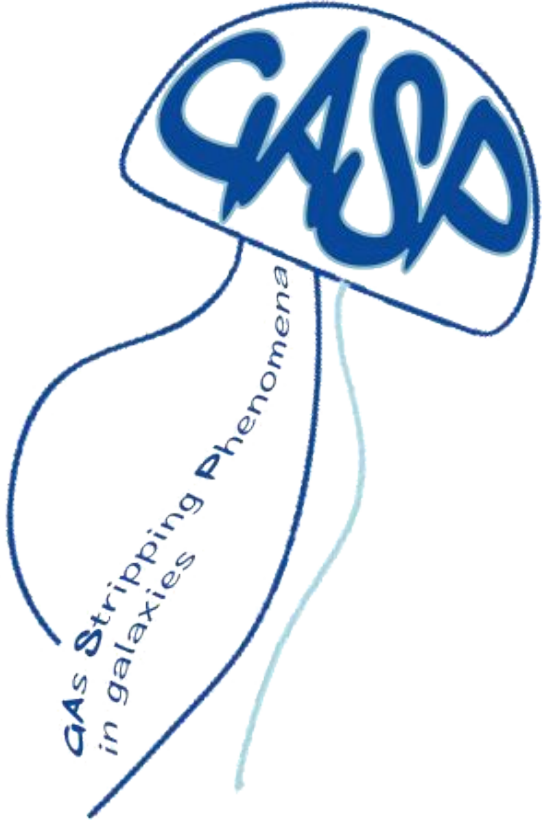

Ram pressure stripping in local clusters: the GASP perspective

Alessia Moretti,
INAF-OAPD

http://web.oapd.inaf.it/gasp/

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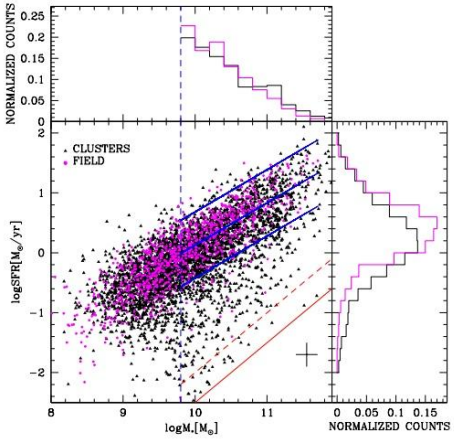
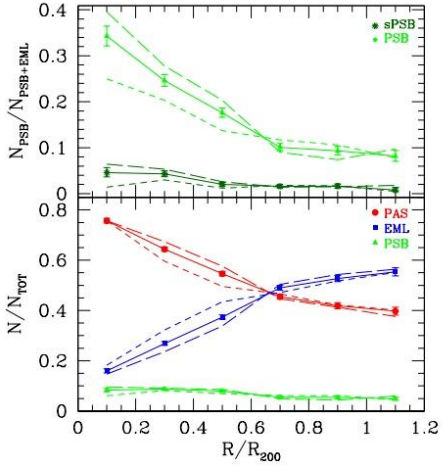
Transition and PSB galaxies in local clusters



