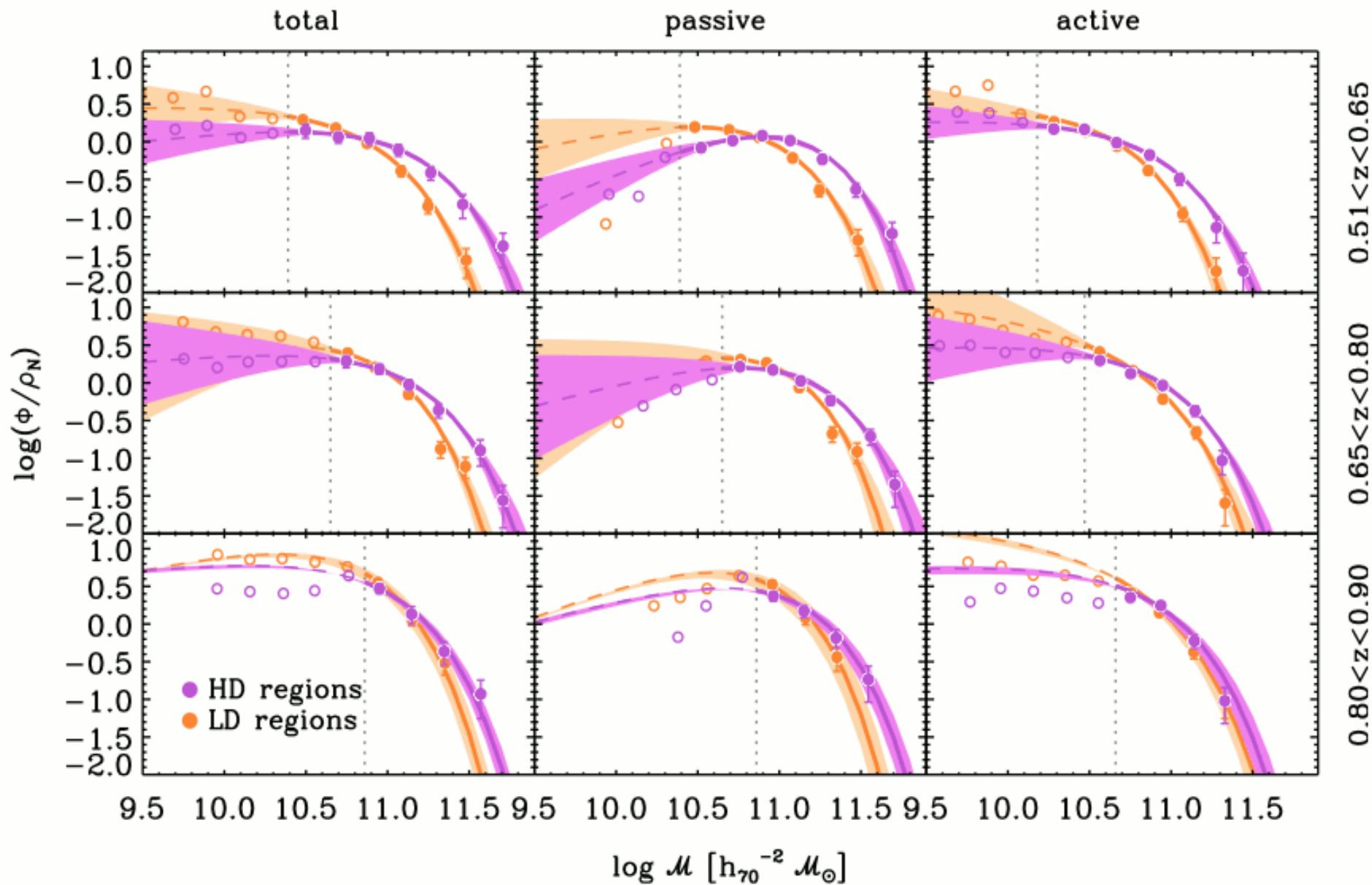 - How can we link progenitors and descendents?

