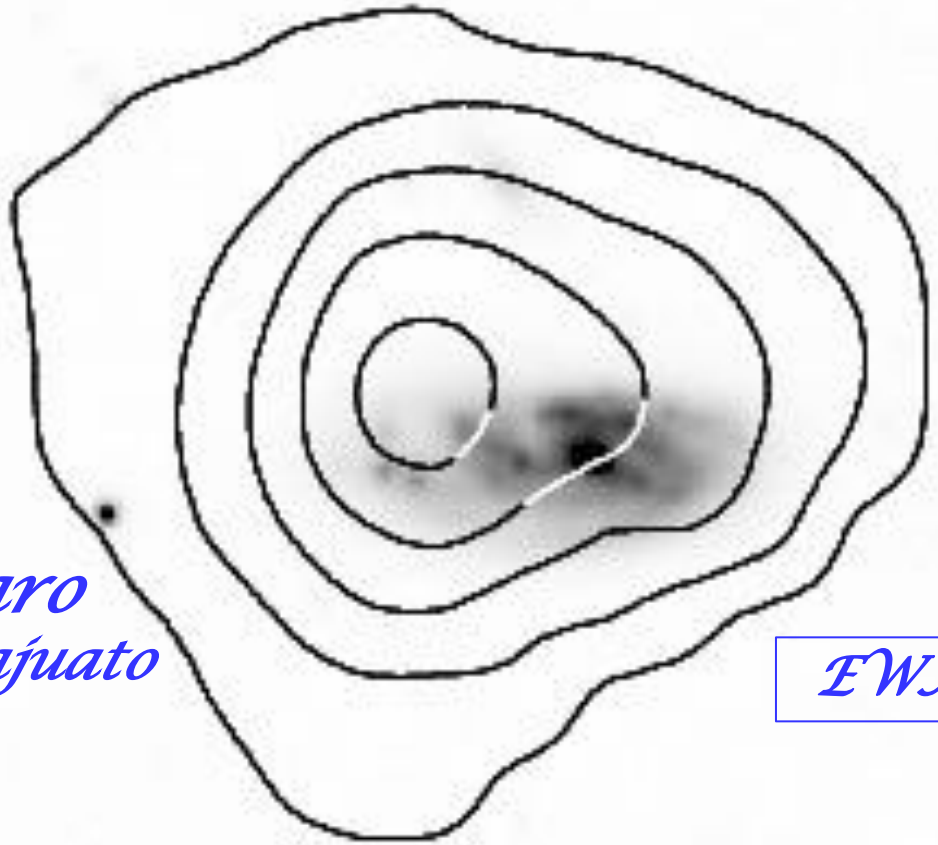
RPS - tidal interactions: HI and NIR imaging in A085 / A496



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EWASS 2017

Collaborators

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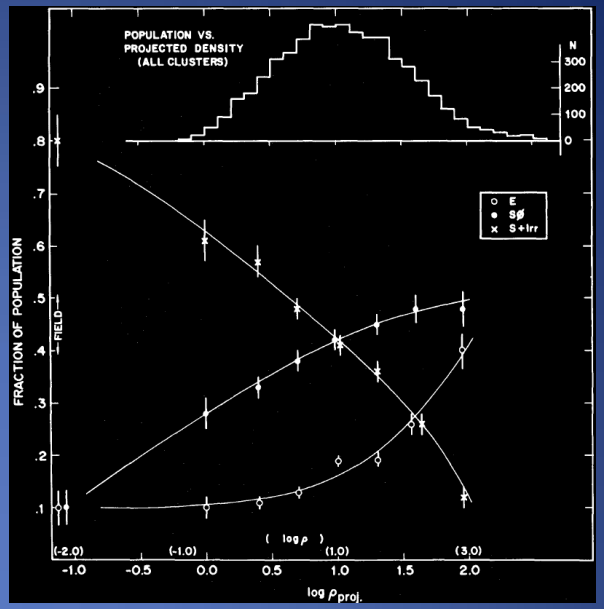
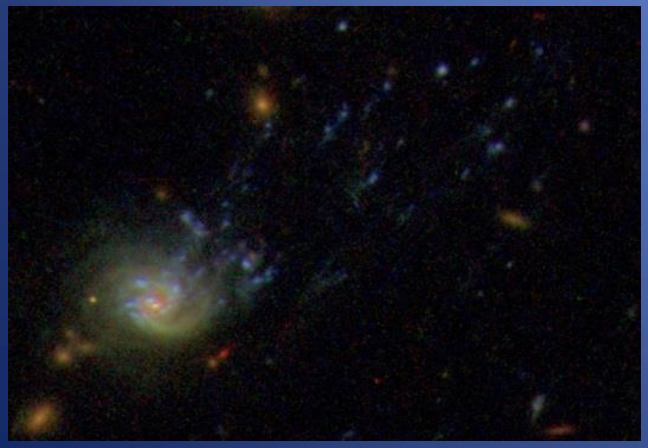
Normal spiral

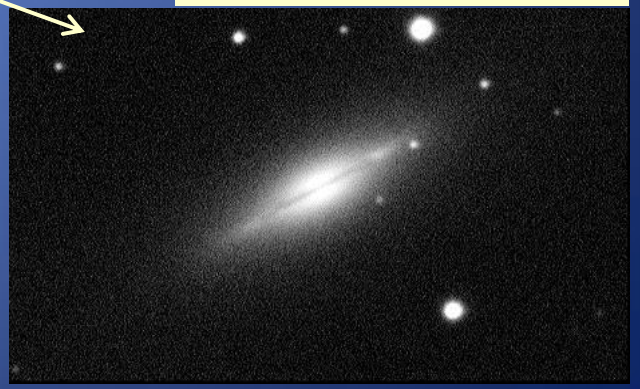


Dressler (1980)

Evolutionary sequence?



S0 and Red-passive Sp



Our “recipe”:

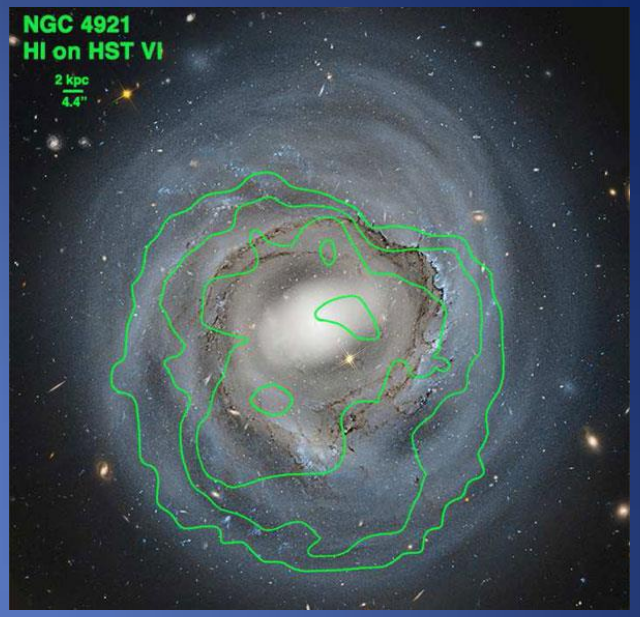
- Studying ***nearby clusters*** ($z \leq 0.2$), having
- ***different physical*** conditions (Lx, mass, relaxation, etc).
- We observe the ***whole volume*** in HI, opt and NIR.
- We analyse/quantify galaxy ***disruptions*** and
- combine with the ***ICM*** (X-ray) distribution and with
- the cluster ***substructures*** …..

