The zCOSMOS 10K sample: the role of galaxy stellar mass in the colour-density relation up to z~1

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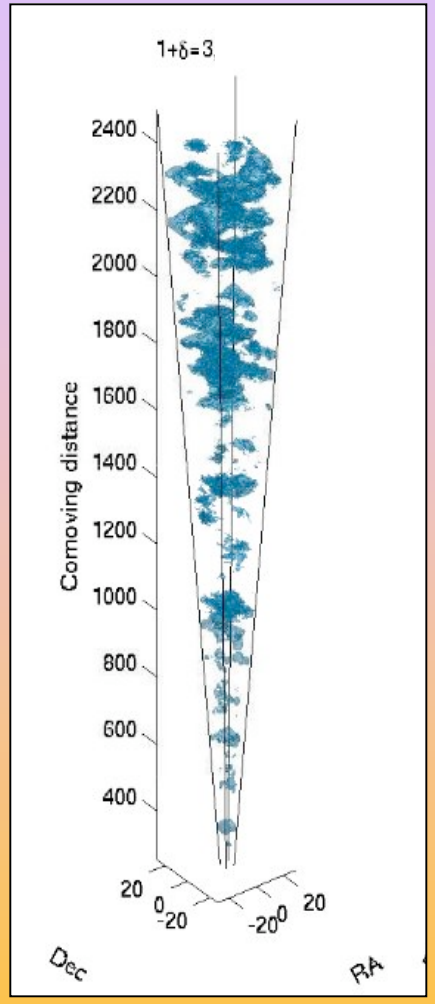
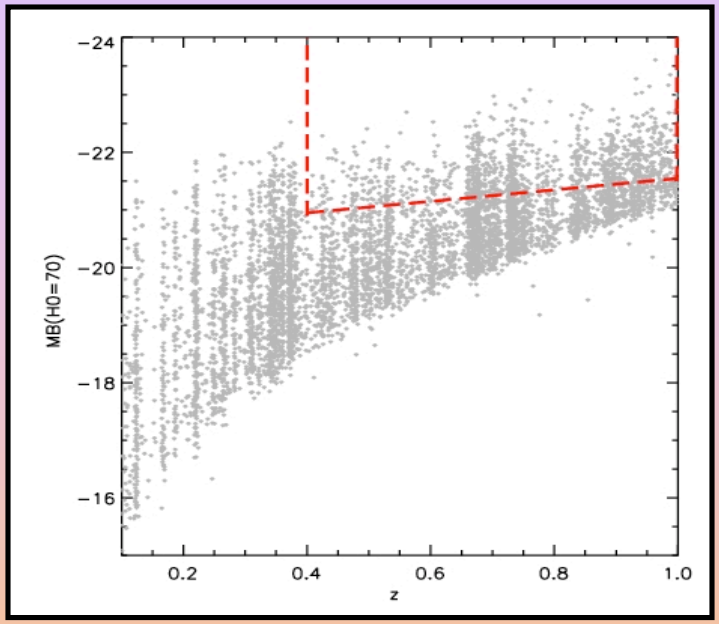
Submitted to A&A
[submitted version uploaded on both COSMOS repository and zCOSMOS wiki pages]



(Kovac et al 2009)

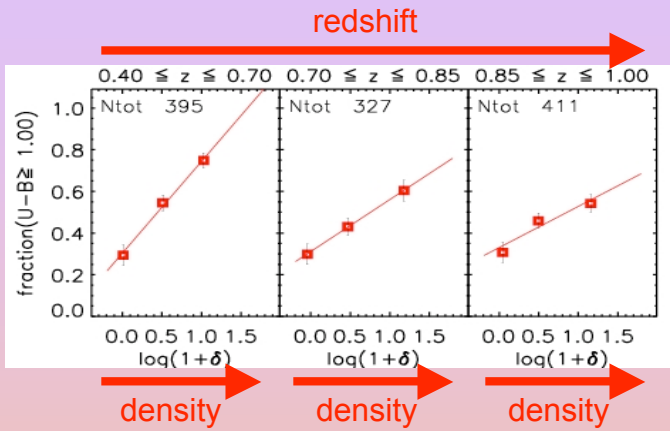
Environmental effects on galaxy properties in a **luminosity selected** sub-sample



