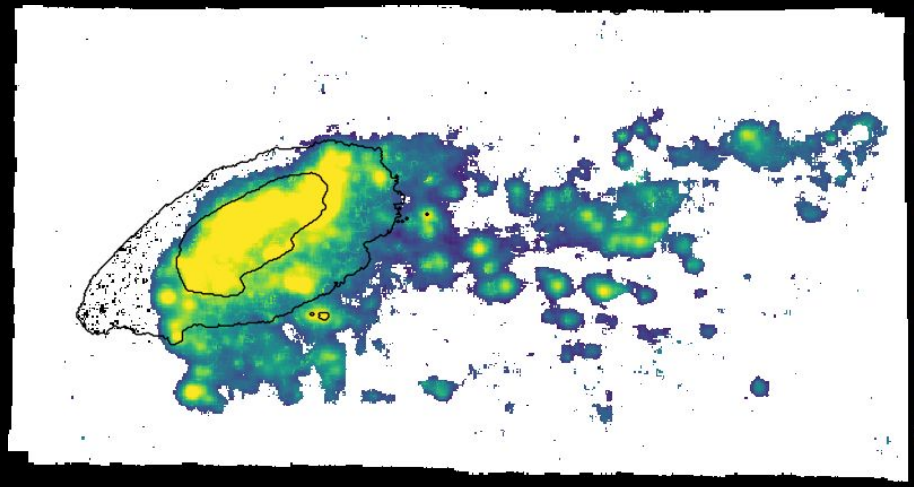
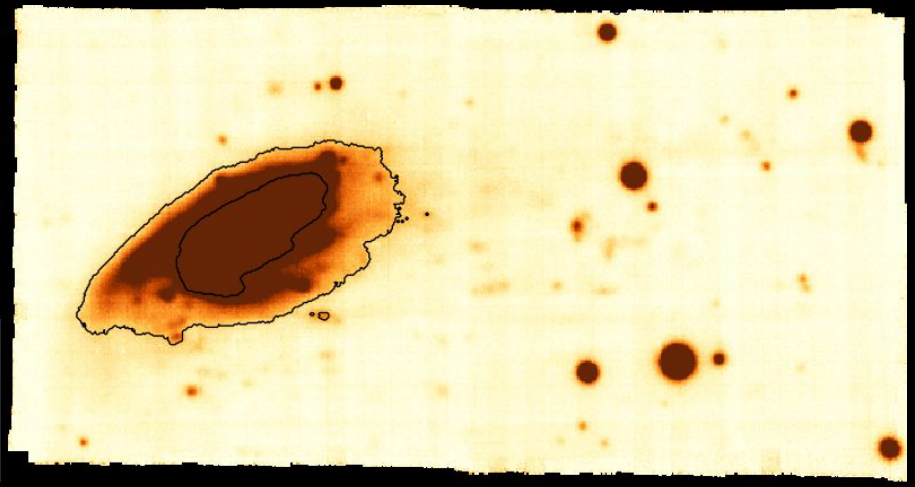
The discovery of a ram-pressure stripping / AGN connection
Ram pressure feeding super-massive black holes?





Marco Gullieuszik

INAF - Osservatorio Astronomico di Padova, ITA

Bianca M. Poggianti, Yara Jaffe', Alessia Moretti, Mario Radovich, Stephanie Tonnesen, Jacopo Fritz, Daniela Bettoni, Benedetta Vulcani, Giovanni Fasano, Callum Bellhouse, George Hau, Alessandro Omizzolo

The discovery of a ram-pressure stripping / AGN connection
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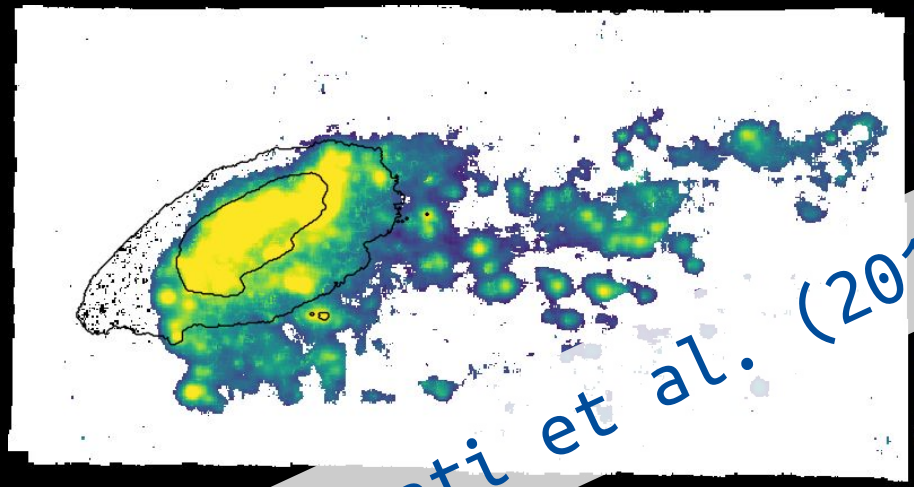