… all this provides
hints on galaxy evolution in clusters,
individually and statistically.

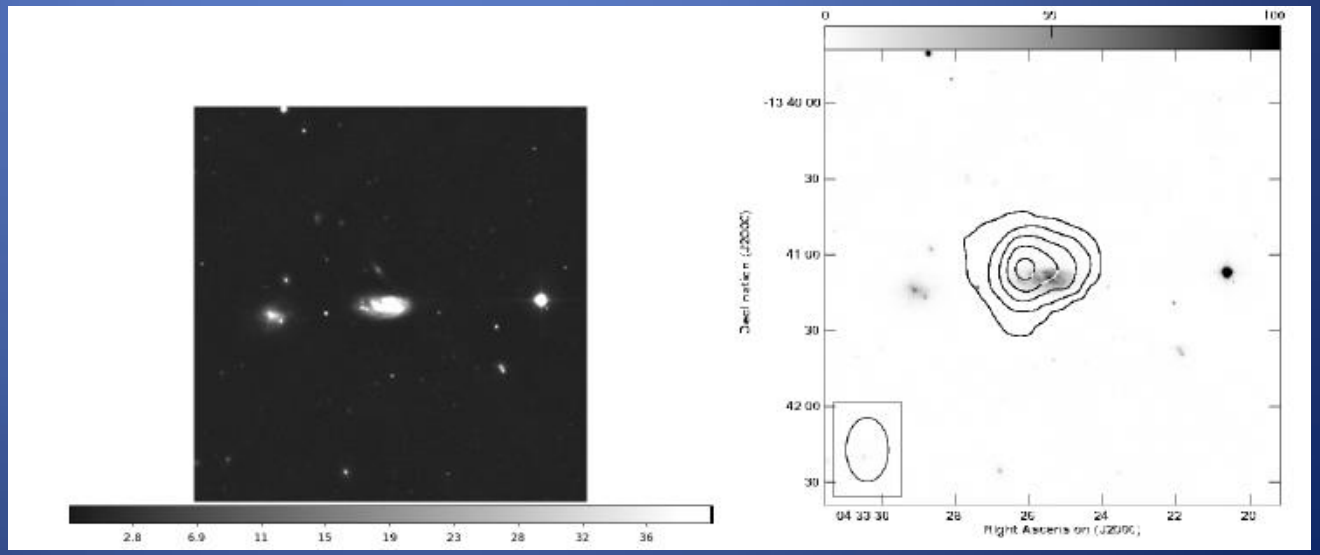
Strategy (a simple description)

- Case 1 : if the ***HI*** component is perturbed but the ***stellar*** disk is not → ICM (**hydrodynamics**)

- Case 2 : if both the ***gas*** **and** ***stellar*** components are perturbed → **gravitational** mechanisms



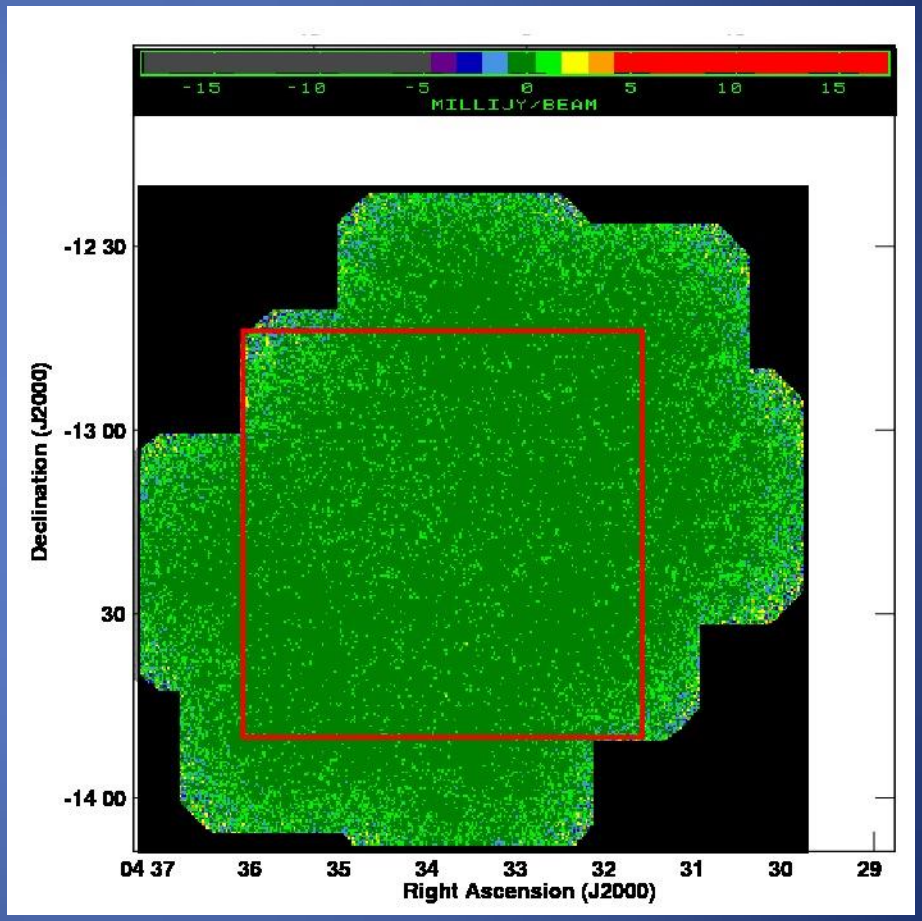
Kenney, Abramson & Bravo-Alfaro , 2015



HI and NIR imaging in A496; Bravo-Alfaro et al. In prep

Still few clusters have been imaged (whole volume) in HI

Observations : A496 (z=0.03; a relaxed, isolated cluster)
(L_x (0.1-2.4 eV) ~ 3.8 ·10^{44} ergs/s)