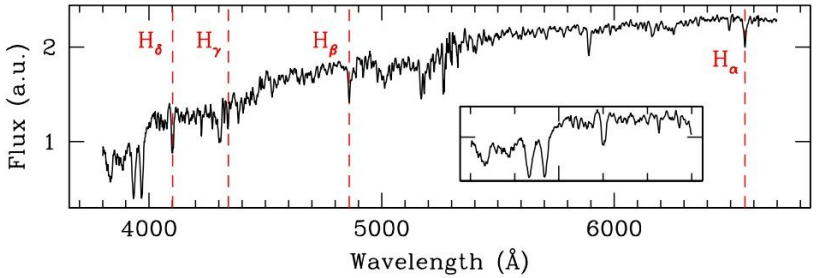


Quenching related to gas supply/removal

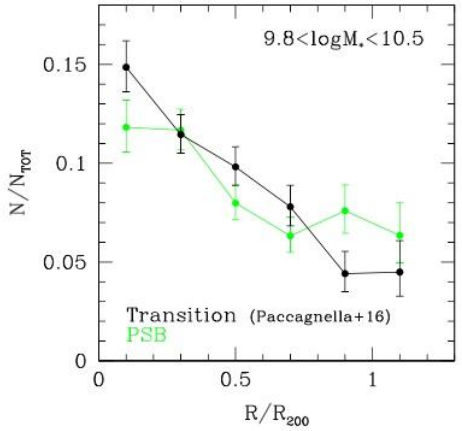
→ RPS, strangulation (fast and slow gas-only removal)

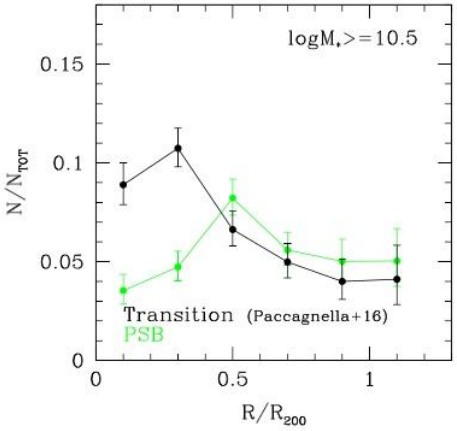
→ mergers, tidal interaction (gas and stars)

→ internal mechanisms (AGN, stellar winds)



Galaxy type	PAS		PSB		sPSB		EML	
	N	%	N	%	N	%	N	%
Clusters	8162 (4235)	55.7±0.4	1057 (560)	7.2±0.2	154 (80)	1.1±0.3	5441 (3029)	37.0±0.4
Field	415 (225)	19.7±0.8	28 (15)	1.3±0.2	7 (3)	0.3±0.1	1667 (923)	79.0±0.9





Paccagnella et al., 2017

The GASP survey (PI B. Poggianti, ESO MUSE LP)

GAs Stripping Phenomena in galaxies with MUSE

→ Galaxies in different environments (clusters, groups, field+control sample)

→ Galaxies with different masses (from 10^{9} to $10^{11.5}$ $M_{\odot}$)

→ Galaxies with different stripping signatures (Jclass 1-5, taken from Poggianti et al., 2016)