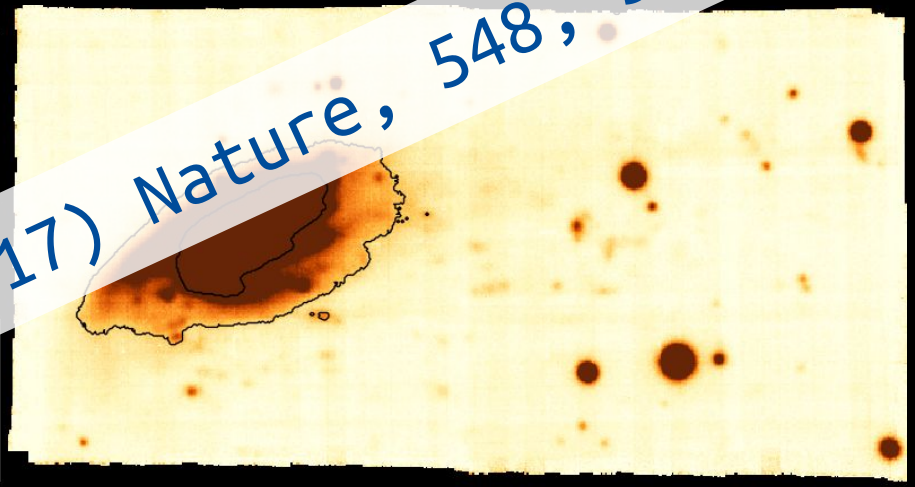

Poggianti et al. (2017) Nature, 548, 304

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The GASP Programme

Gas Stripping Phenomena in galaxies
ESO Large Programme - PI Poggianti

120h with MUSE@VLT
End of observations: ~2018
94 Gas stripping candidates (clusters/groups/field)
20 galaxies as control sample

where, how, why is gas removed from galaxies?

Poggianti et al. (2017) ApJ, 844, 49
Talk by Moretti, this conf.
http://web.oapd.inaf.it/gasp

Jellyfish galaxies

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We selected extreme cases of gas stripping