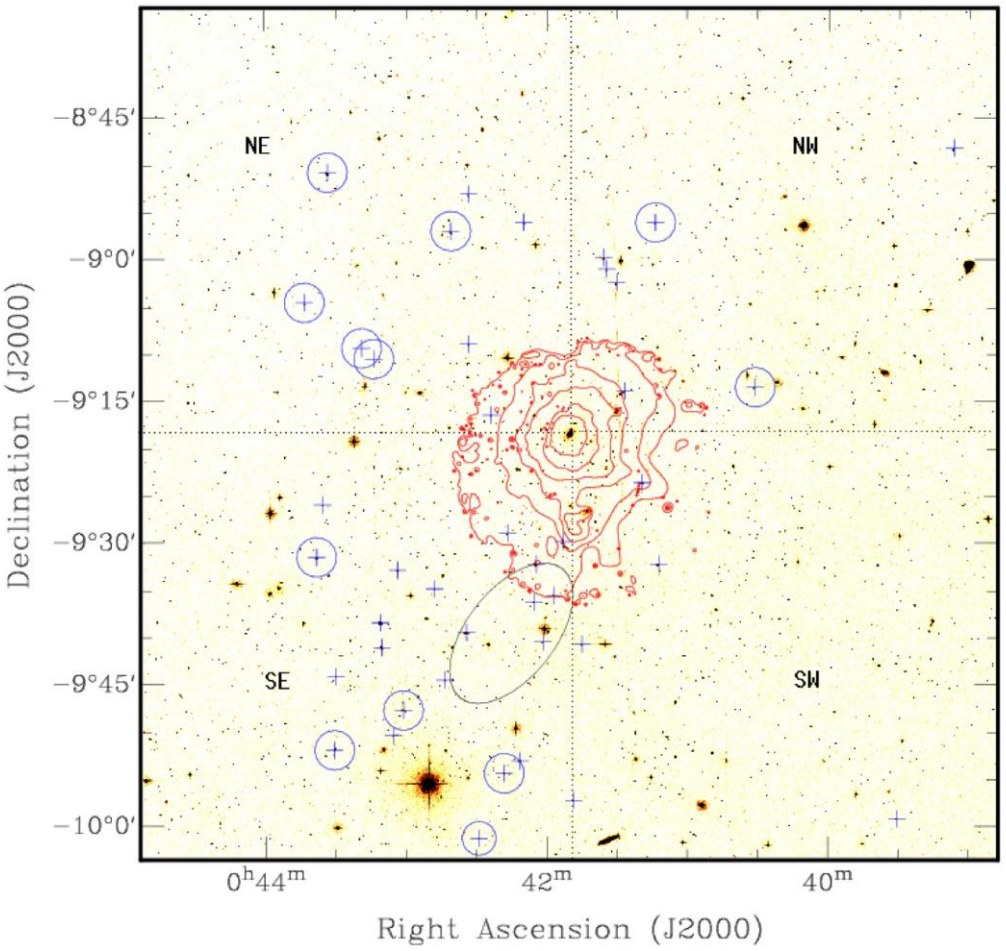


The polygon indicates de area imaged in HI, with the NRAO-VLA. The red sqauer is the field observed with WIRCam and the 3.6 CFHT.

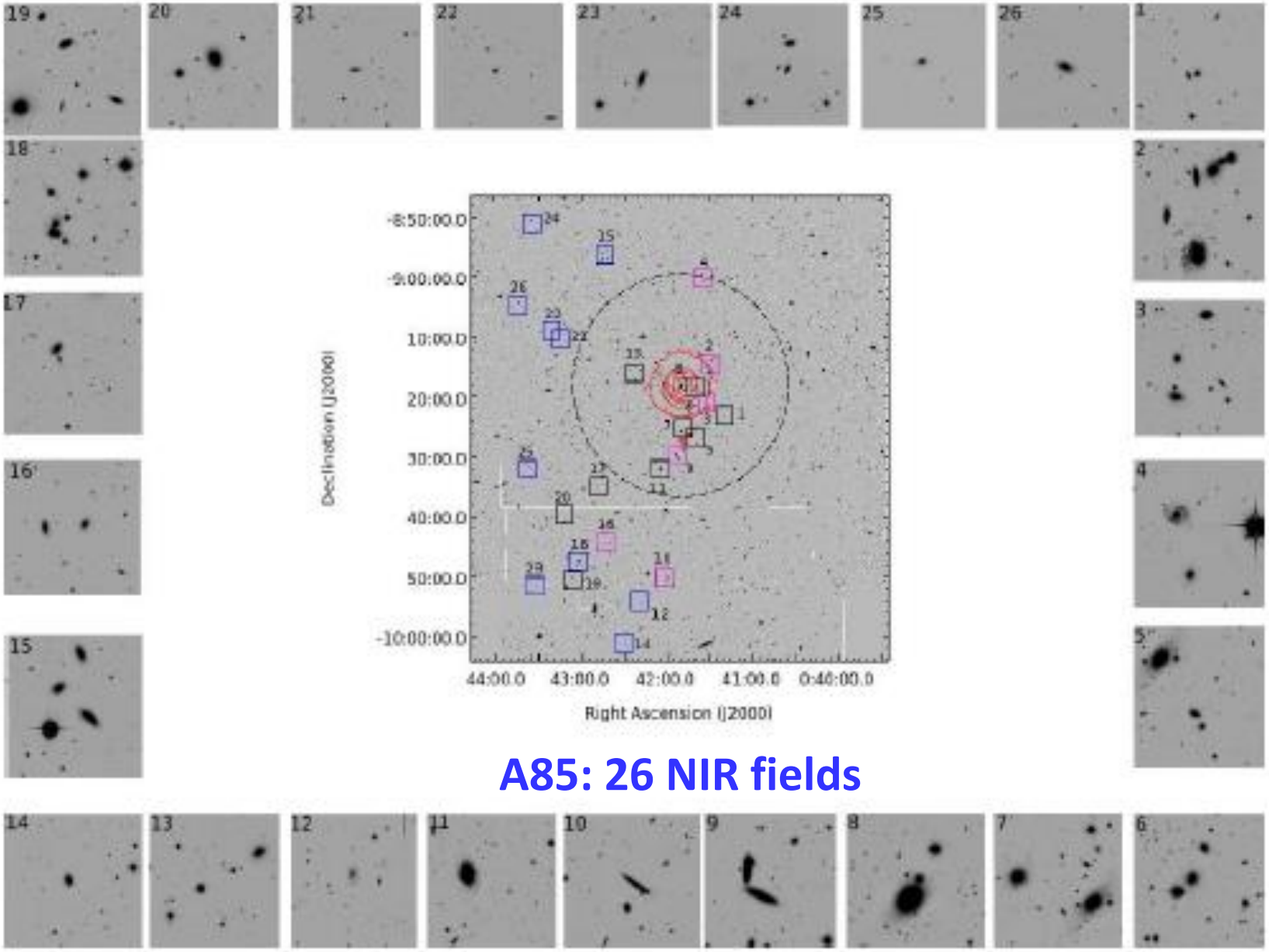
Abell 085 z = 0.05 : more massive , more substructures and brighter in L_x than A496 (z=0.033). A85 is part of a super cluster (L_x (0.1-2.4 eV) ~ $9.4 \cdot 10^{44}$ ergs/s


2m Tel. OAN, Mx.