→ 114 [94+20] gx, 120 hrs, 2700s/pointing, 1e5 spectra/pointing

→ 0.2"/px, 2.5 A FWHM, 4700-9300

→ Started in 2015, 63% observed

→ **Fov (1'x1')~60x60 kpc^2**

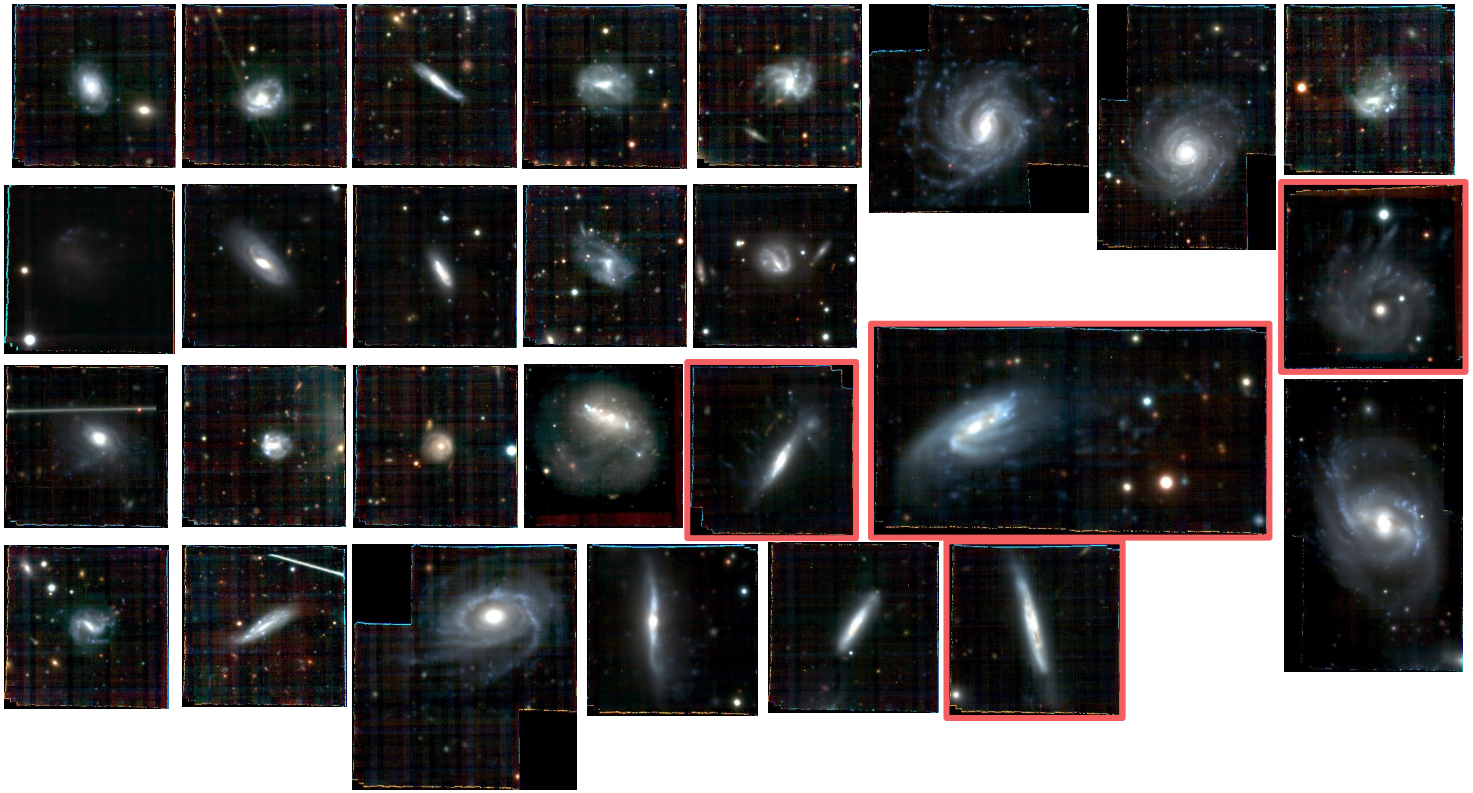
NB Target galaxies selected to have signatures of GAS-ONLY removal processes (no mergers, no tidal interactions)

1. Debris trails, tails or surrounding debris on one side of the galaxy
2. asymmetric/disturbed morphology
3. Distribution of star forming knots/region suggesting induced SF on one side

http://web.oapd.inaf.it/gasp/index.html

The GASP survey: observed galaxies [clusters]

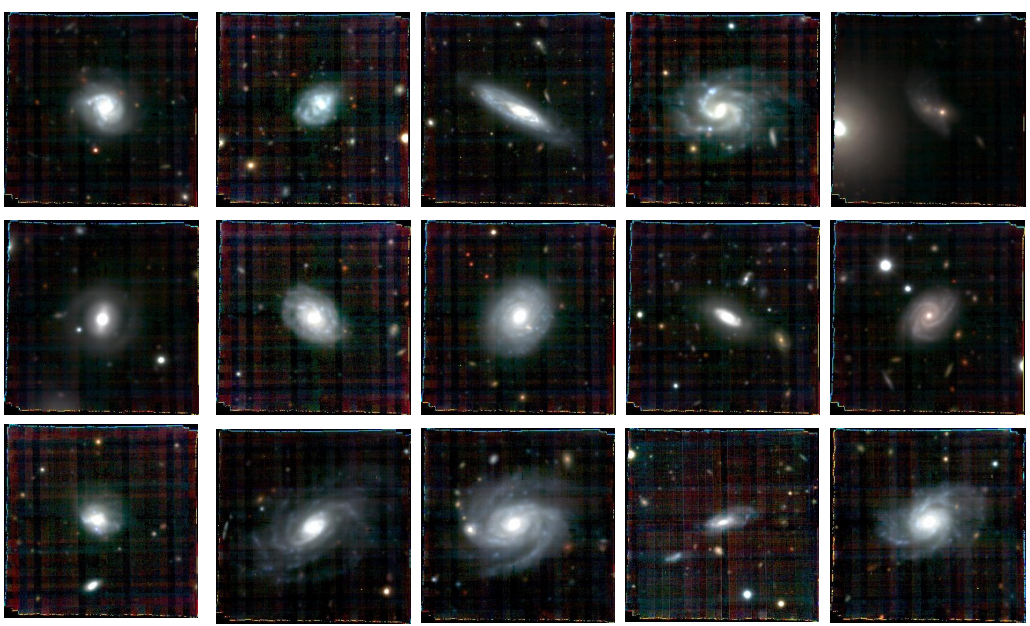
GAs **S**tripping **P**henomena in galaxies with MUSE