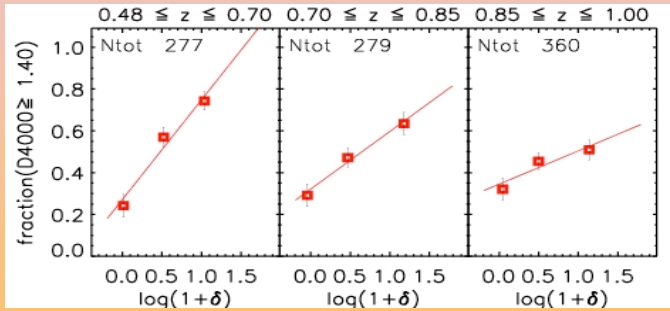
1) The fraction of red (U-B ≥ 1) galaxies depends on environment at least up to z=1.
2) This trend is mirrored by the behaviour of the fraction of galaxies with D4000 ≥ 1.4.
3) The fraction of galaxies with log(EW[OII]) ≥ 1.15 is higher for lower densities, and this is true up to z=1.

--> All these trends weaken for increasing redshift.

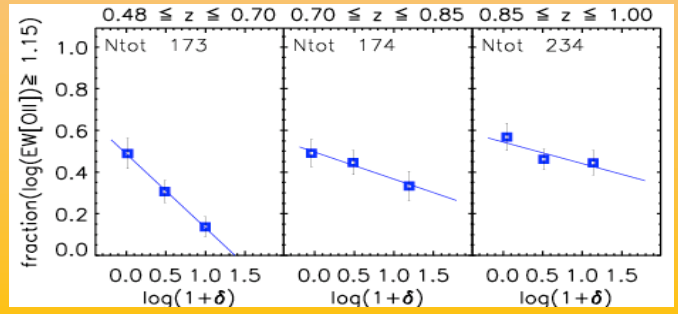
fraction of **red** galaxies



fraction of **'passive'** galaxies



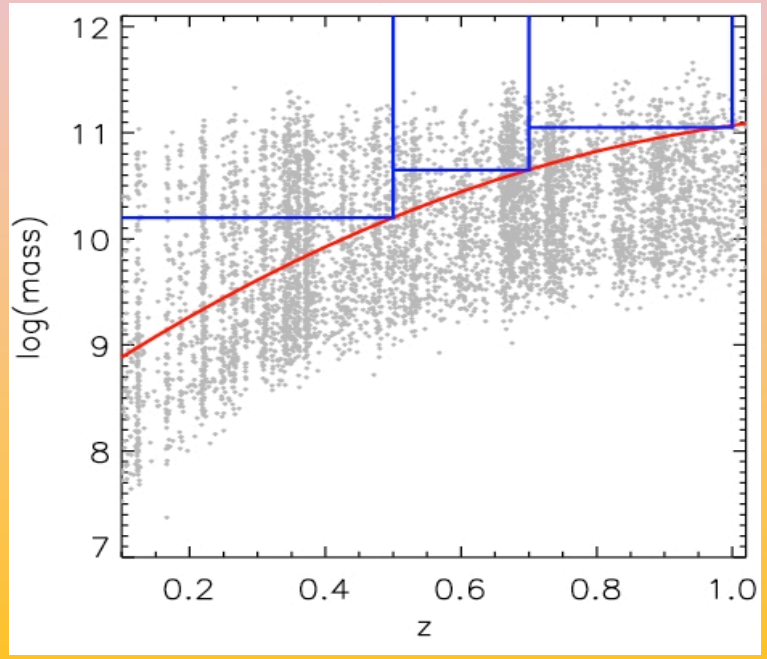
fraction of **'active'** galaxies