Only 10-12 HI detections, all are far from the cluster center



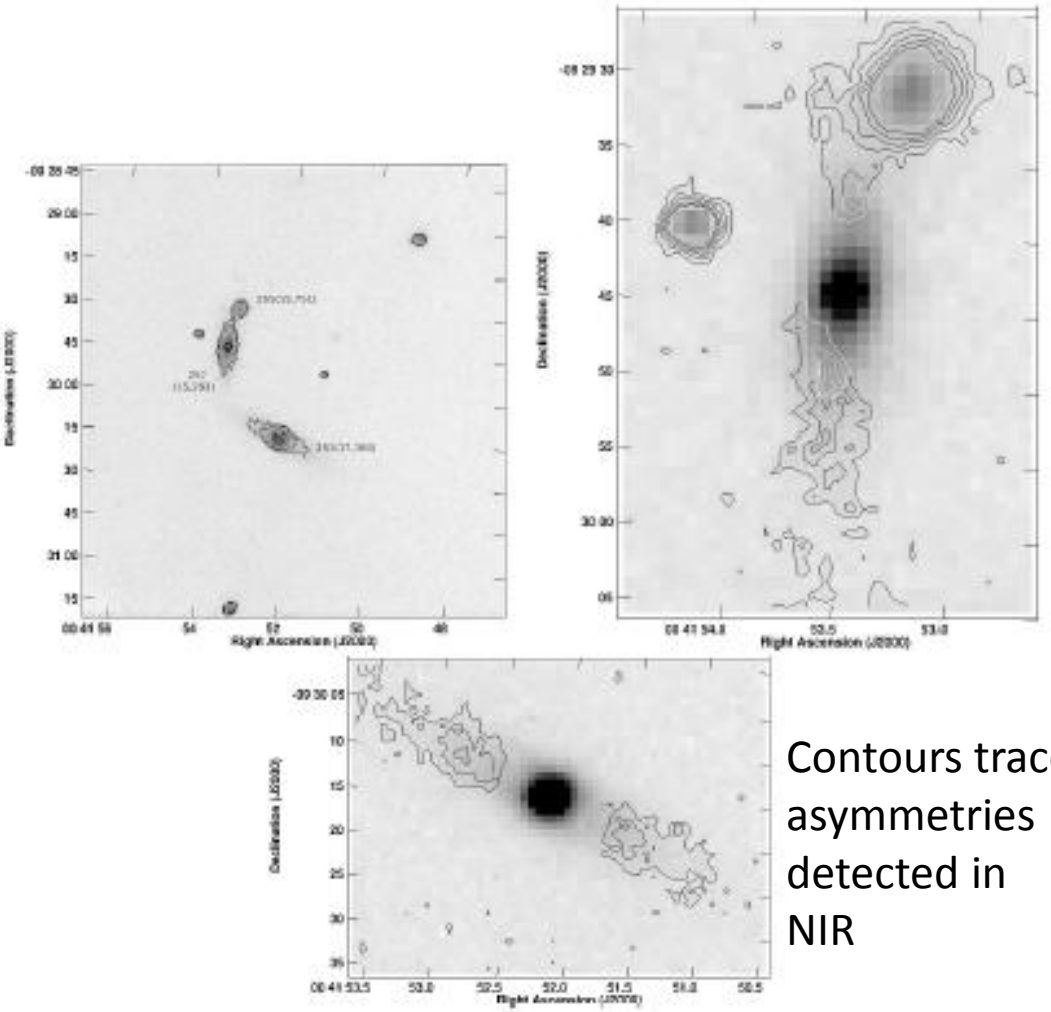
NIR imaging on Abell 85, coming from the 2m Tel (OAN) and the 5m Palomar Tel. Bravo-Alfaro et al. 2009, 2017 in prep.



A85: 26 NIR fields

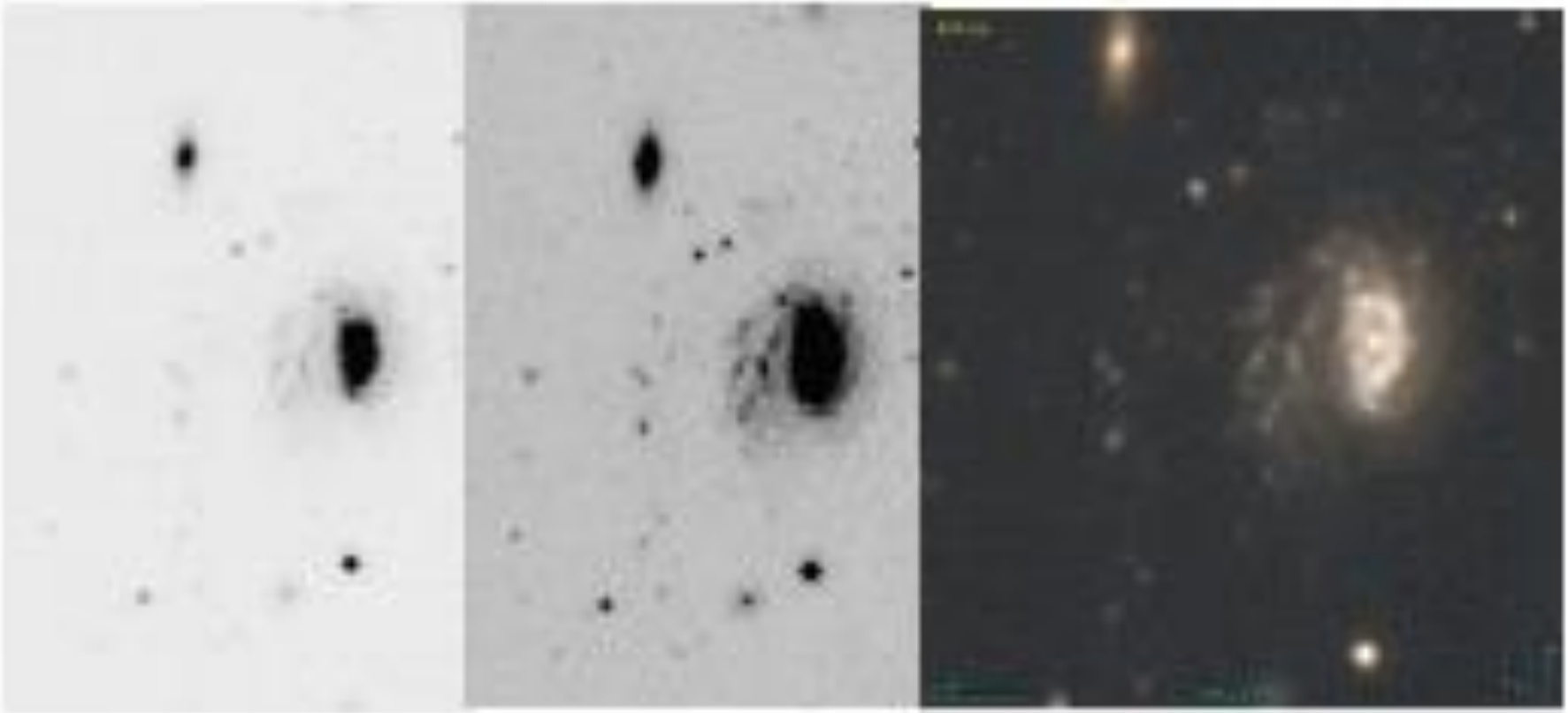
Venkatapathy et al. 2017, accepted for publication, AJ