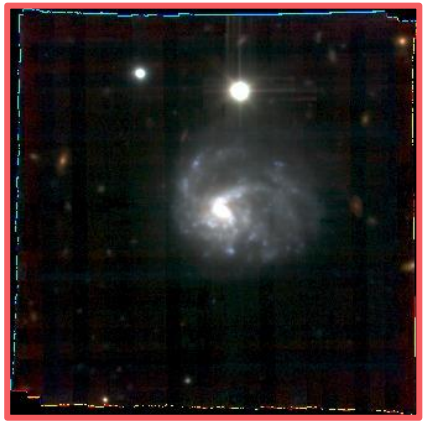


http://web.oapd.inaf.it/gasp/index.html

The GASP survey: observed galaxies [groups/field]

GAs Stripping Phenomena in galaxies with MUSE

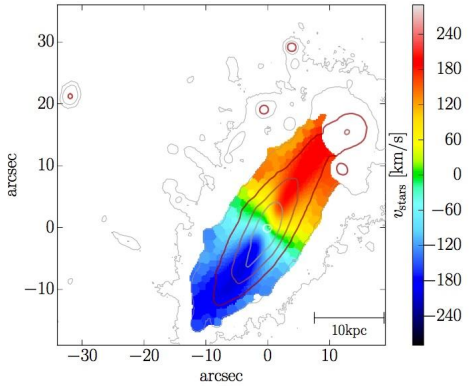


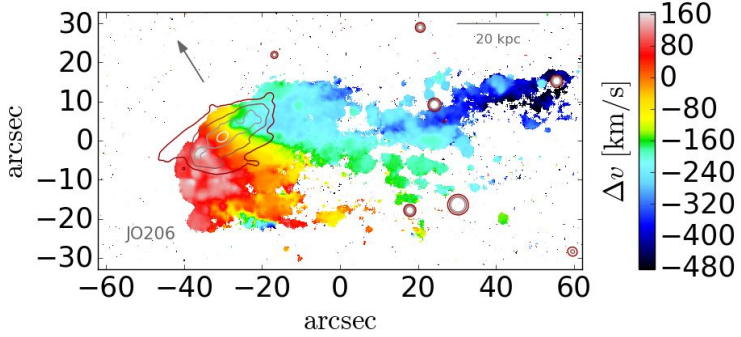


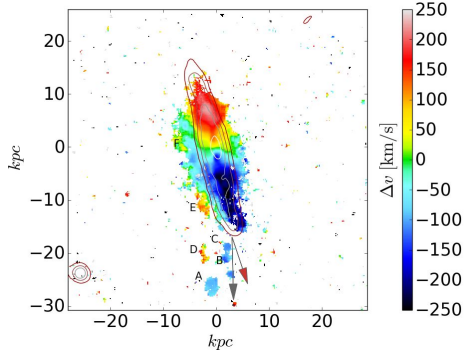
http://web.oapd.inaf.it/gasp/index.html

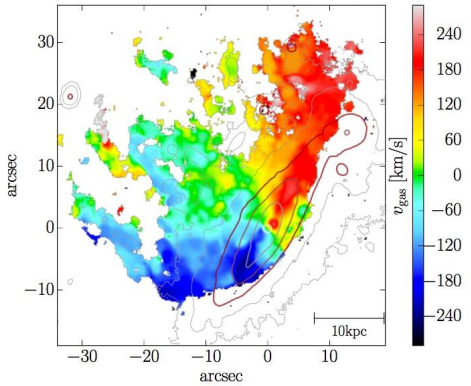
The GASP survey: inference of ram pressure

