Finding Jellyfish Galaxies with MeerKAT

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GASP and MGCLS teams

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RHODES UNIVERSITY
Where leaders learn

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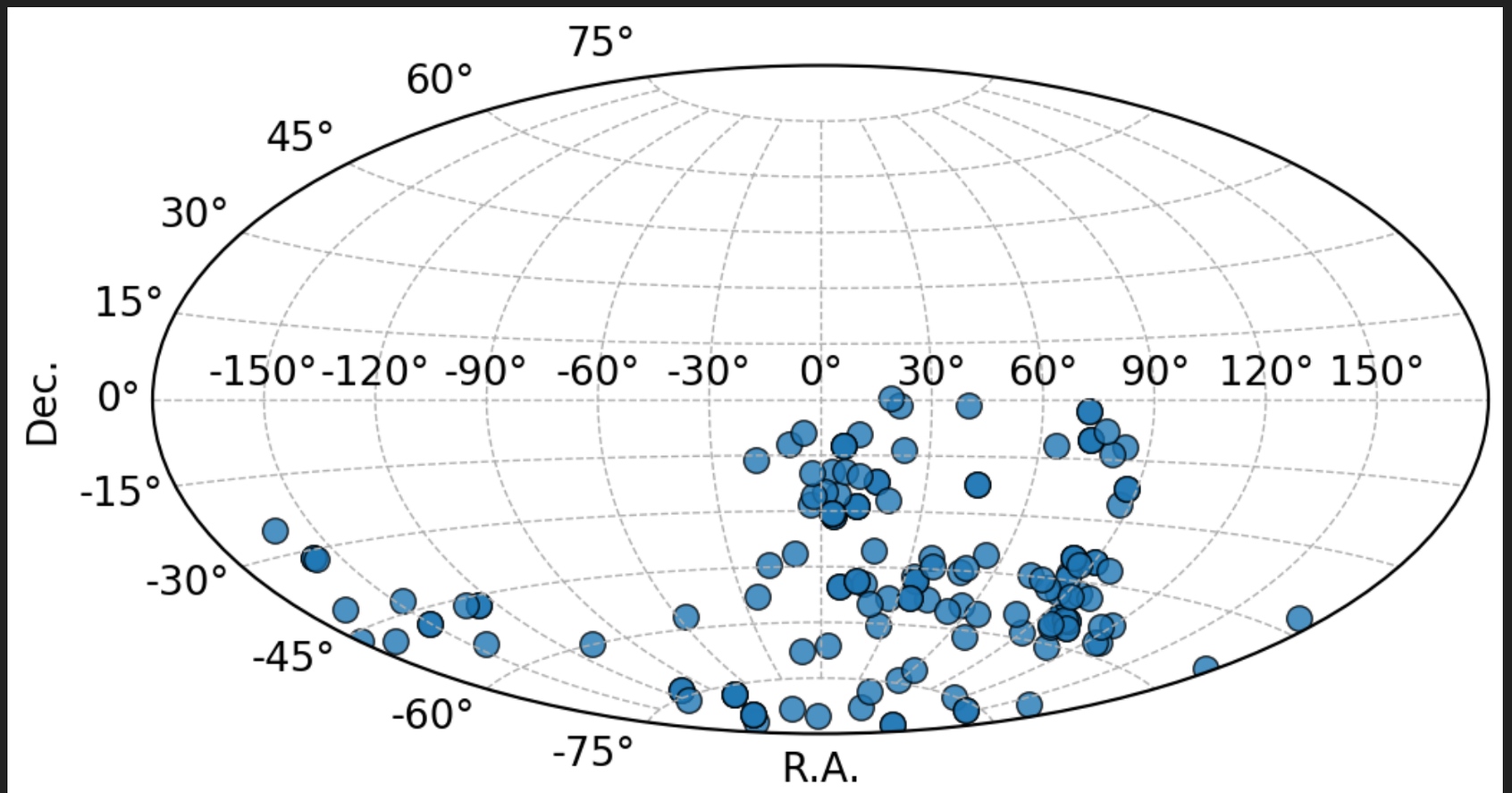
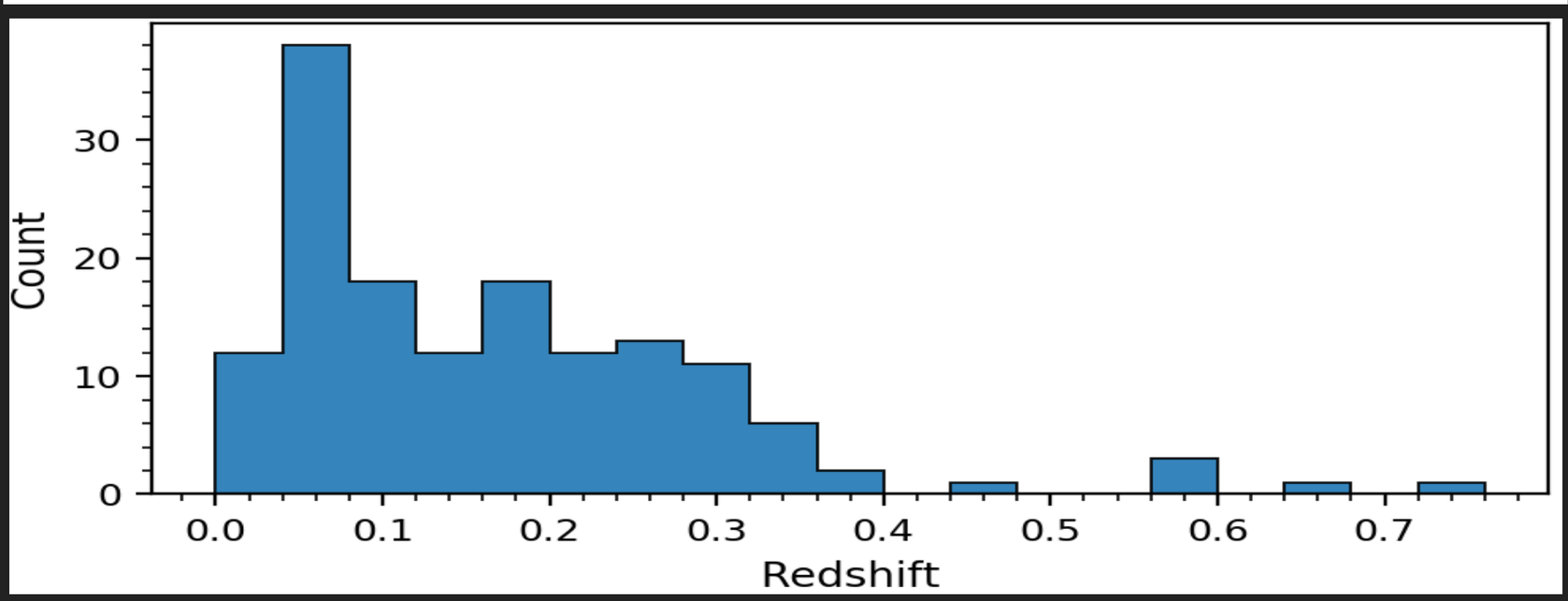
MeerKAT Galaxy Cluster Legacy Survey (MGCLS)



