Galaxy evolution and environment: lessons from MUSE and perspectives for MAVIS

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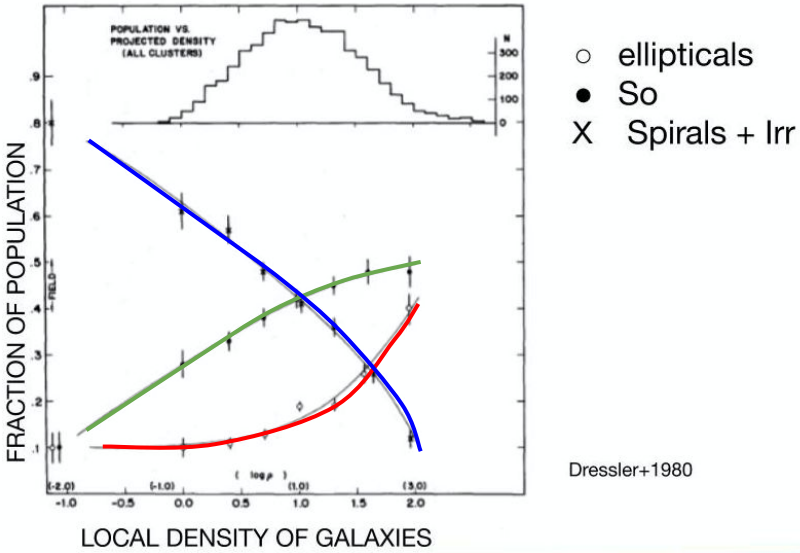
Galaxy evolution and environment: observed properties

→ morphology-density relation (and morphology-radius relation)

(Dressler 1980, Fasano+2015)



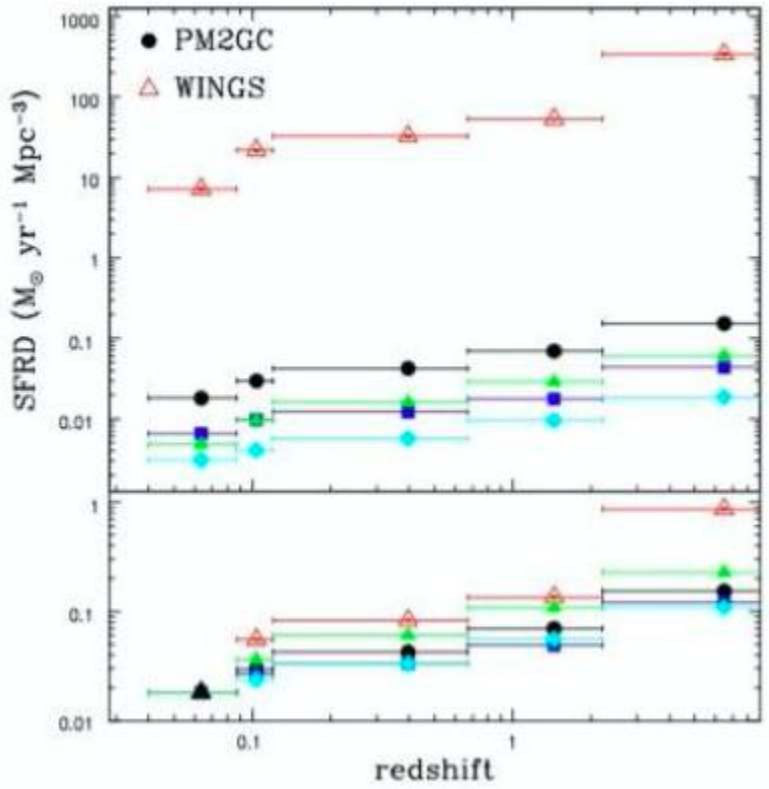
What drives the morphological evolution of galaxies?