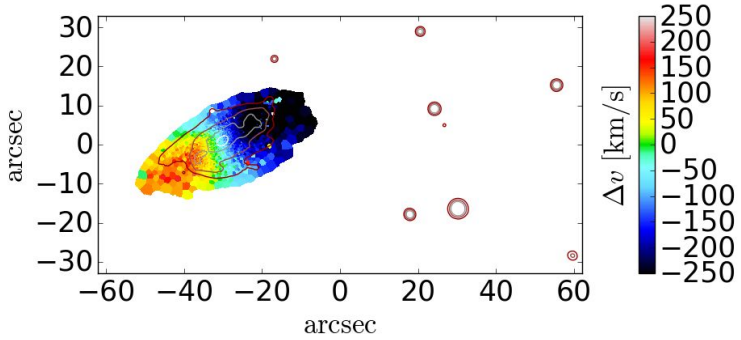
GAs Stripping Phenomena in galaxies with MUSE

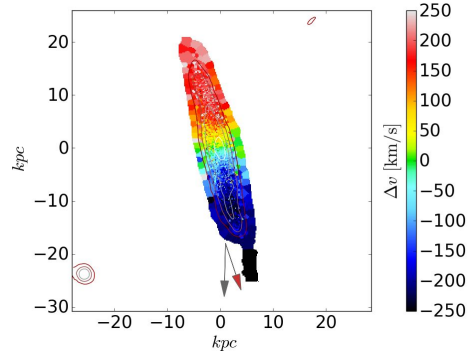








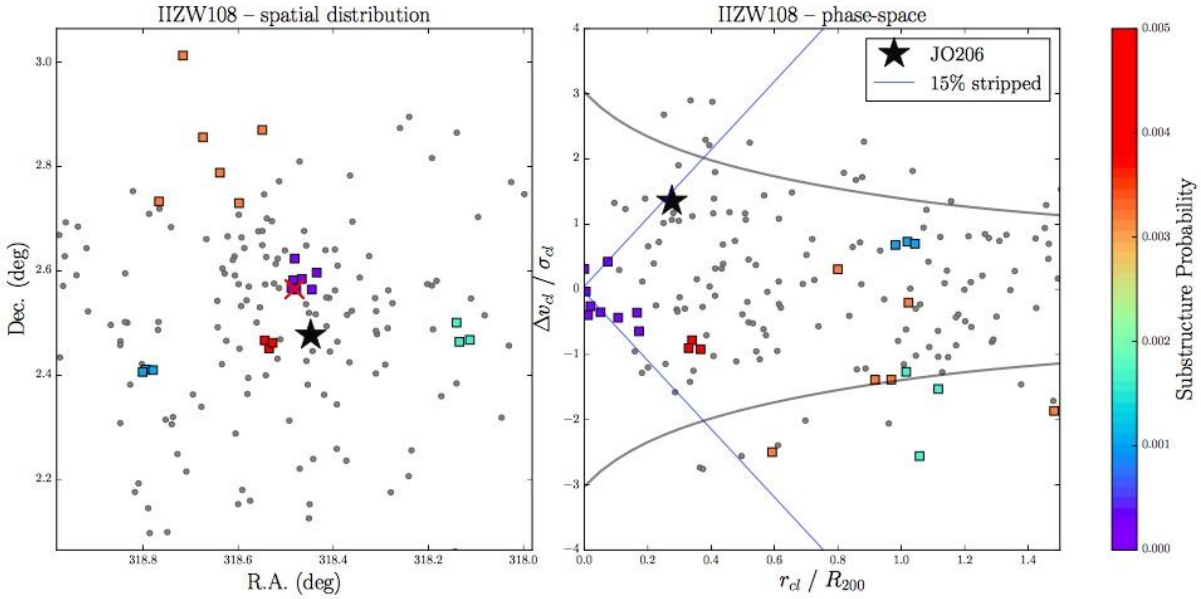




http://web.oapd.inaf.it/gasp/index.html

The GASP survey: inference of ram pressure (JO206)