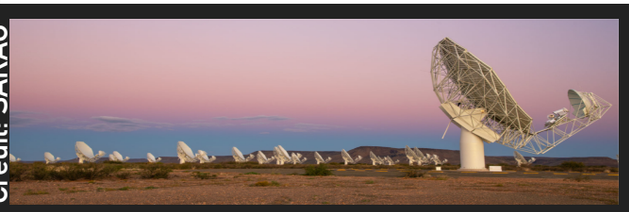
115 galaxy clusters

Full pol. MeerKAT array
L-band: 900 ~ 1670 MHz
4k mode (0.21 MHz)

~ 10 hours (per cluster)



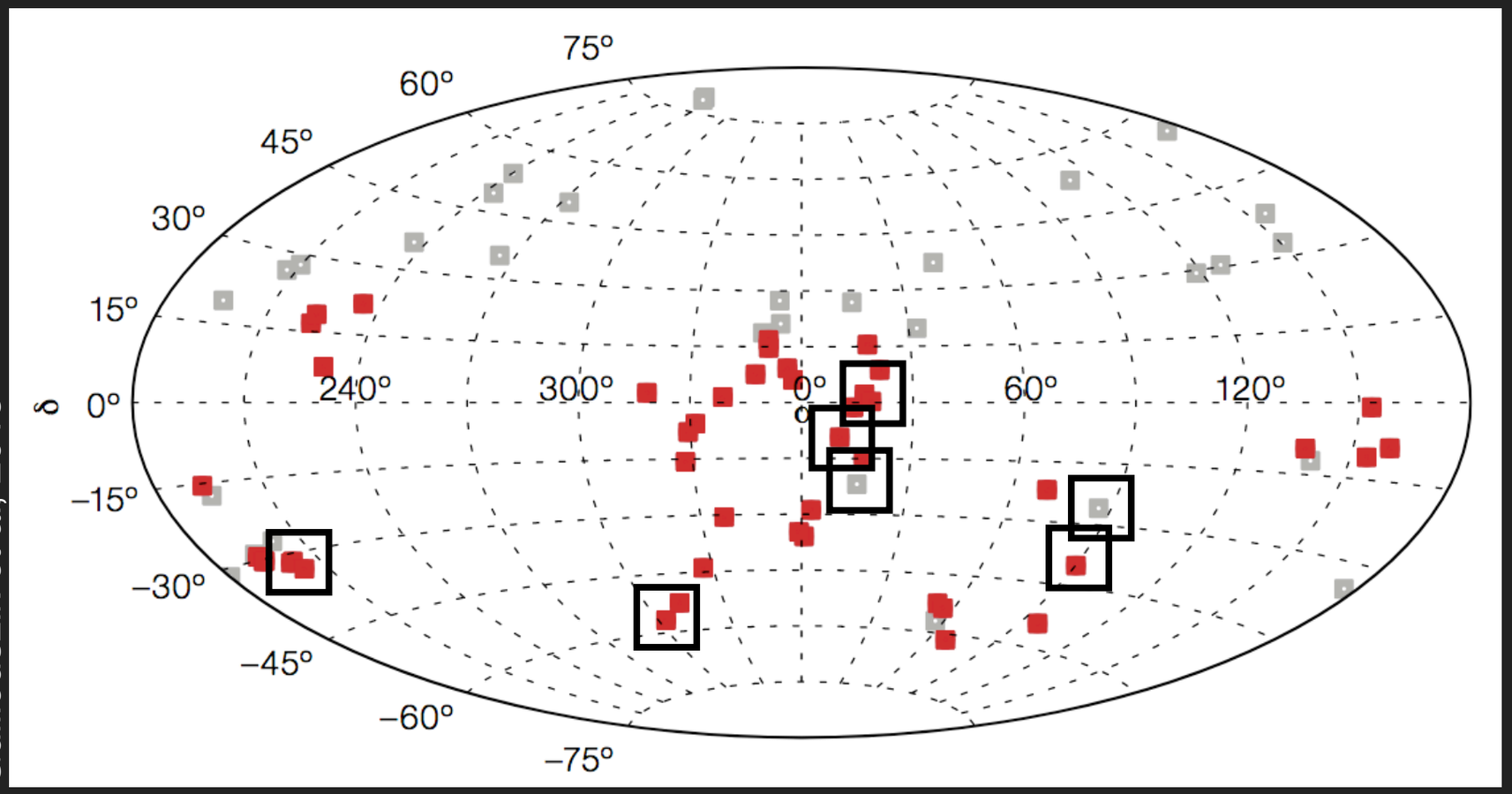
Redshift: 0 ~ 0.7



Credit: SARAO

Knowles et al, 2021(2) in review

WIde-field Nearby Galaxy-cluster Survey (WINGS)