selection criterion: Hα tentacles longer than the diameter of the stellar disk

>> 7 galaxies
>> all massive: $4 * 10^{10}$ - $3 * 10^{11}$ Msun

Jellyfish galaxies: JO206

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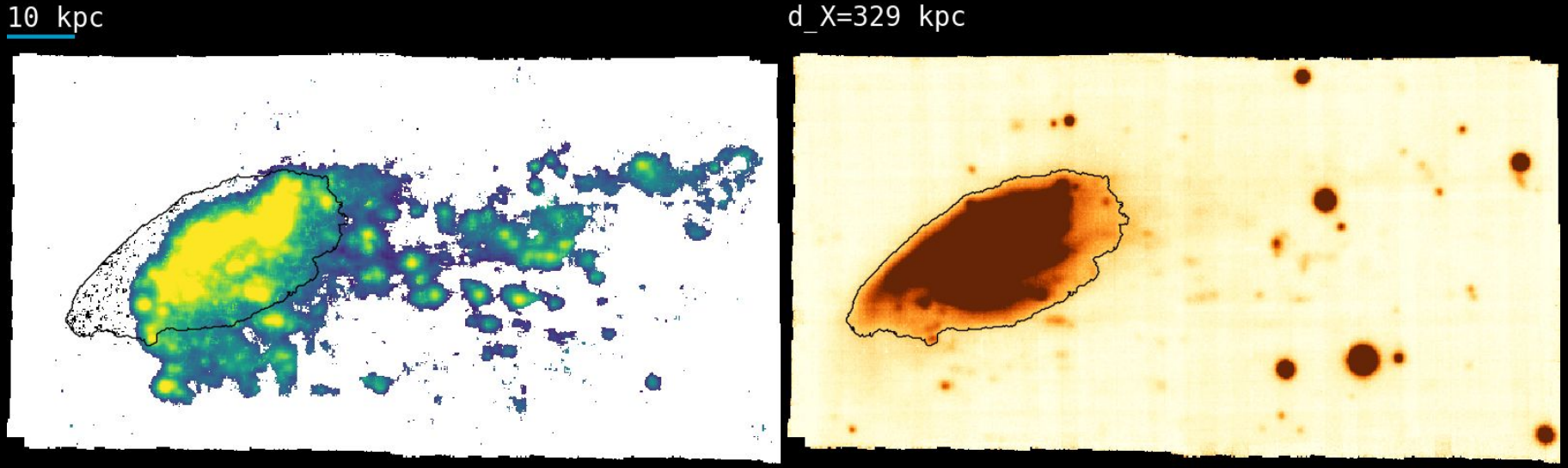
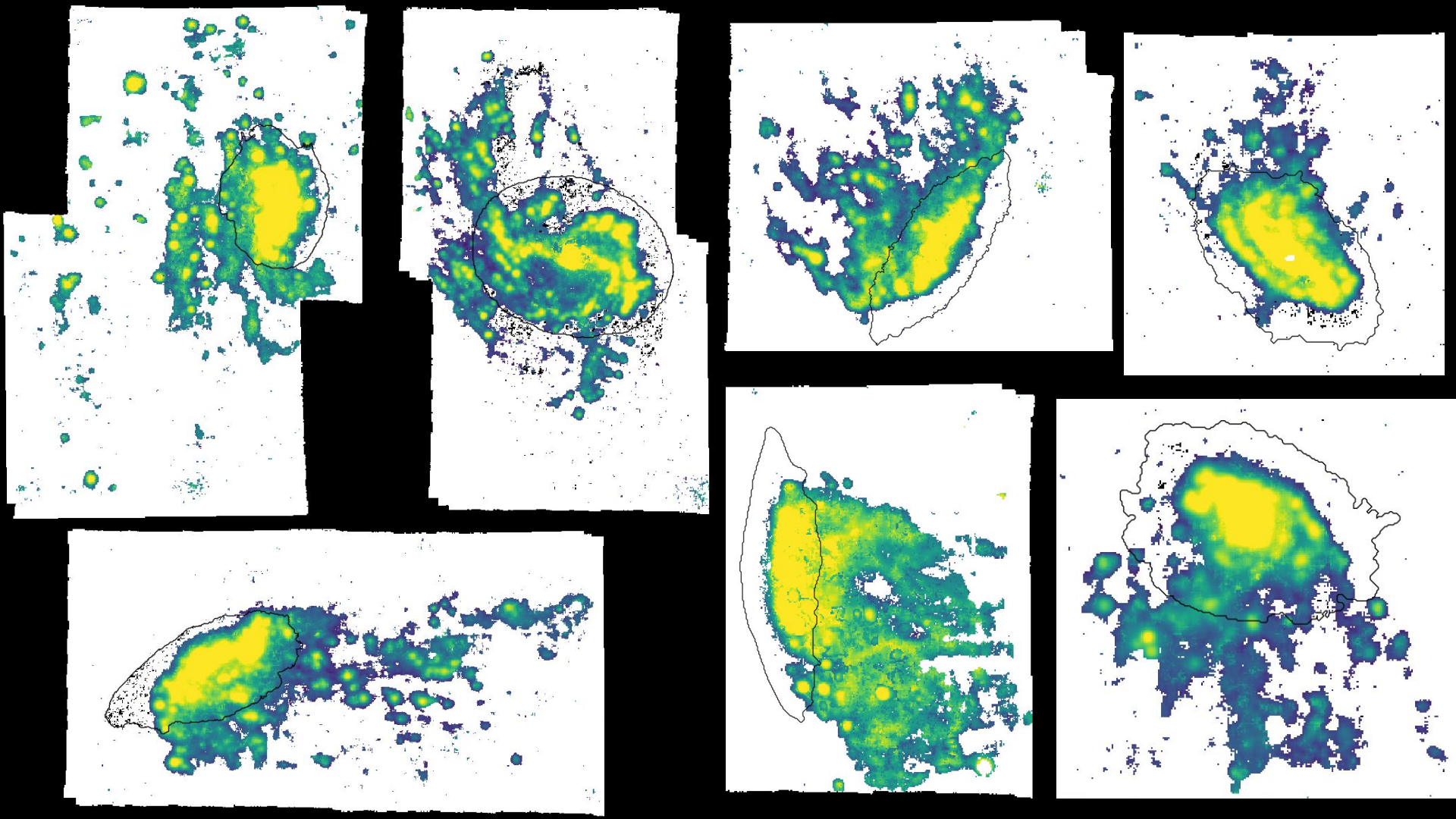