We confirmed several interacting galaxies in A85 (in pairs and groups).
We measured the asymmetries with a novel index : ***α_An***
(Venkatapathy et al. 2017)



Contours trace asymmetries detected in NIR

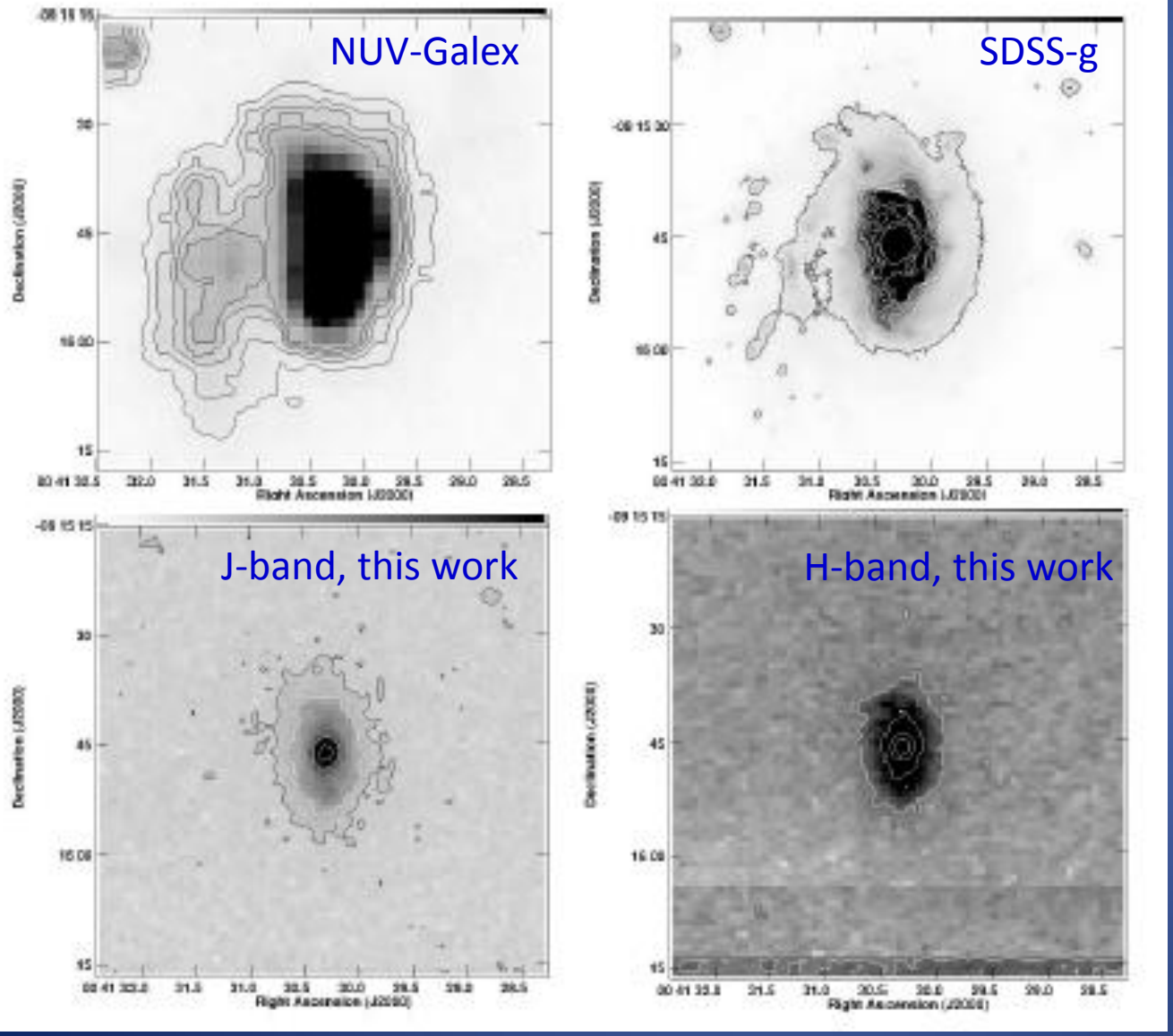
We find a fraction (25%) of galaxies with clear asymmetries in opt-NIR, suggesting that **tidal interactions** are playing a role in A85. But…



KAZ 364, a confirmed jellyfish galaxy in A85,
Seen in optical bands
(Poggianti et al. 2016, Bellhouse et al. (2017)