Gullieuszik et al, 2015

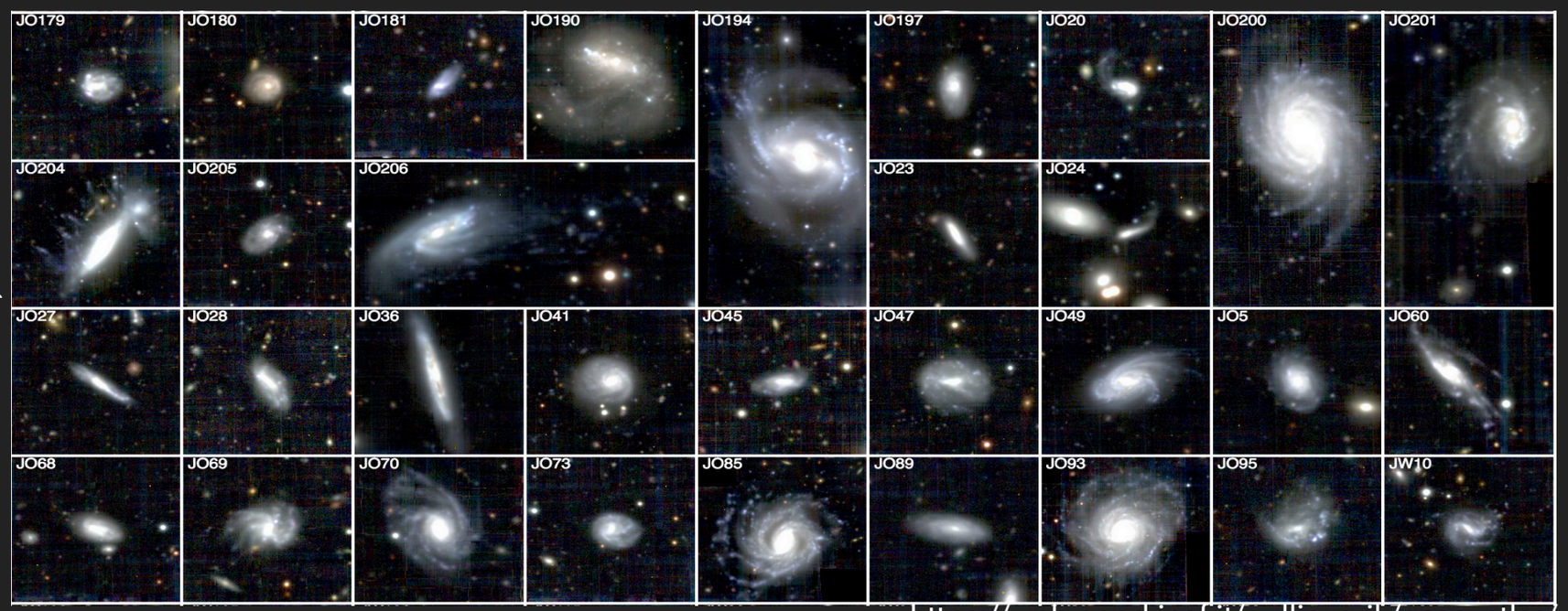
MGCLS + (Omega)WINGS

~ 7 overlapping clusters

Abell:
85,133, 3376, 3667, 3558, 548, 168

z ~ 0.05

GAs Stripping Phenomena (GASP) in galaxies with MUSE: PI Poggianti



Gullieuszik et al, 2015