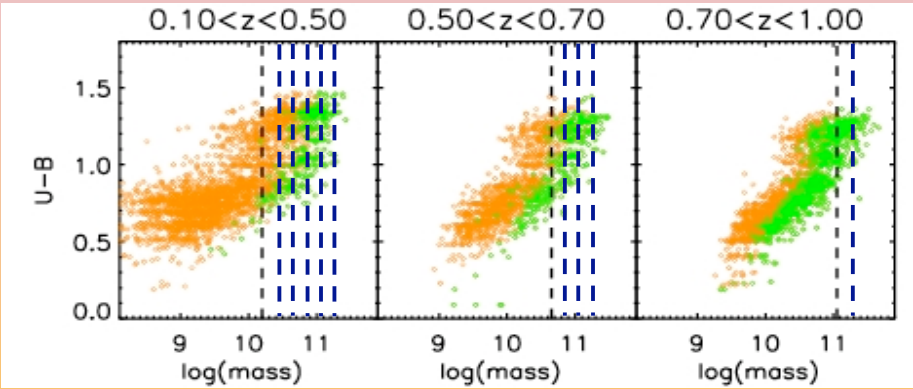


Moving to stellar masses:
the key ingredient of the colour-density relation?

1) Colour depends on local density
2) Colour depends on stellar mass
3) Stellar mass depends on local density (see Micol's talk)

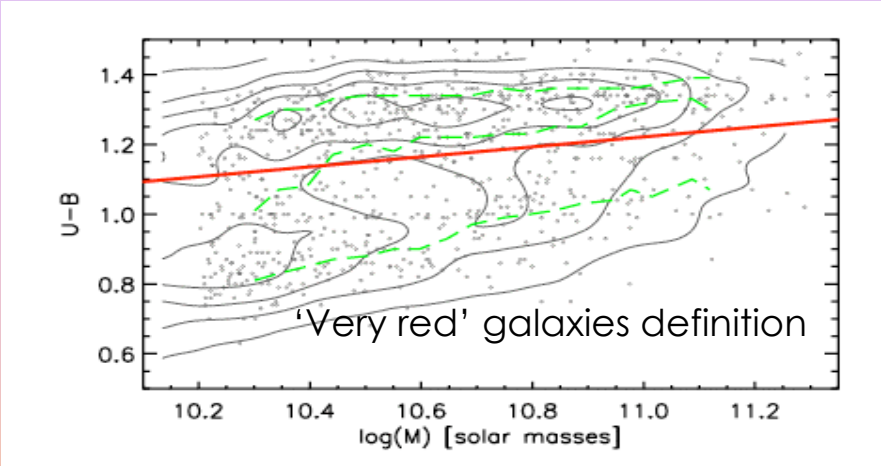
--->The **wide spread in mass-to-light ratios embedded in the luminosity selected sample** leaves us with a broad range in stellar masses, that biases any possible direct colour-density relation via the mass segregation as a function of environment.