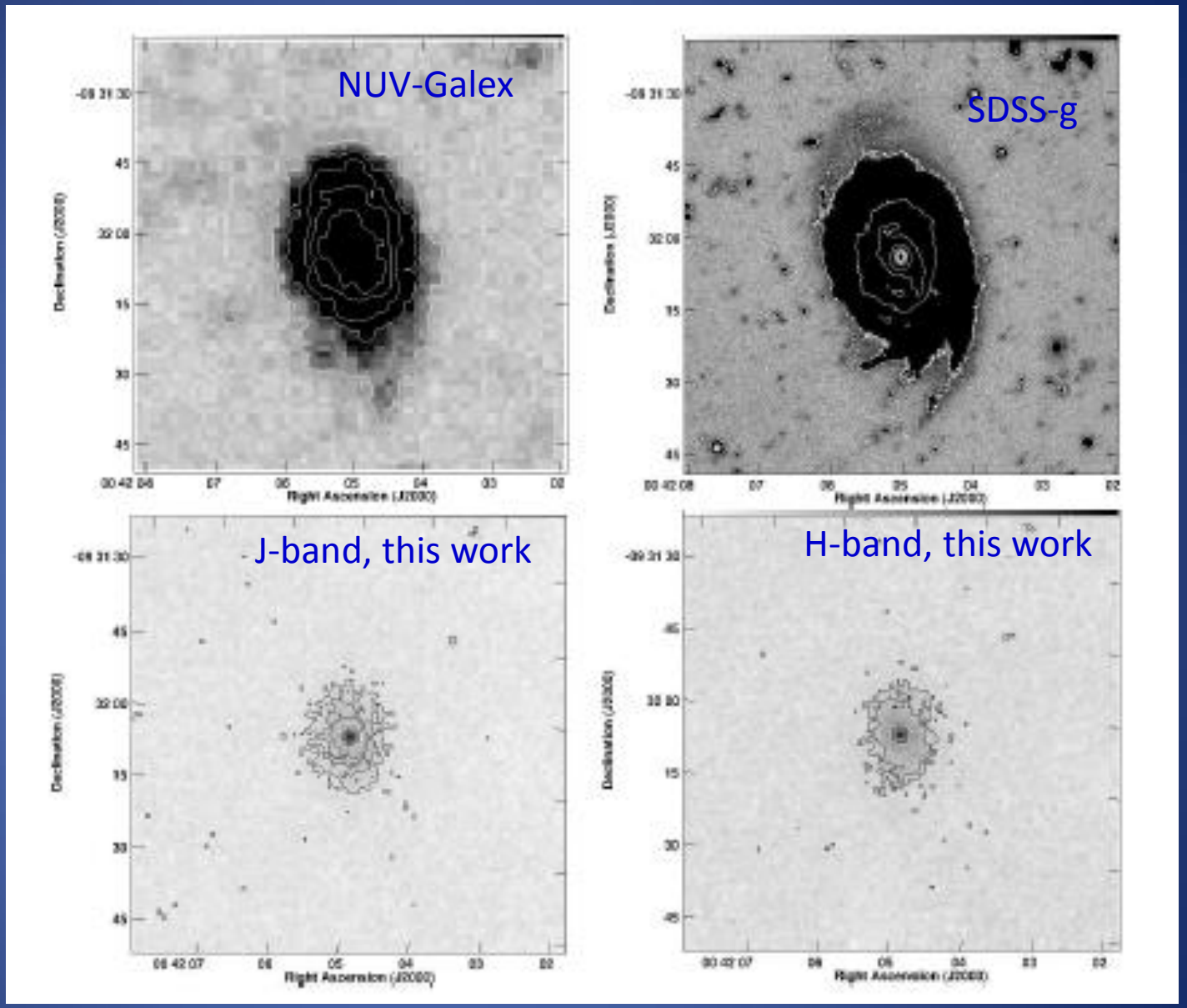
No old stars found along the filaments

→ the blue stars must be formed in situ, after a strong RPS event !!



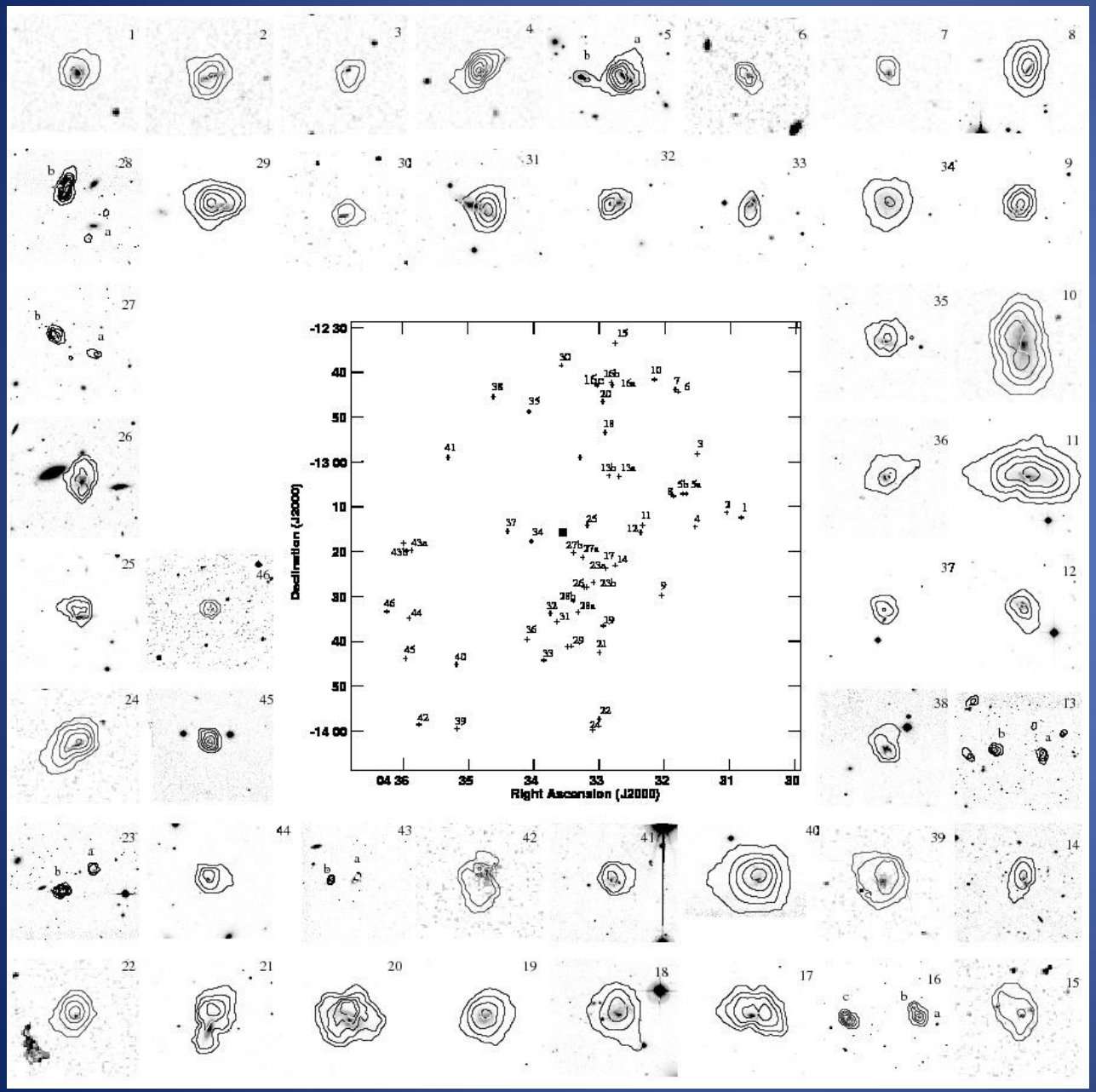
A85[ADF98]286

A second jellyfish, seen in a different stage than KAZ364. This is a very HI deficient object.