https://web.oapd.inaf.it/gullieuszik/gasp_atlas/

Jellyfish galaxies

Tentacles of material stripped from the galaxy body

Extreme ram-pressure stripping

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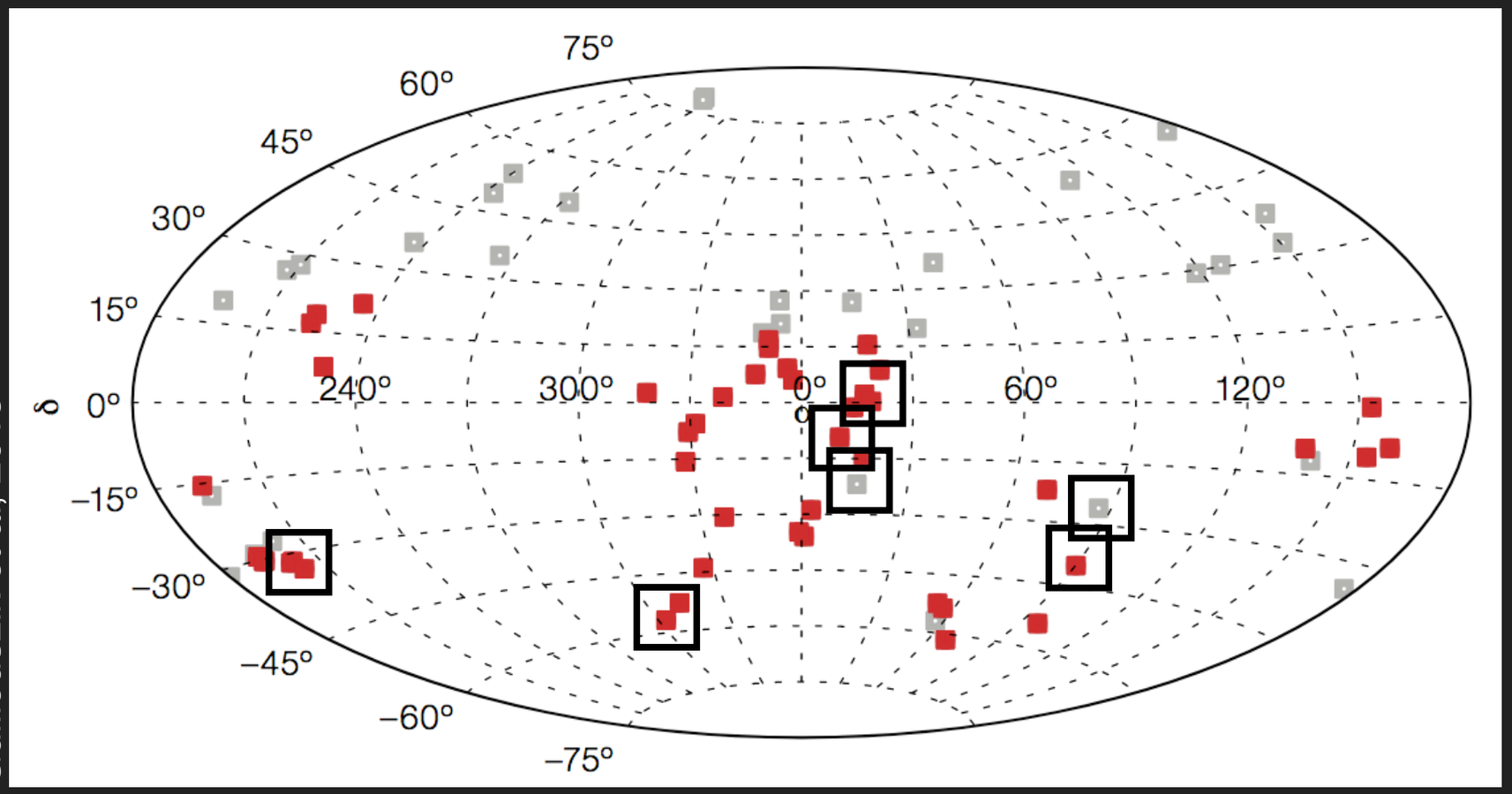