Galaxy evolution and environment: observed properties

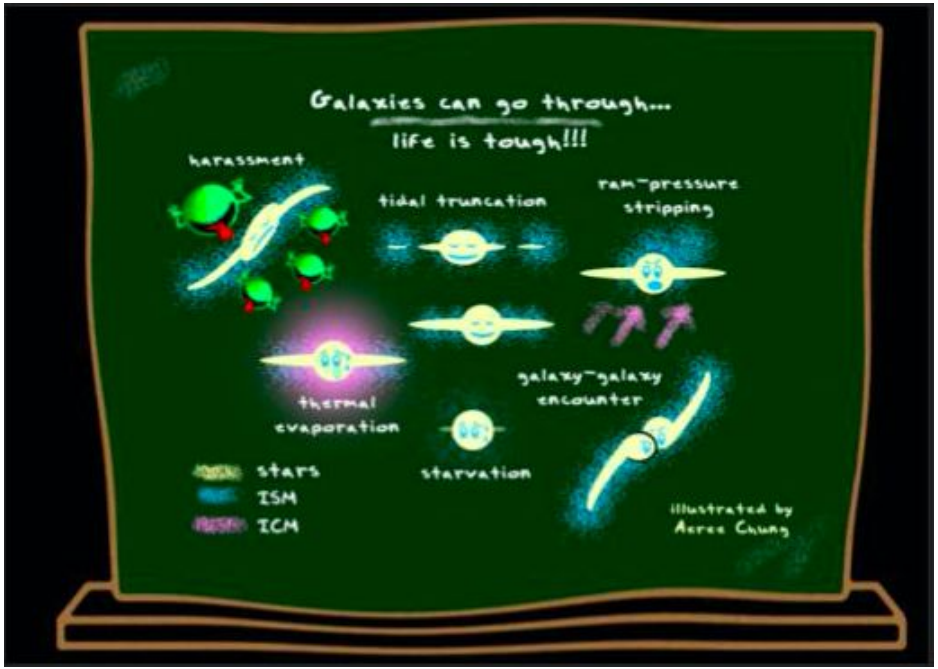
→ morphology-density relation (and morphology-radius relation)

(Dressler 1980, Fasano+2015)

→ SF efficiently suppressed in clusters (Guglielmo+2015)



The hard life of a galaxy in a cluster



Quenching related to gas supply/removal

→ RPS, strangulation (fast and slow gas-only removal)

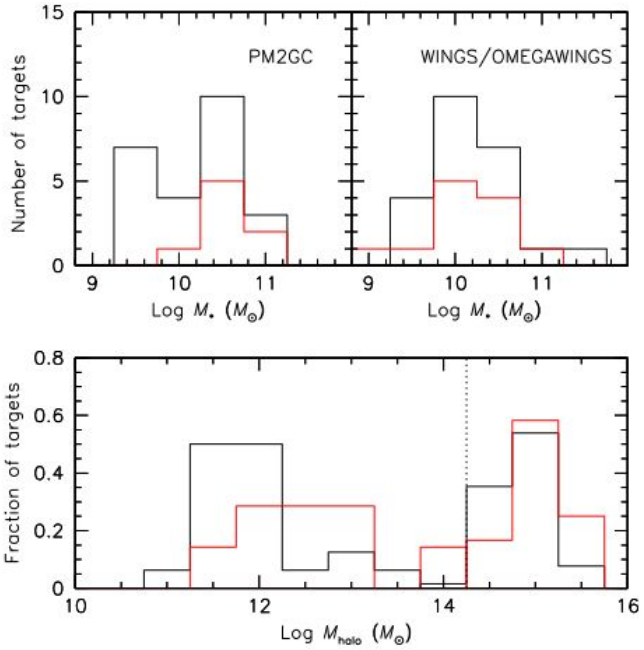
→ mergers, tidal interaction (gas and stars)

→ internal mechanisms (AGN, stellar winds)

GASP and the ram-pressure stripping w. MUSE

Gallery from M. Gullieuszik

GASP and the ram-pressure stripping w. MUSE



Technical details:

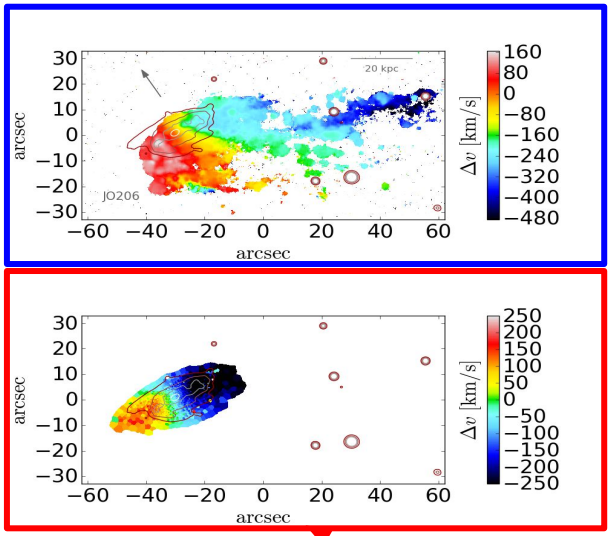
Pix size=0.2”, PSF~1” ⇒ 1 kpc scale properties at our redshift