GAs Stripping Phenomena in galaxies with MUSE



Cluster dynamics from WINGS/OmegaWINGS dataset (Moretti et al., 2017, Biviano et al., in preparation) on 171 spectroscopic members

M_{200}=1.9 x 10^{14} $M_{\odot}$, R_{200}=1.17 Mpc

JO206 does not belong to any substructure

Located at 0.3 R_{200} with Δv~1.5 σ_{cl} → ideal conditions for RPS

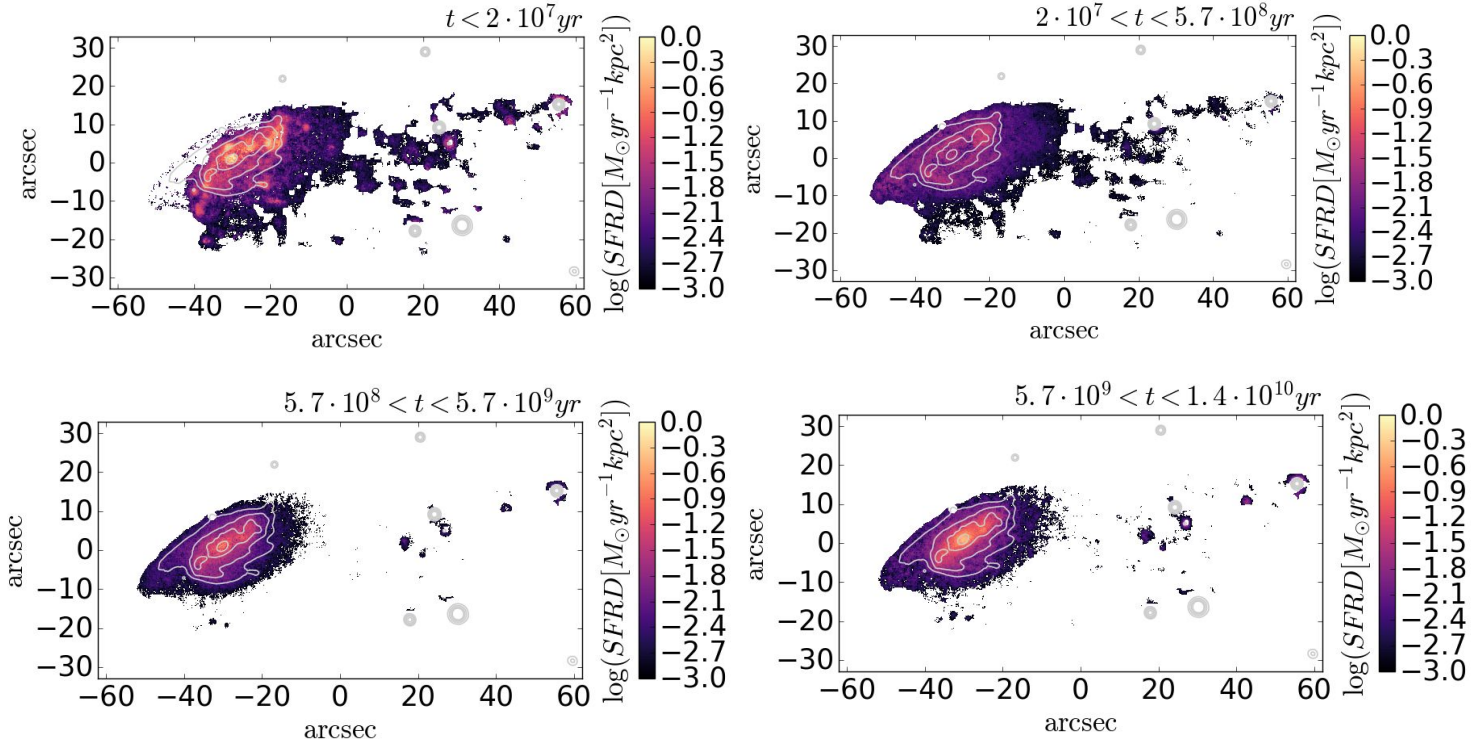
By comparing P_{ram} with the anchoring force of a disk galaxy as JO206 → condition for stripping met at r~20 kpc