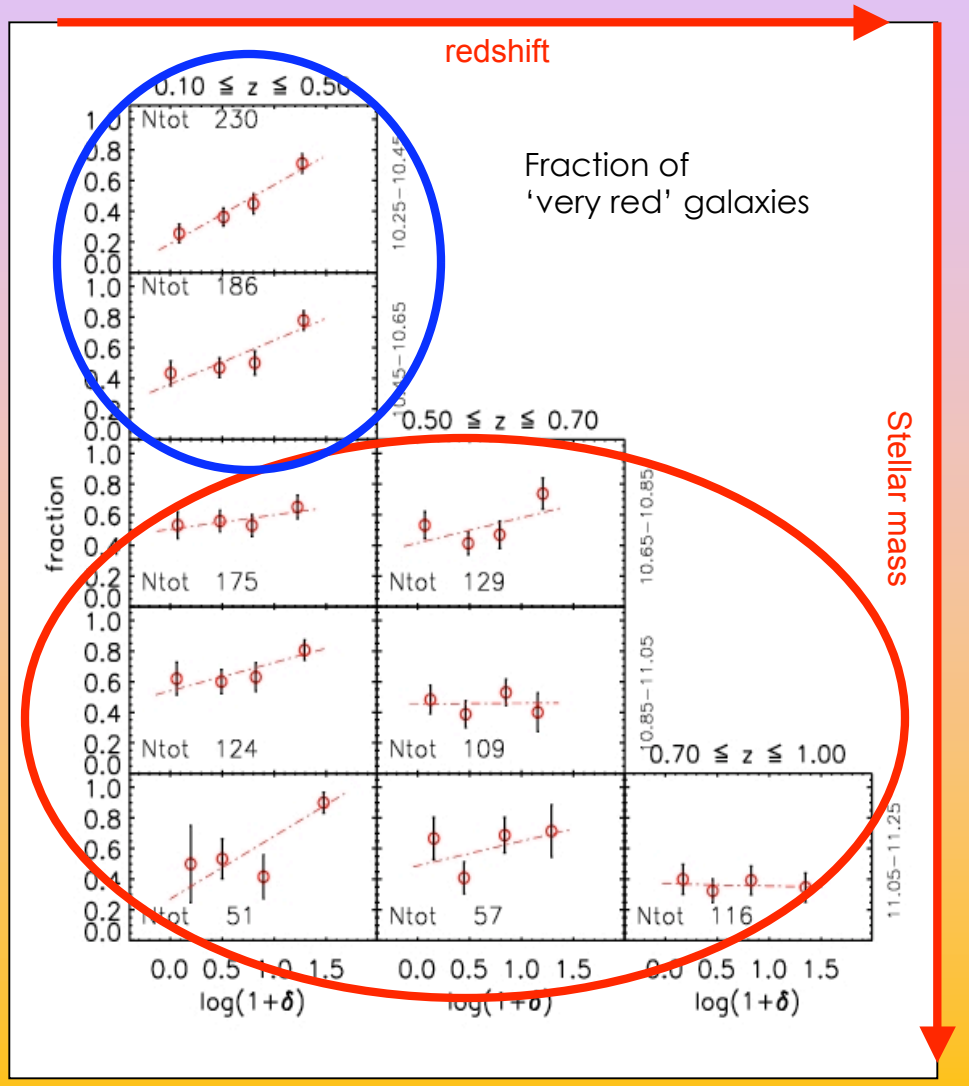




The only way to disentangle the colour-mass-density relation is to use galaxy subsamples enclosed in (complete) mass bins, narrow enough to avoid any dependence of mass on local density.

The colour-density relation at fixed stellar mass: dependence on mass and redshift





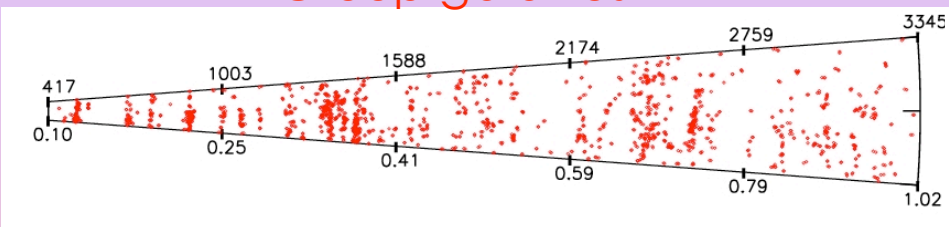
The fraction of red galaxies globally does not depend on environment up to z ~ 1, when log($M/M_\odot$) ≥10.7: colour depends primarily on stellar mass.

The fraction of red galaxies depends on δ within 0.1 ≤ z ≤ 0.5 when log($M/M_\odot$) ≤ 10.7: for these mass and redshift ranges, environment affects directly also galaxy colours.