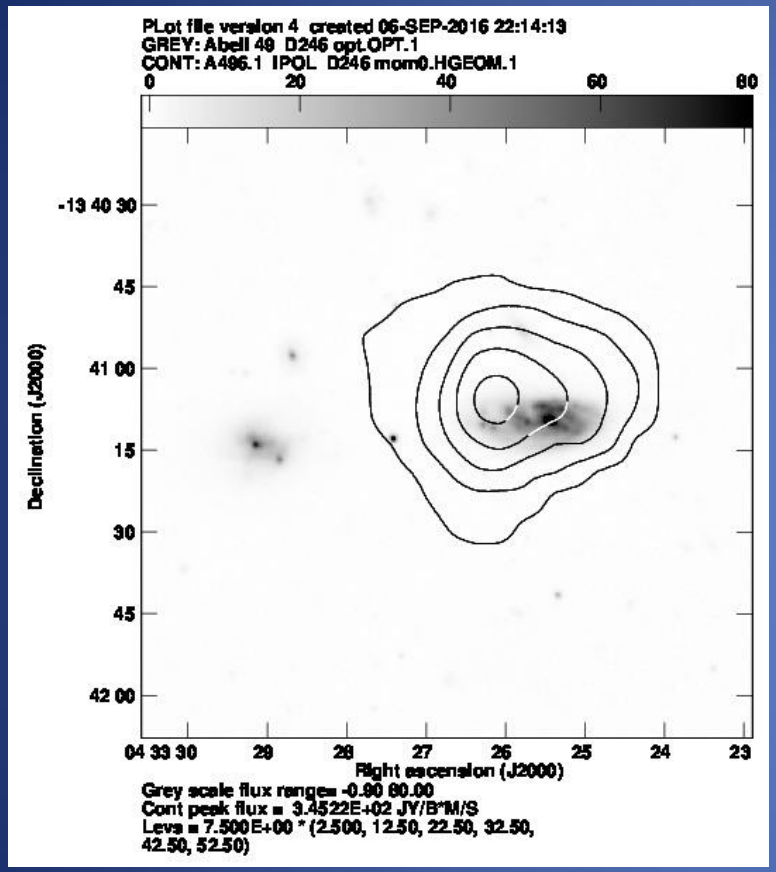
In total three very disrupted galaxies in A85 have no red stars along the peculiar arms (until our limit of 22.4 mag arcsec $^{-2}$ in J-band) → **RPS is very active in A85 too**.

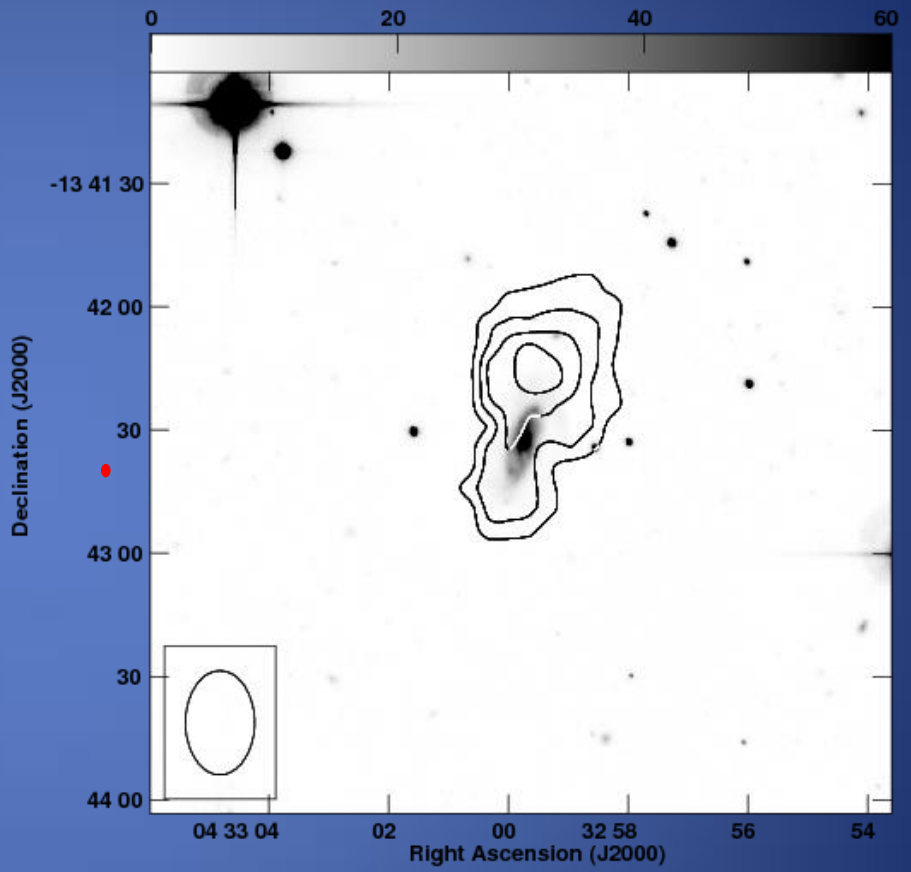
Abell 496 : the full view in HI



- **58 HI detections**
- **20% - 30% show HI disruptions**, either:
- **gas deficiency**,
- **HI-asymmetry**, and/or
- optical-HI **offsets**.

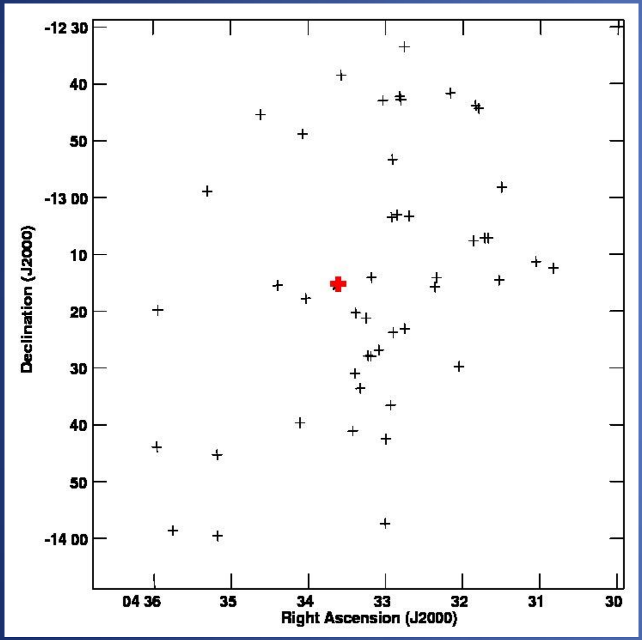
Exemples of galaxies with significant opt-HI offsets in Abell 496:



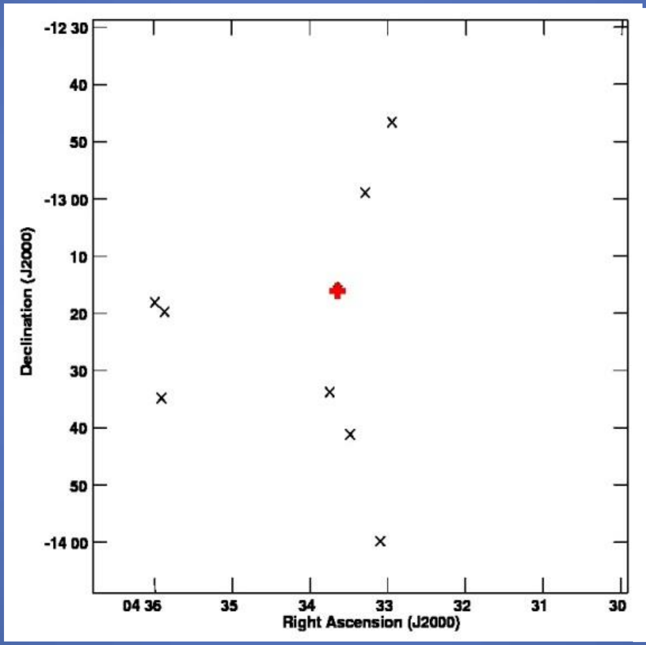


Lopez-Gutierrez (Bach. Thesis, 2017) and Bravo-Alfaro et al. In prep.