Hα emission

V-band from MUSE



They are ram-pressure stripped

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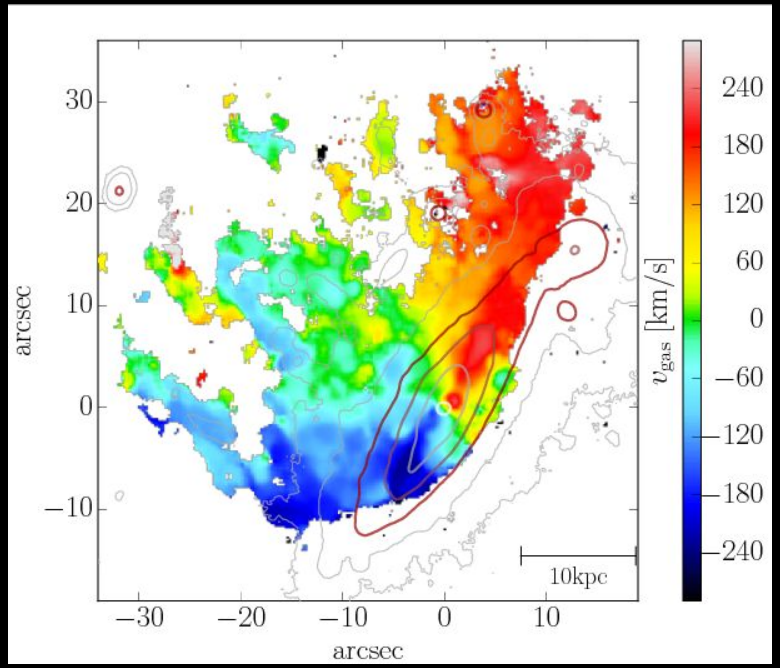
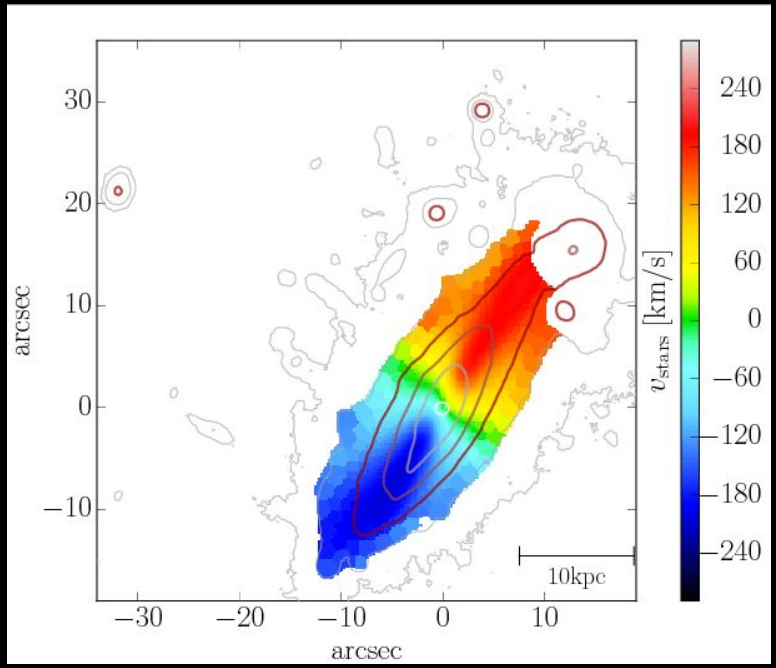
GAS

STARS

Gullieuszik et al. (2017)