2.5A FWHM resolution, ~100 km/s [4700-9300 A]

1’x1’ FoV, i.e. 60x60 kpc^2 at our redshift

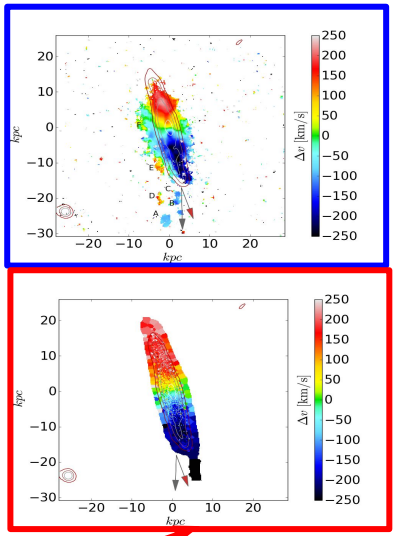
GASP results

→ RPS is effectively acting on cluster galaxies quenching the SF



Gas vs stellar kinematics to infer ram pressure stripping

→ RPS effective in low and high mass clusters



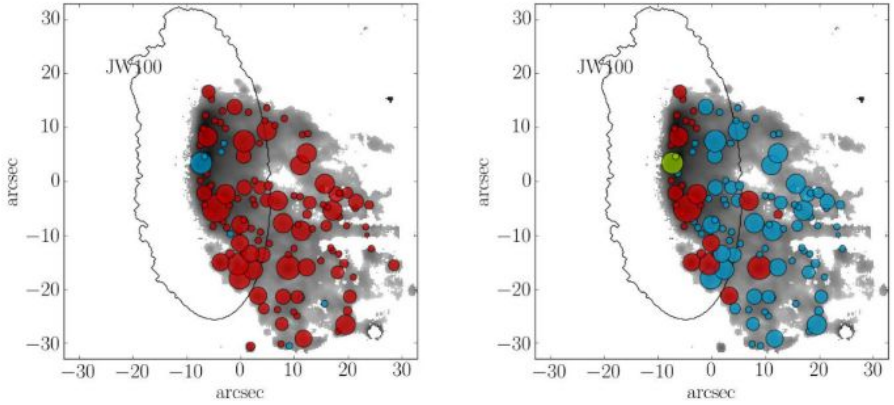
Different stripping stages!

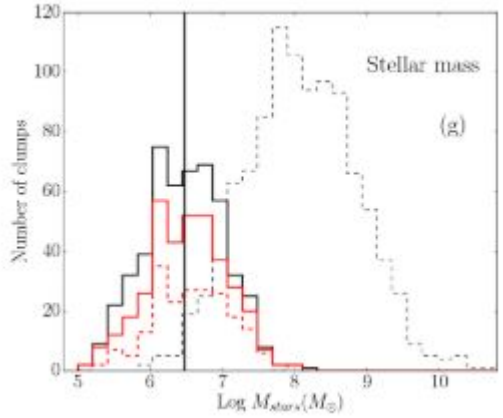
Is RPS effective only at these (low) redshift?