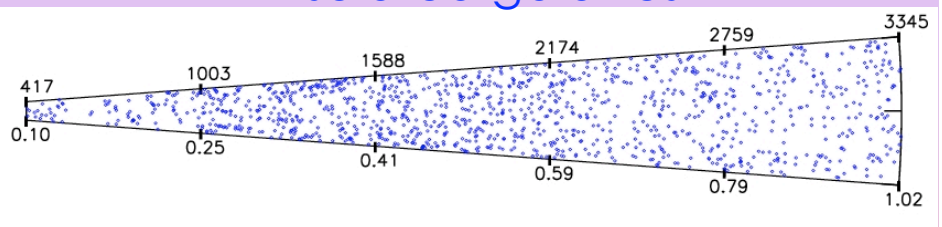
Groups vs. isolated galaxies

(on behalf of Angela Iovino)

Group galaxies



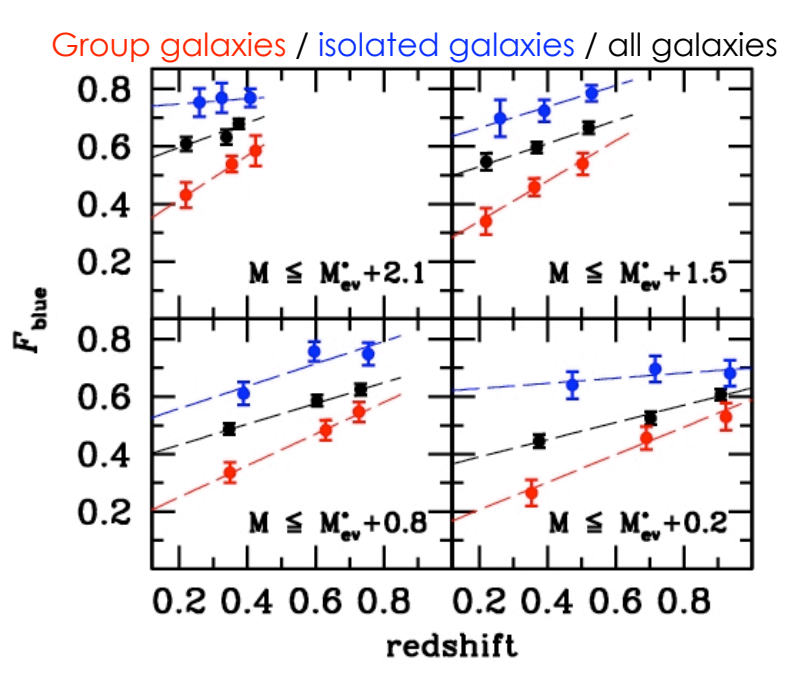
Isolated galaxies



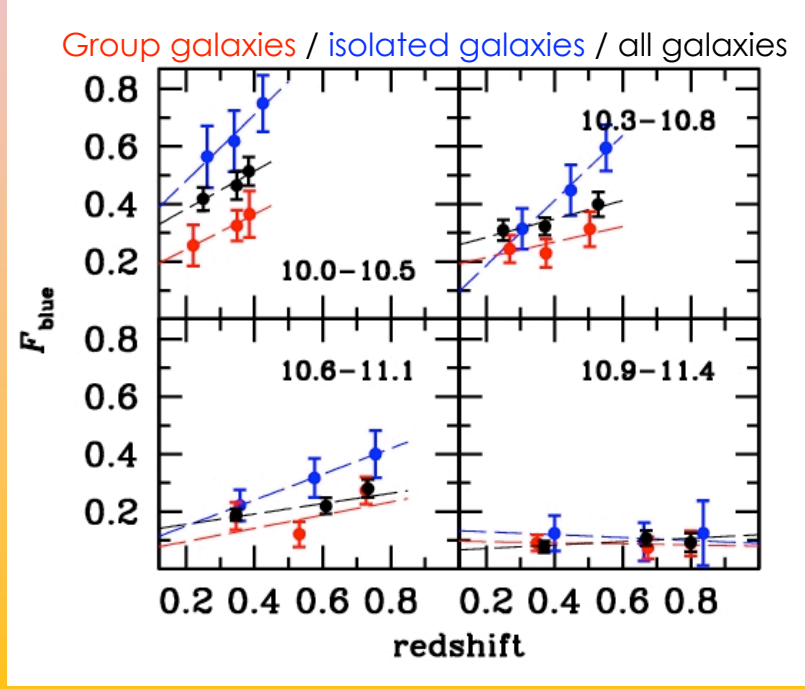
(from the group catalogue derived by Christian Knobel)