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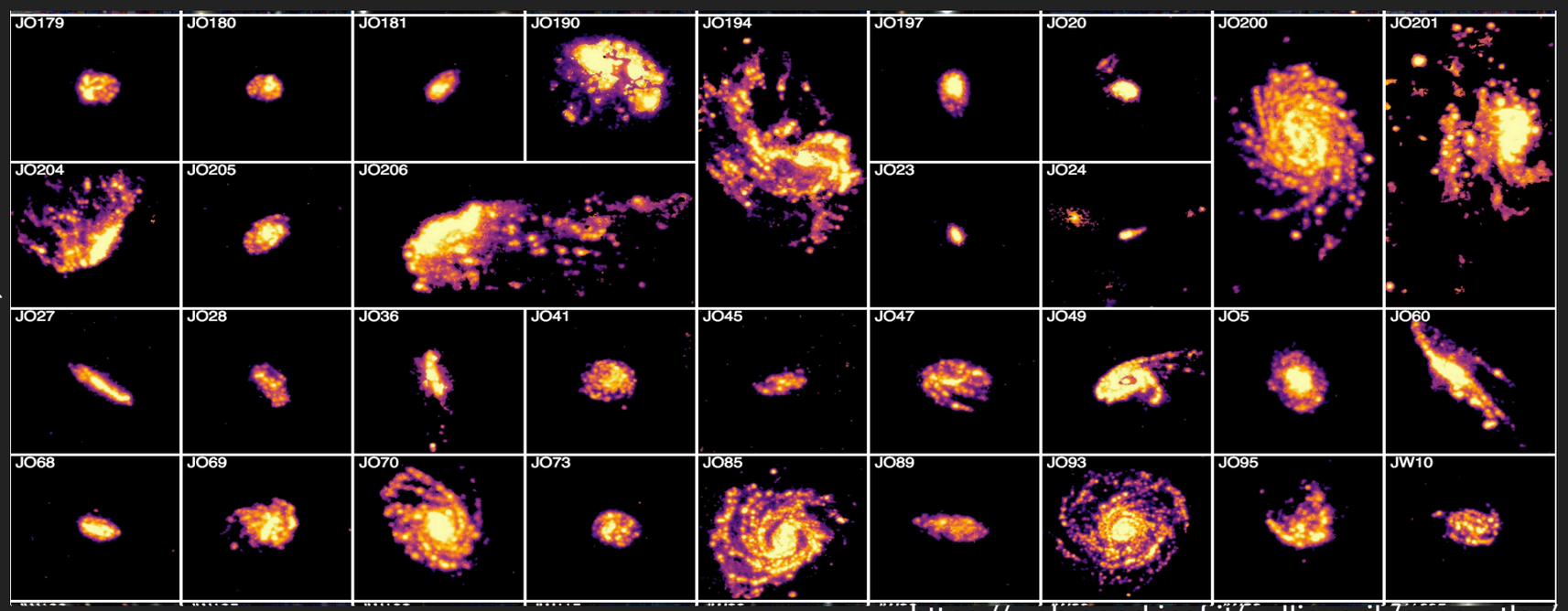