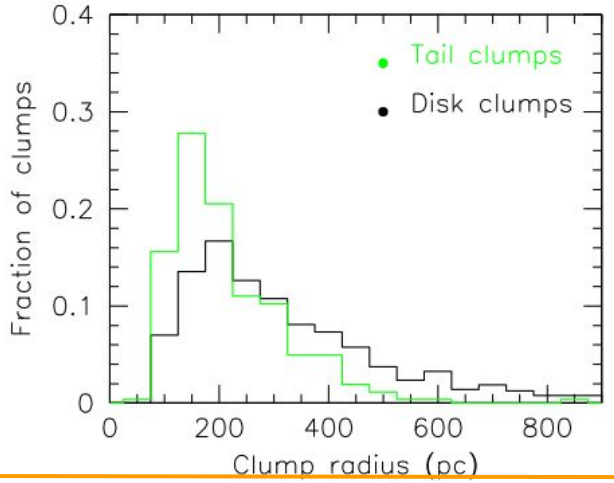
GASP results

→ RPS is effectively acting on cluster galaxies quenching the SF

→ Big (~1kpc) complexes of SF regions are found in the tails - smaller sizes possibly implied by local gx scaling relations w. H_α luminosity



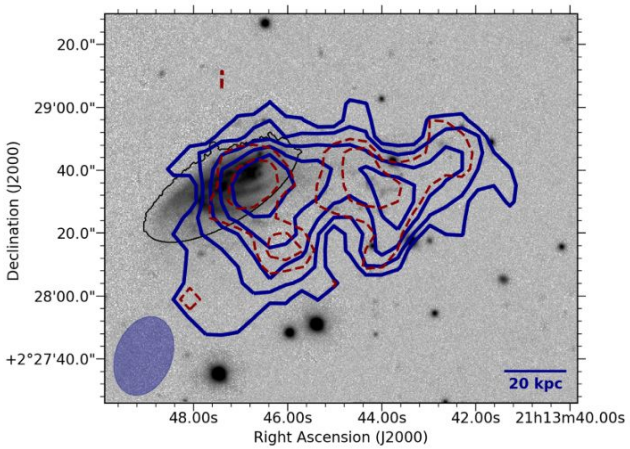




Poggianti+2019

GASP results

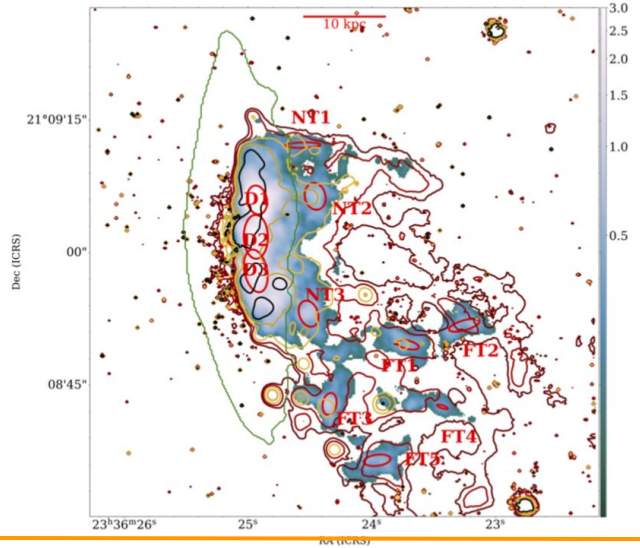
Ramatsoku+2019



→ RPS is effectively acting on cluster galaxies quenching the SF

→ Big (1kpc) complexes of SF regions are found in the tails

Moretti+2018,2020



→ Multiwavelength datasets confirm HI and H2 gas tails

Is SF acting on such big scales, or do we need better resolution?