Blue galaxies fraction:

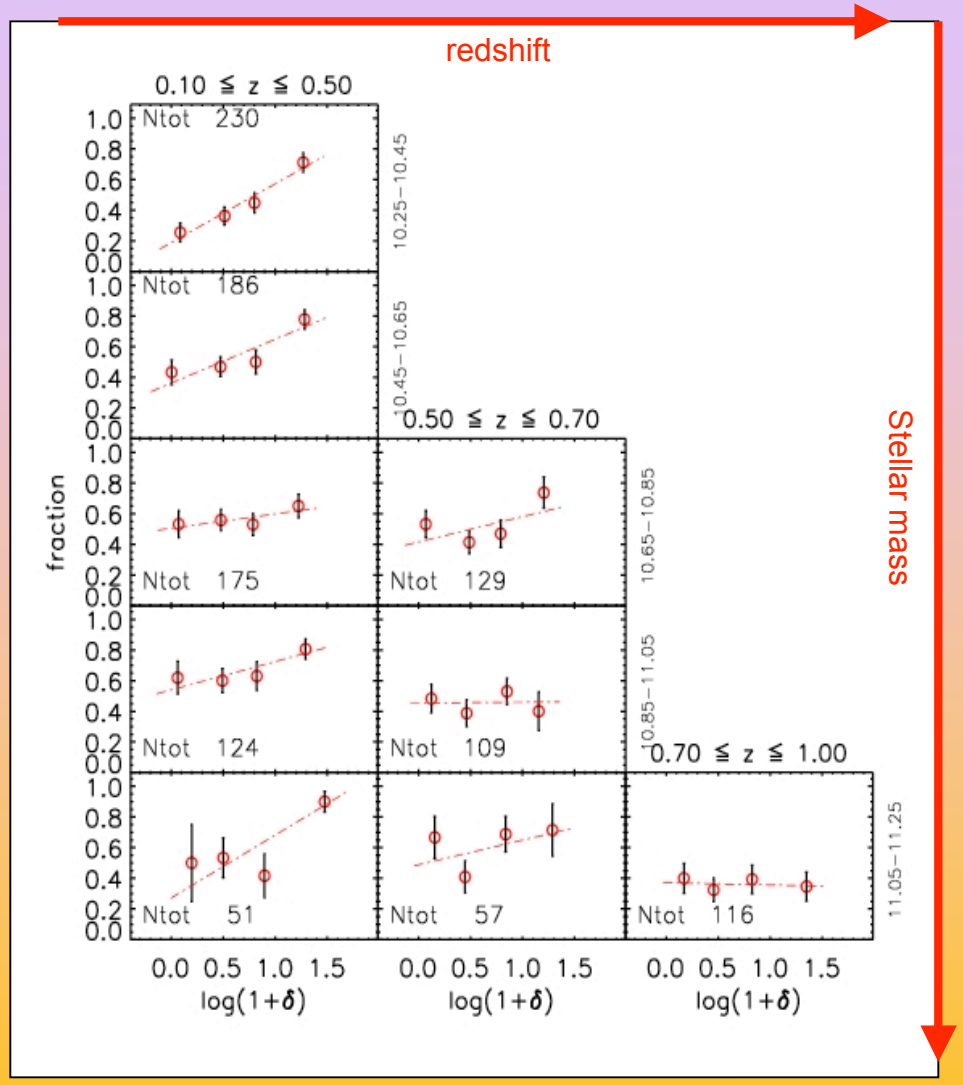
in **luminosity-selected** samples



in **mass-selected** samples



Suggested scenario



- more massive and/or higher z galaxies formed in an epoch when more evolved structures were not yet in place (z ≥ 1)

- more massive galaxies have on average faster Star Formation Histories: this does not allow environment-driven physical processes to operate during long periods of time.

Future work

We need to study the galaxy formation epoch and star formation time scales

(take into account inter-correlations among all the parameters we need, the meaning of their scatter in this context, increase statistics and mass ranges, add information from other star formation indicators evolving on different time scales..)