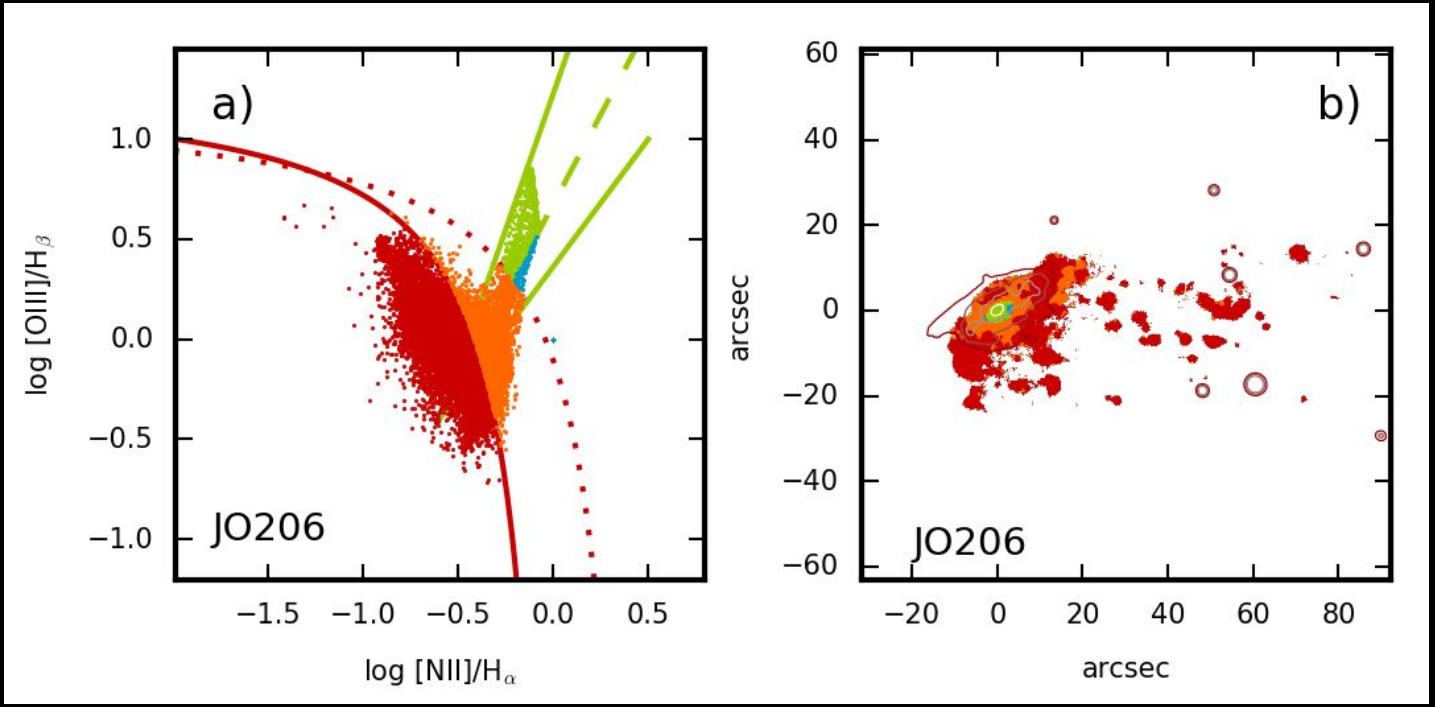


The stellar component is not disturbed
Gas-only stripping > ram-pressure

Detailed analysis for:
JO206 Poggianti et al. (2017)
JO201 Bellhouse et al. (2017)
JO204 Gullieuszik et al. (2017)

Ionization mechanism

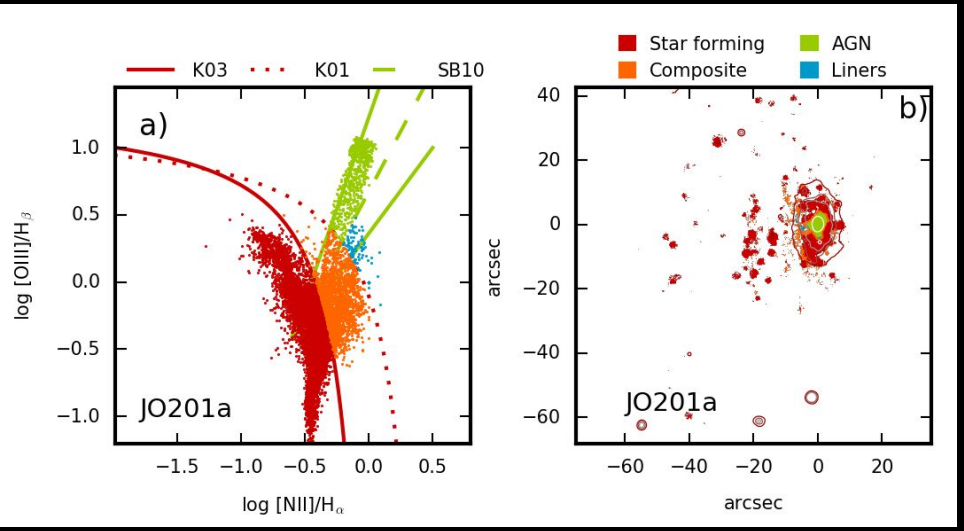
BPT diagram with line ratios for each spaxel.