Still open questions

What is the effect of the environment on

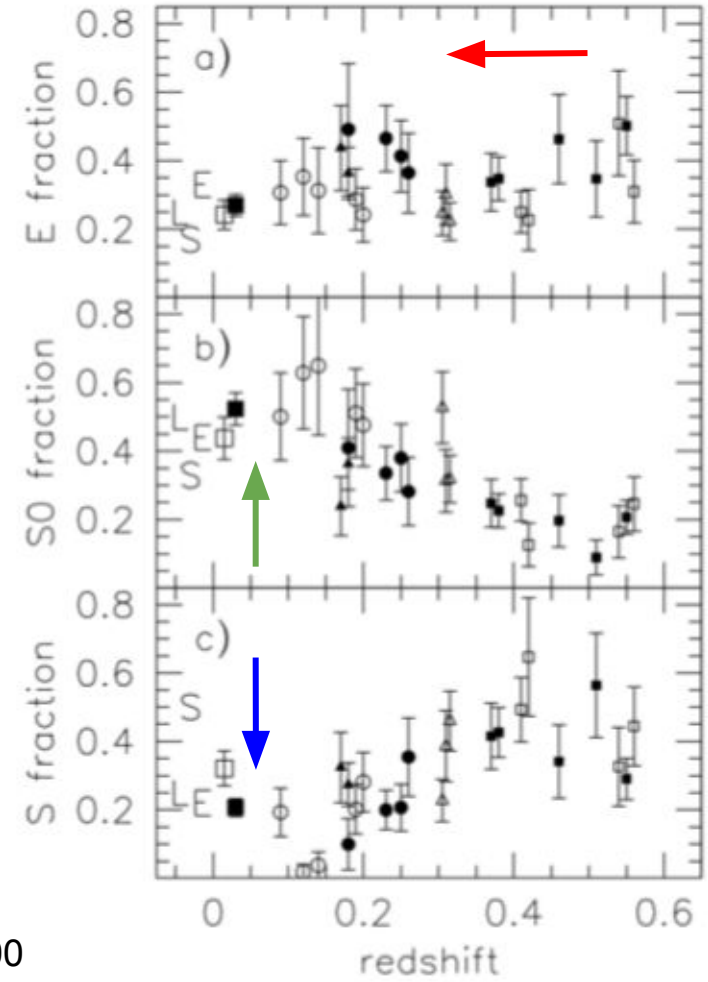
- morphological evolution ?
- size evolution/mass growth ?
- quenching mechanisms ?
- star formation ?

MAVIS science cases

→ Morphological evolution:

- distinguish E from S0
- are cluster and group/field S0 coming from different physical mechanisms?

MAVIS imaging (30”x30”) **in B** can do that for a large sample of cluster and groups environment at redshift 0.4-1 (with pre-selection on pre-existing surveys)



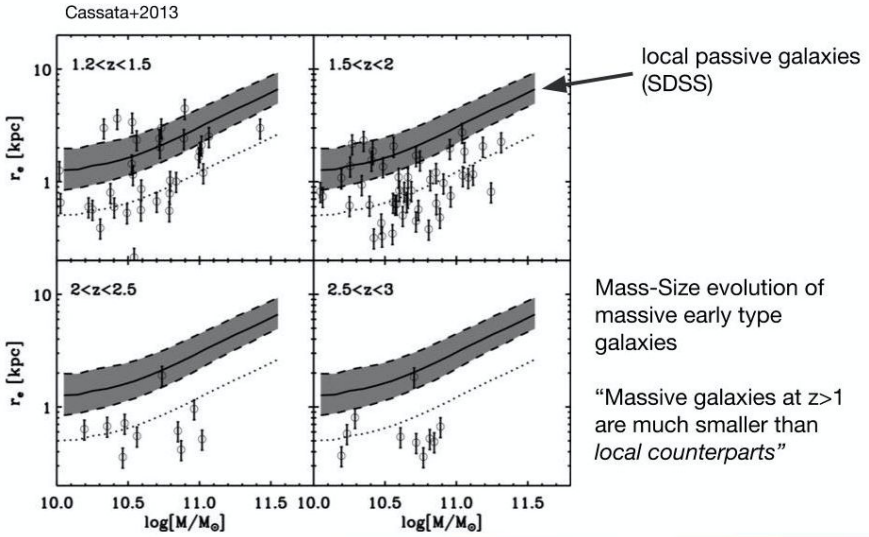
Fasano+2000

MAVIS science cases

→ Size/mass evolution:

- Build the correct progenitor-descendant tree in measuring the size evolution, i.e. who are the local counterpart of high-z supermassive gx?
- How significant/strong is the mass size evolution?

MAVIS imaging in R/I can map V rest-frame at 0.3-0.6 + high spatial resolution allow unprecedented size measurement