Models of galaxy evolution, embedded in DM simulations

An example:
Galaxy stellar mass function per environment
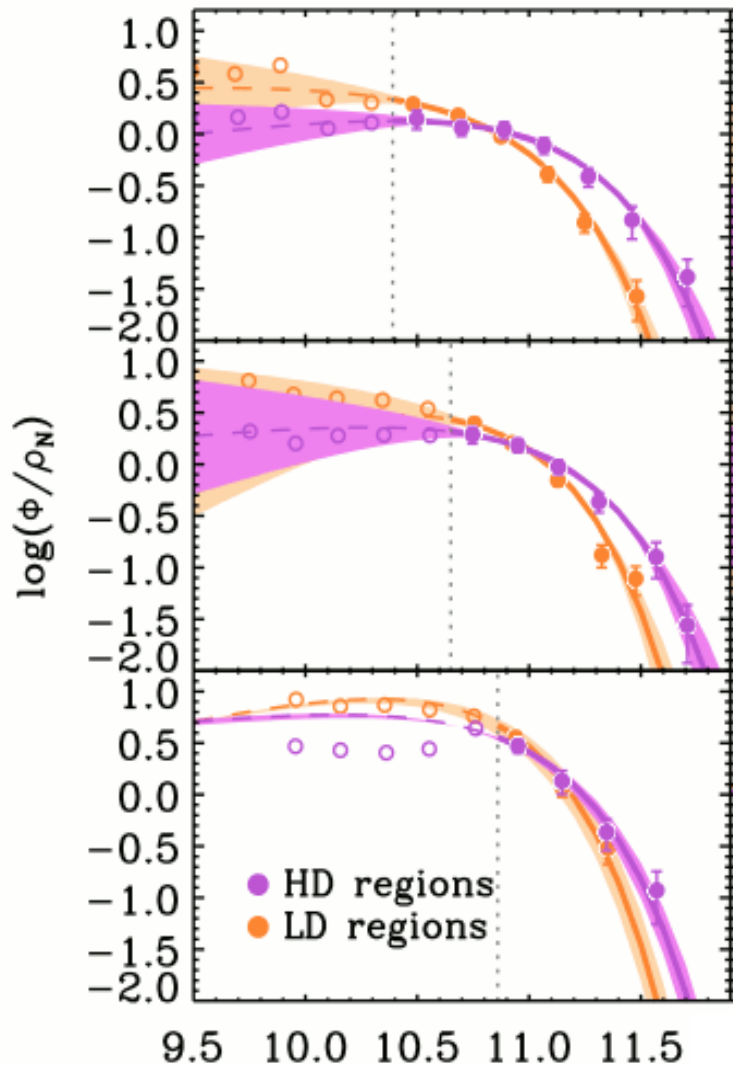## (Davidzon + 2016, VIPERS sample)
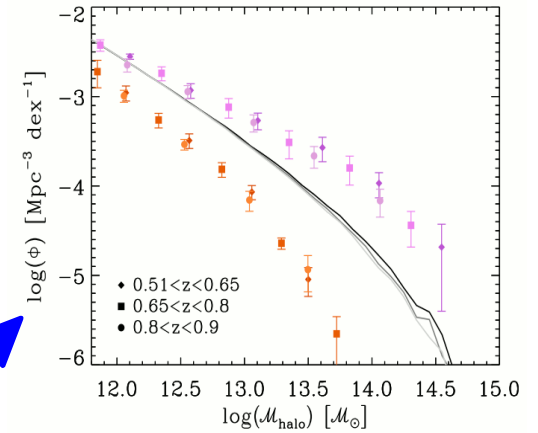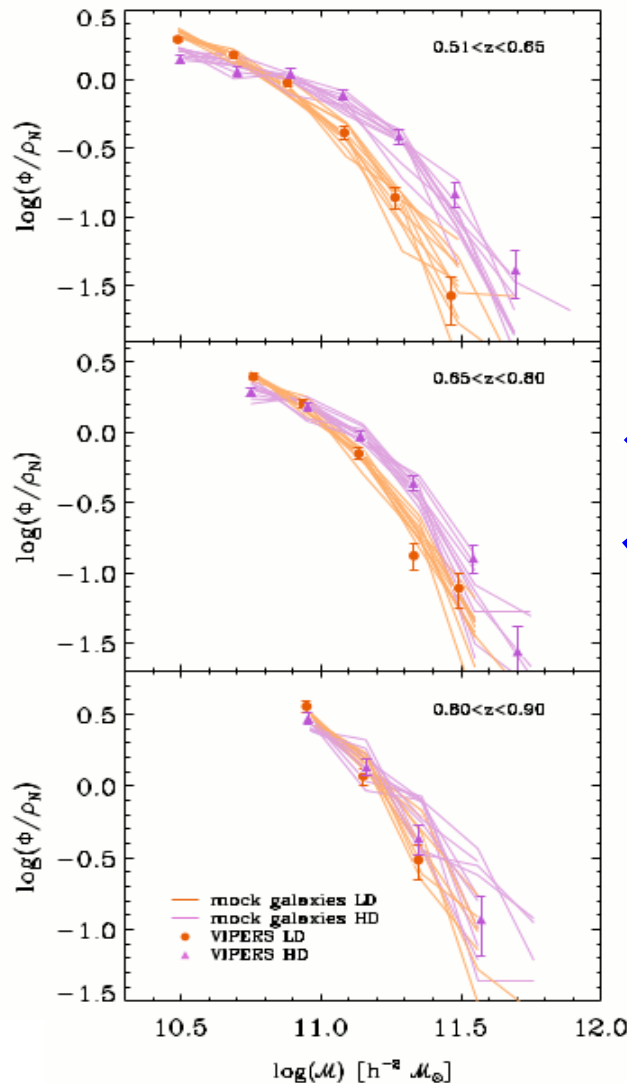
An example:
Galaxy stellar mass function per environment
(Davidzon + 2016, VIPERS sample)

VIPERS

MILLENNIUM DM +
Delucia&Blaizot07 SAM

DM and galaxies merger trees to study the **environmental history of galaxies** (and go beyond the scheme centrals/satellites)

Present and future

Combine different approaches:

- In-depth studies & statistical analysis

  → **Large/Deep spec-z surveys:** VUDS, VIPERS, VANDELS... WHT+WEAVE, VLT+MOONS, E-ELT+MOS... (see Lucia's talk)

- Observations & simulations

  → **New models of galaxy evolution** (S.A.M., hydro, etc ...see Pigi's talk)

- Galaxy properties & DM structures

  → **Synergy of spec-z and photo-z**, exploiting future missions' probes (Euclid, see Stefano's and Gigi's talk …)