The estimated gas mass fraction lost to the ICM is ~15%

Caveat
→ Only projected measurements
→ Idealized exp. Disk for JO206
→ Assumed homogeneous ICM
→ Hα used as gas tracer

The GASP survey: stellar populations

GAs Stripping Phenomena in galaxies with MUSE



Ongoing and recent SF in the tails

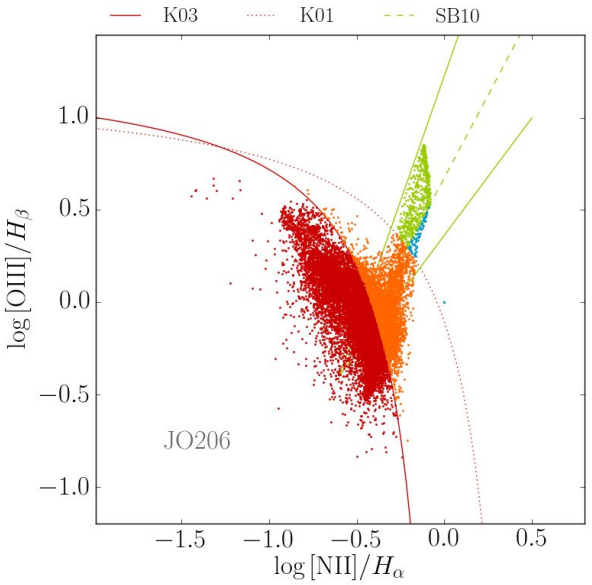
Older stars confined to the main galaxy body

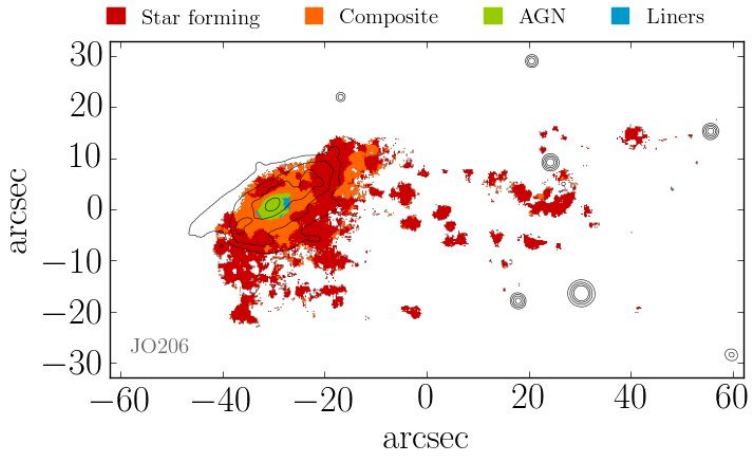
SF in the stripped gas started during the last 5×10^8 yrs

http://web.oapd.inaf.it/gasp/index.html

The GASP survey: SF in the tails

GAs Stripping Phenomena in galaxies with MUSE





Origin of SF in the tails (from massive stars formed in the last 10^7 yr)

→ new stars in situ (compatible with measured stellar continuum and stellar ages)

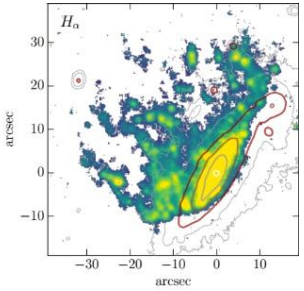
→ ionizing radiation from stars in the disk