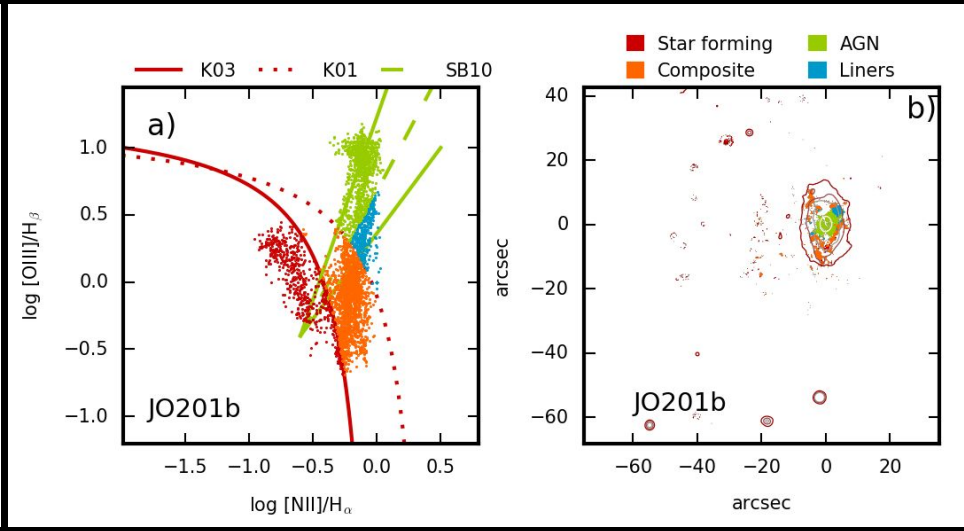


Ionization mechanism

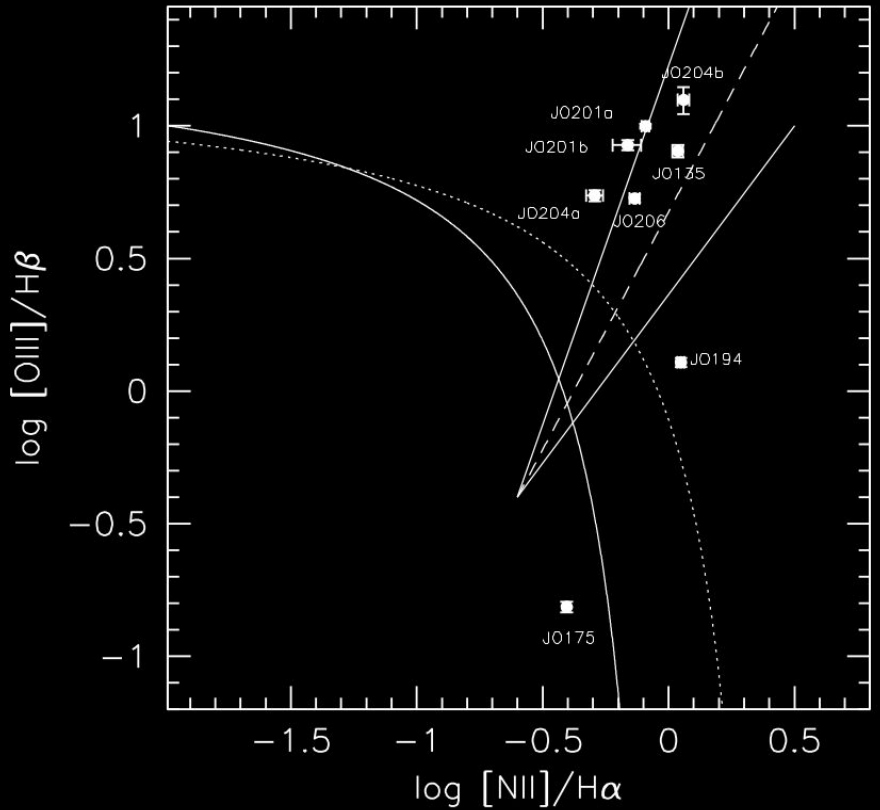
BPT diagram with line ratios for each spaxel.
JO201, JO204, JW100: gas emission lines have double peaks -> multi-component fit