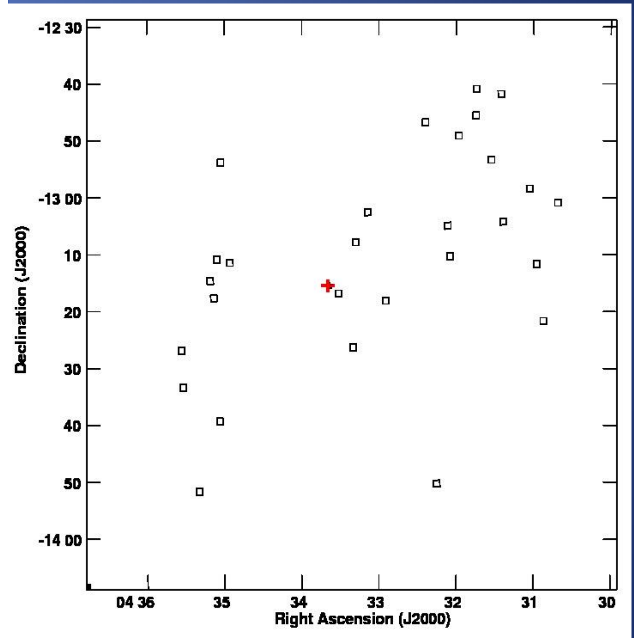
Distribution of bright spirals (b ≤ 17.5) in A496.
A very different typical compared with Coma and A85
(i.e. Hi deficient objects near the cluster center).



HI-normal



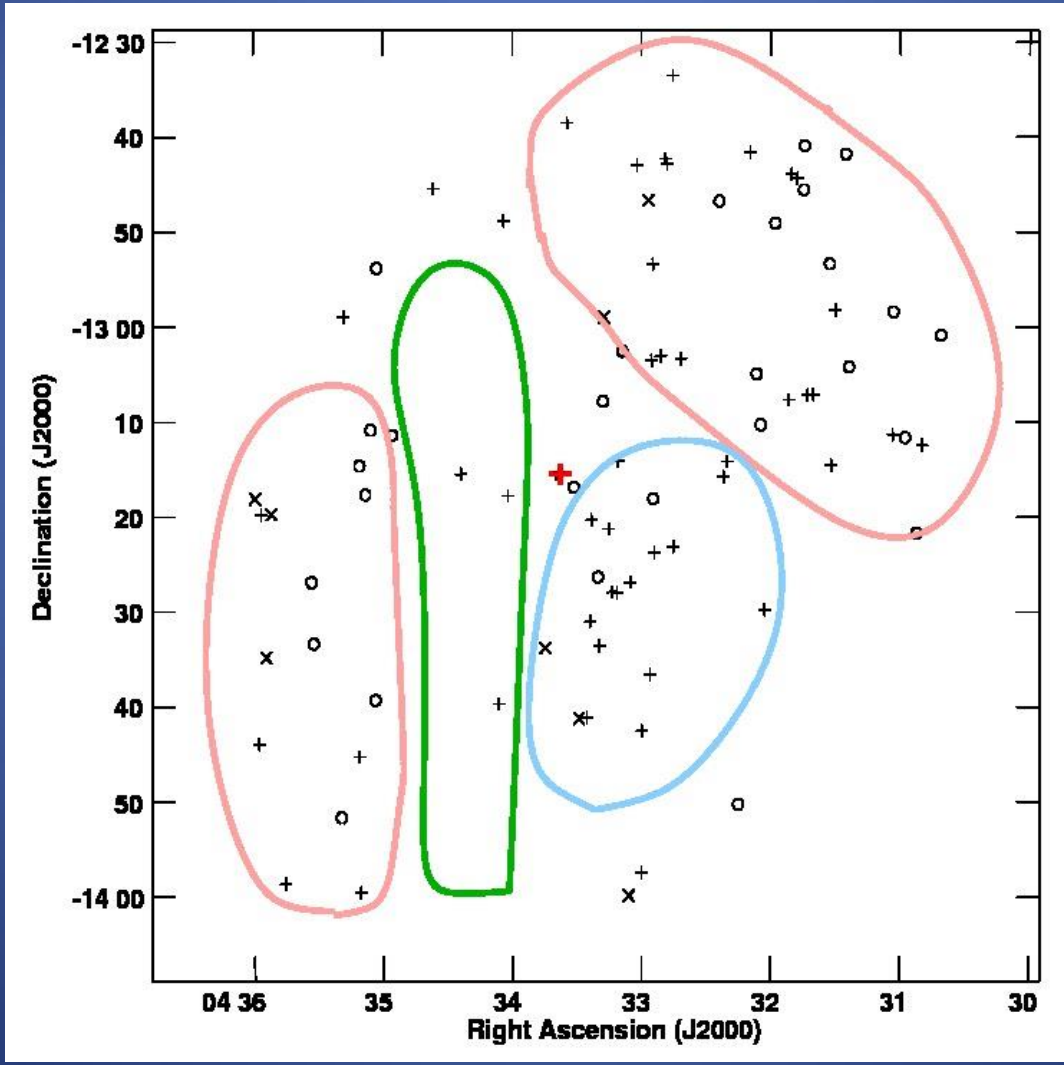
HI-deficient (yet detected)



HI deficient (non detected)

The distribution of bright spirals in A496

- Pink zone: perturbed in HI and normal in NIR : RPS
- Blue zone: perturbed in HI and perturbed in NIR : tidal
- Green zone: a peculiar region almost totally depleted of spirals!



Summary

- Multi-λ : a powerful tool to study environment & evolution.
- Pre-processing: active in these clusters with both, RPS and tidal interactions.
- We get lots of information on the dynamical state of the clusters.

Questions and puzzles

- Very disrupted galaxies in clusters : How?
- How RPS can be so strong at larger cluster-centric distances?

Thank you!