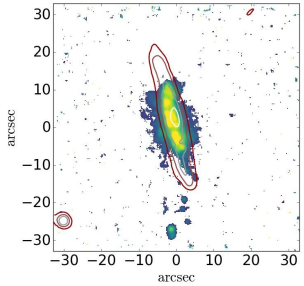
→ stripping of ionized gas (recombination time too short, or implying gas traveling at ~9000 km/s)

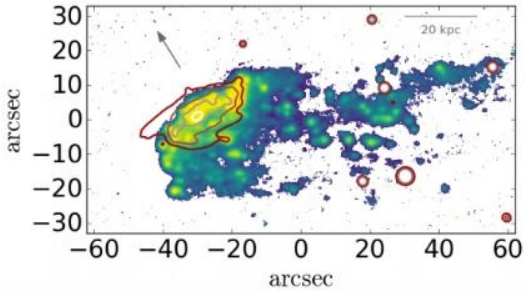
http://web.oapd.inaf.it/gasp/index.html

The GASP survey: General Results

GAs Stripping Phenomena in galaxies with MUSE







Common phenomena:
→ Hα coincident with HII regions in the tails

→ SF ongoing in the stripped tails [WIP ICL, WIP Fraction of JF among spirals]

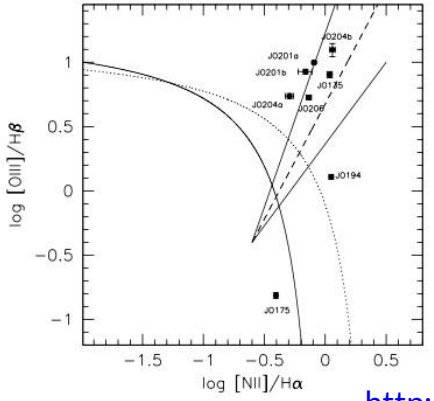
Success

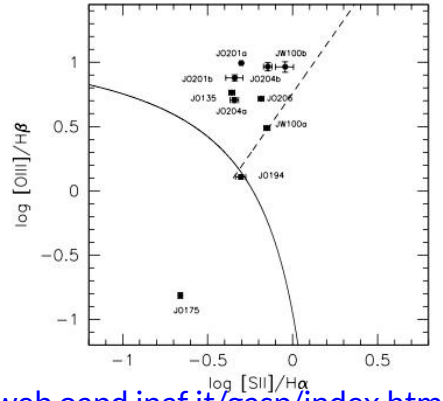
→ MUSE data able to infer RPS and date it

Results

→ RPS effective in low mass and high mass clusters, and
For massive and less massive galaxies

→ JF “degree” connected to AGN (See M. Gullieuszik’s talk)





GASP I : arXiv:1704.05086
GASP II: arXiv:1704.05087
GASP III: arXiv:1704.05088

http://web.oapd.inaf.it/gasp/index.html

The GASP survey: complementary observations

GAs Stripping Phenomena in galaxies with MUSE

→ CO gas with APEX (33+44 hrs) for 5 galaxies to detect molecular hydrogen in the galaxies and in the tails: is the molecular gas stripped as well? How much molecular gas is present in the tails and left in the main body? [molecular gas is present both in the disk and in the tails, with different velocities, Moretti et al., in preparation]

→ Deep HI observations of 15 JF in 5 clusters with JVLA (100 hrs, 15 kpc resolution)[mainly to study the interplay of the different gas phases, but also to correlate HI deficiency to the JF appearance and to discover interactions, if any.]

→ Ultraviolet view of RPS in action with Astrosat (24.4 ks)

→ Chandra observations [14 galaxies with masses >2e10 and JClass>=3, 40 ks each, 560 ks in total, 11 already show X-ray emission Nicastro et al., in preparation. To detect AGN signatures, shock fronts, ULXs]

→ ALMA observations [4 targets, 20 hrs requested, all with AGN, in different clusters. 1 kpc resolution would allow to resolve the knots as in GASP. CO21 and CO10]

http://web.oapd.inaf.it/gasp/index.html