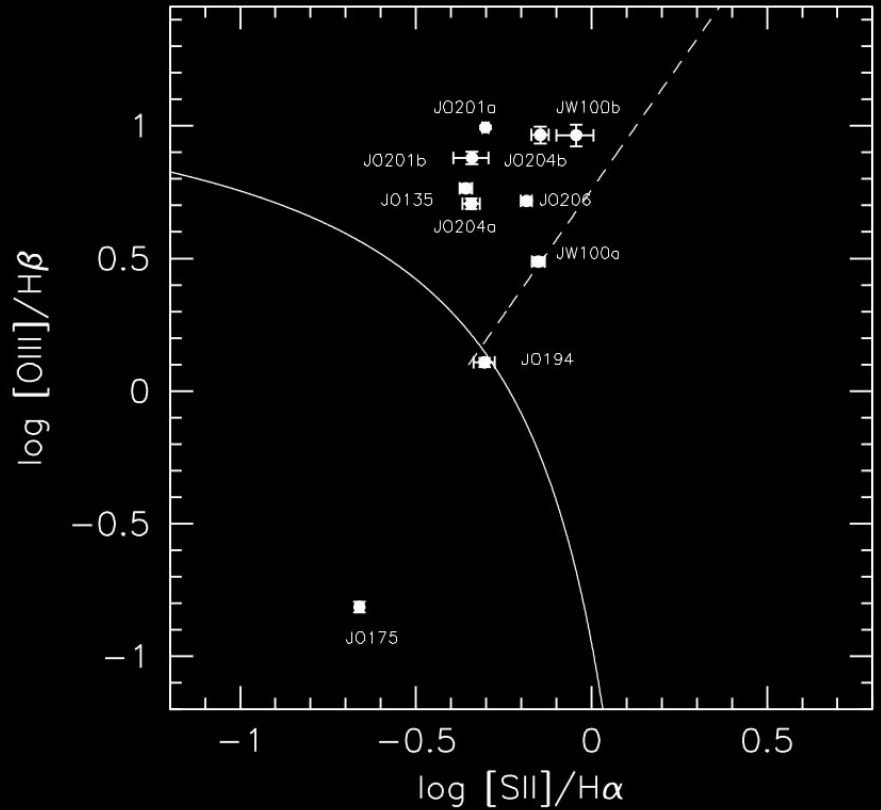
> BPT diagrams for each component



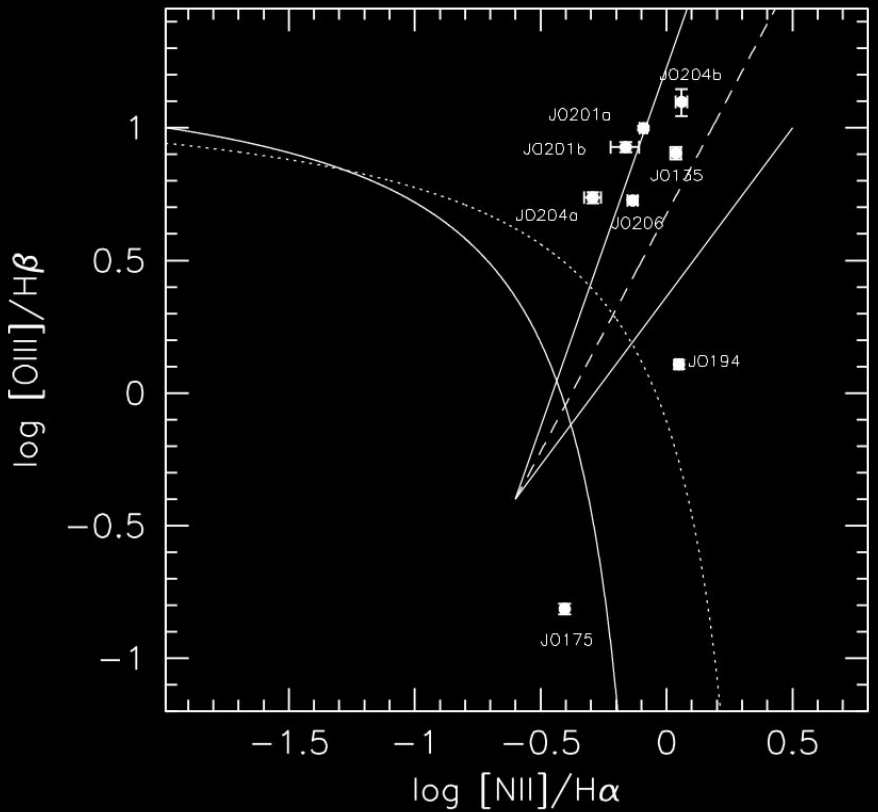


They host an AGN





They host an AGN



ID_{P16}	M_*	L_X
	$(M_\odot)$	$(\mathrm{erg\,s^{-1}}, 0.3\text{-}8\mathrm{keV})$
JO206	1.1×10^{11}	7.7×10^{42}
JO201	6.7×10^{10}	7.3×10^{41}
JO204	4.4×10^{10}	–
JW100	3.2×10^{11}	2.0×10^{41}
JO135	1.0×10^{11}	3.2×10^{41}
JO194	1.6×10^{11}	1.4×10^{41}
JO175	3.9×10^{10}	–

Discussion

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AGN are rare:
3% in WINGS cluster galaxies (Marziani et al. 2017)
8% in field galaxies (Brinchmann et al. 2004)

We found 6 AGN in our sample of 7 jellyfish galaxies

There must be a link between ram-pressure stripping and AGN activity.

But other surveys are finding jellyfish galaxies with no AGN
(talks by Fossati, Gavazzi, Consolandi, yesterday)

Mass effect? Our galaxies have Mstar > 10^{10} Msun
RPS phase? Our jellyfishes have shorter tentacles
MHD models show inflows induced by RPS (Ramos-Martinez, yesterday)
The inflows disappear after ~250Myr

Which came first? ram-pressure stripping or AGN?