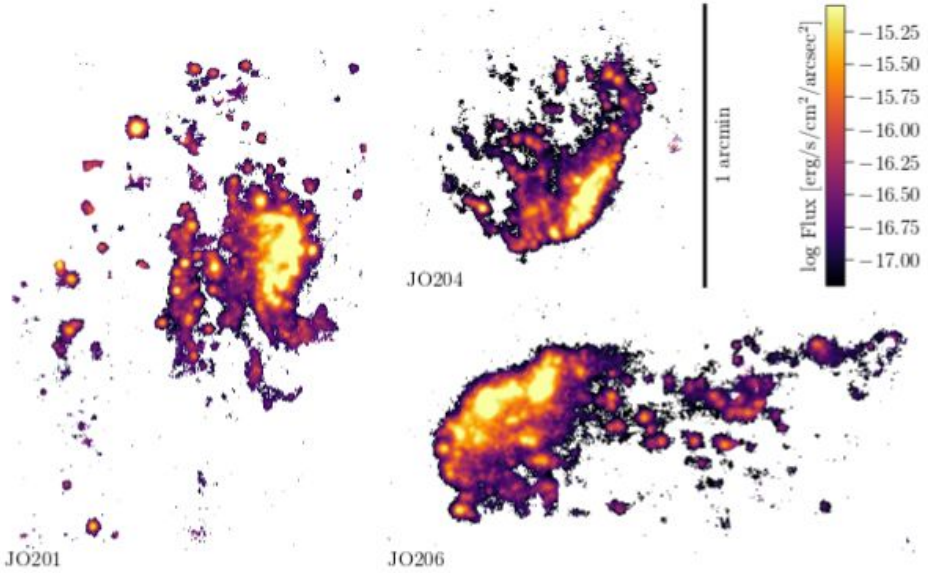
MAVIS science cases

→ Star forming clumps:

- SF clumps physical properties are related to environment?
- How are they distributed within a big complex seen through the PSF?
- Do they evolve with time?

[**BV-band imaging** at intermediate (0.5-1) z → UV restframe! W. 25 mas → ~200 pc

At low z map SF regions on tens of pc scale]



MAVIS science cases

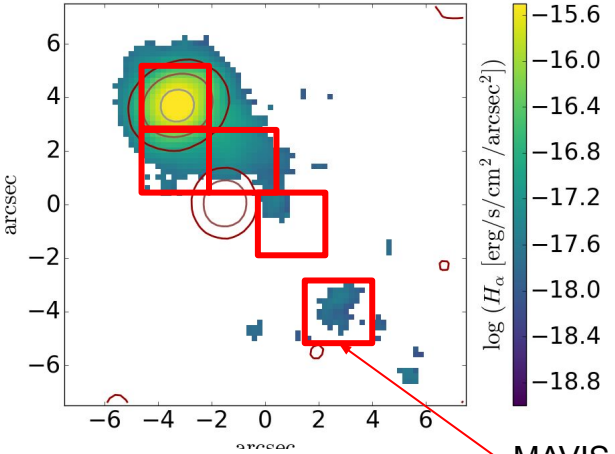
→ RPS at intermediate redshift:

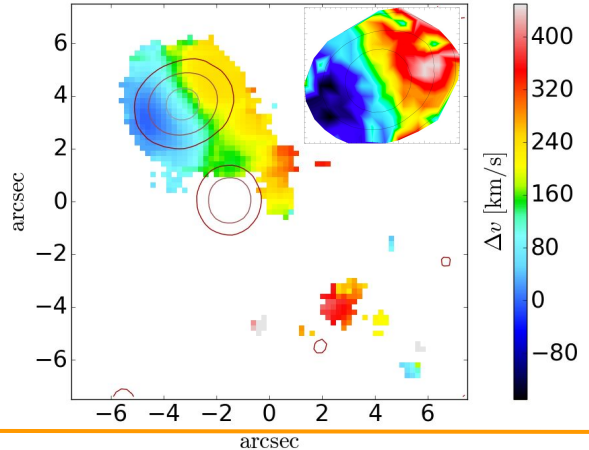
- Is the RPS important also at redshift ~0.3-0.7, i.e. when cluster form and many more galaxies are infalling?

  MAVIS IFU can map **OII, H_β** and **OIII** for a significant sample of galaxies preselected from McPartland+2016 (0.4), RELICS survey (0.2-1), ESO VLT CLASH (0.2-0.5)

  [2 pointings at z~1, 5 pointings at z~0.4, w. IFU 3”x3”; all lines out to 0.6 or 0.8 depending on reddest wavelength, mapping ~100 pc scale]

1 gx in A2744@z~0.3 w. MUSE-WFM ~5 kpc res





Conclusions

→ MUSE has allowed a huge step forward in the galaxy evolution field at low-intermediate z

→ Many open questions can be solved by MAVIS!