AGN >> RPS

AGN inject energy in the ISM
Decrease binding energy
Increase efficiency of RPS

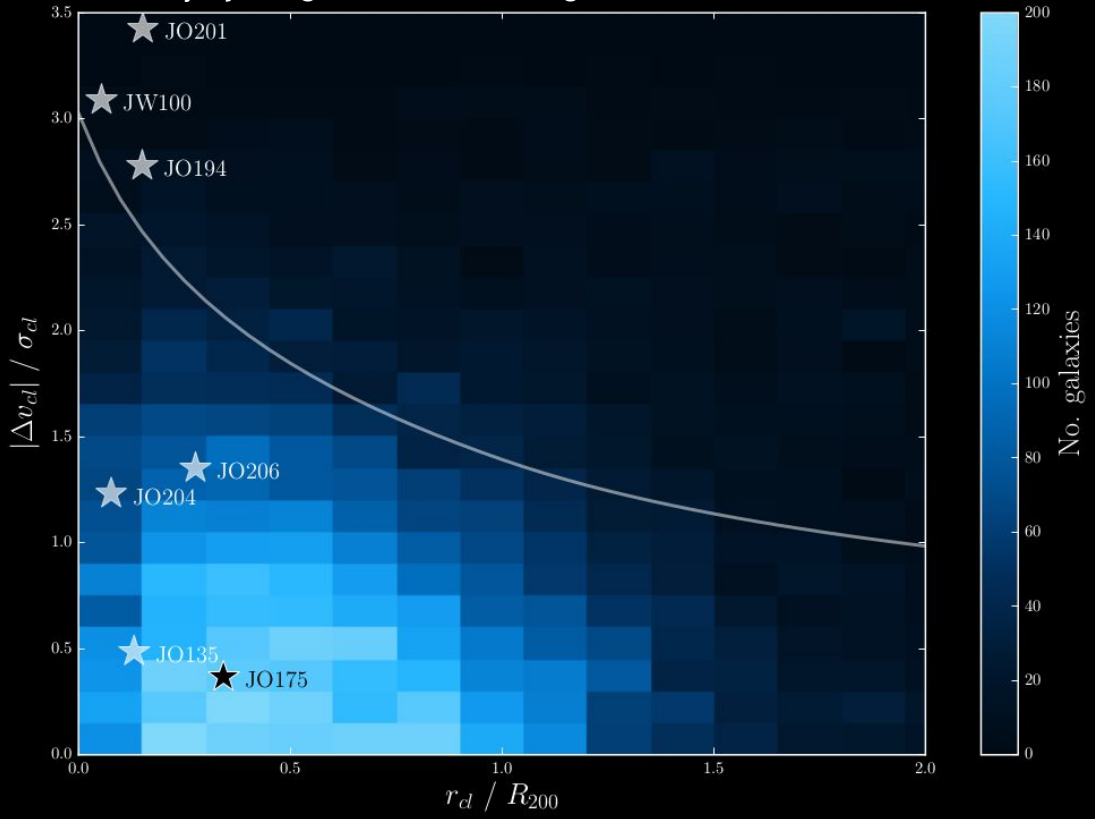
or

RPS >> AGN

RPS can bring gas toward the center feeding the central BH and triggering the AGN.

(projected) Phase space diagram

The 7 jellyfish galaxies + all OmegaWINGS



The 7 galaxies are in the inner regions of the cluster and they move at high speed in the ICM (we measure LOS velocity!)

>> conditions are favourable for RPS

If RPS were triggered by the AGN we should have observed galaxies across the whole phase-space diagram.

Supporting evidences for RPS/AGN connection

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Haines+2012

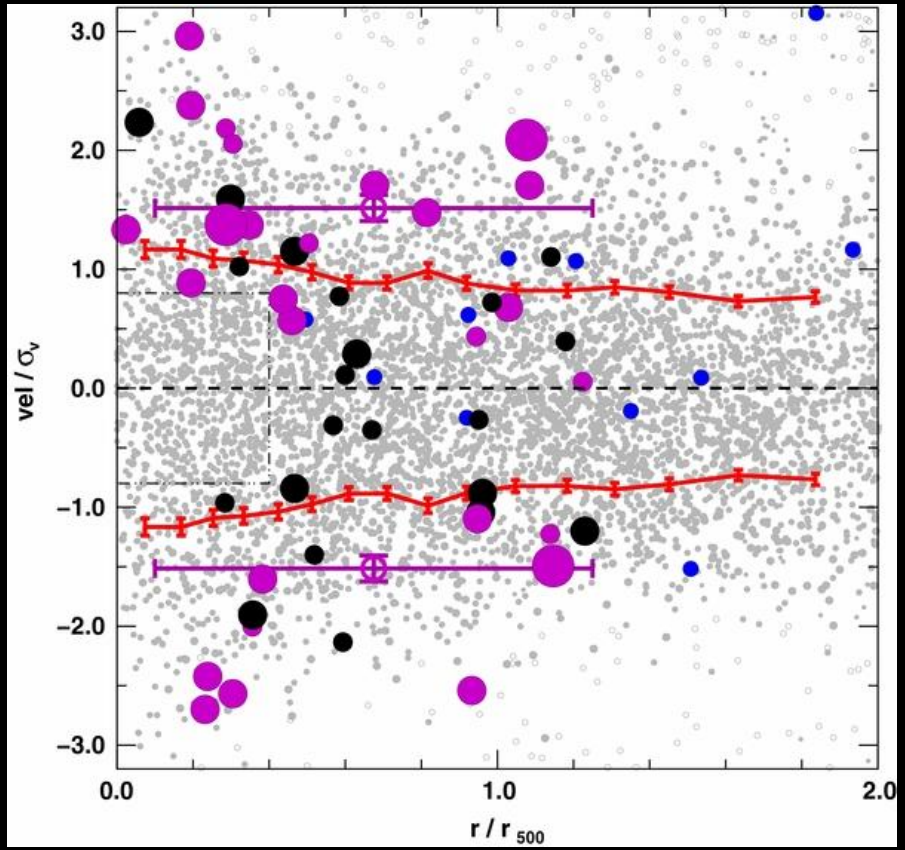
"Nuclear activity may be triggered by interaction with the cluster itself, either as they pass through virial shocks, via compression of gas onto the nucleus in the early stages of ram pressure stripping, or tidal shocks as they pass through cluster pericenter."

Pimbblet+2013

"the most powerful optical AGN may reside on the cluster infall regions"

Ramos-Martinez (this conference)

MHD models predict that RPS can bring gas toward the center



Haines et al (2012)

Summary

We used GASP observations to select extreme jellyfish-galaxies

>> the only criterion is "*the tail of stripped gas is at least as long as the diameter of the stellar body of the galaxy*"

We found 7 extreme jellyfish galaxies

In all of them we found that the stripping is due to ram-pressure

6 of them host an AGN (based on BPT diagram + X-ray emission)

We strongly suggest that the high incidence of AGN among jellyfish galaxies may be due to ram-pressure causing gas to flow toward the center and triggering the AGN.

Background image: Abell 85+ JO201.
BV WFI@ESO2.2m (WINGS survey)
NUV from UVIT-ASTROSAT (K. George)