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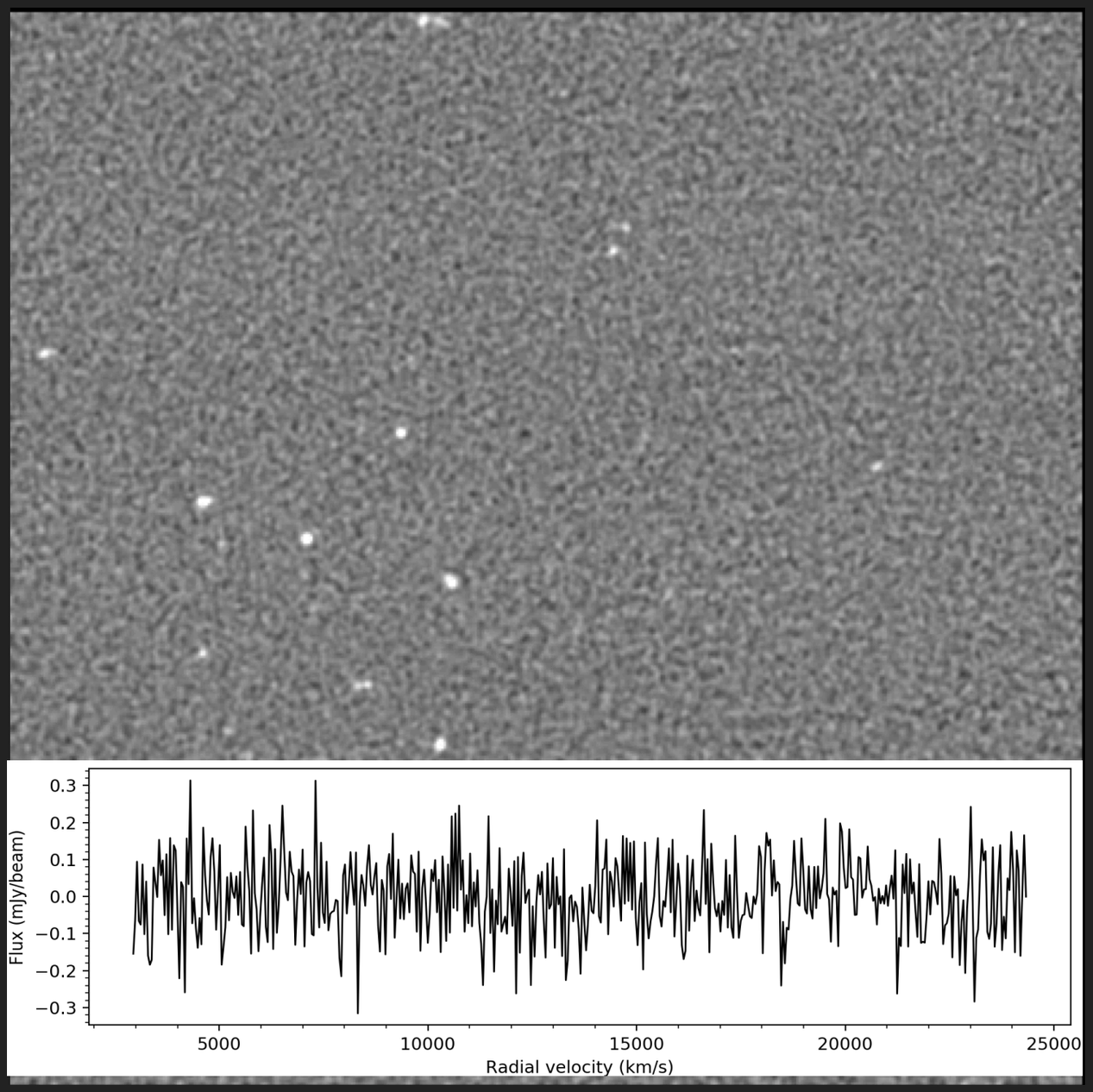
Hα: The gas in the tail is ionized

… (in most cases) by massive young stars

Cold gas fuelling SF—> HI in the tail and disc?

MeerKAT HI observations



sky area ≈ 2.0 sq.deg.
~80 MHz centred at cluster freq
Vel. ≈ 3000 - 25000 km/s
ΔV = 44.5 km/s

Data reduction

CARACAL

Robust parm: 0, taper: 20”
Rms ~ 0.15 mJy/beam
Θ = 24'' x 25'' restoring beam.

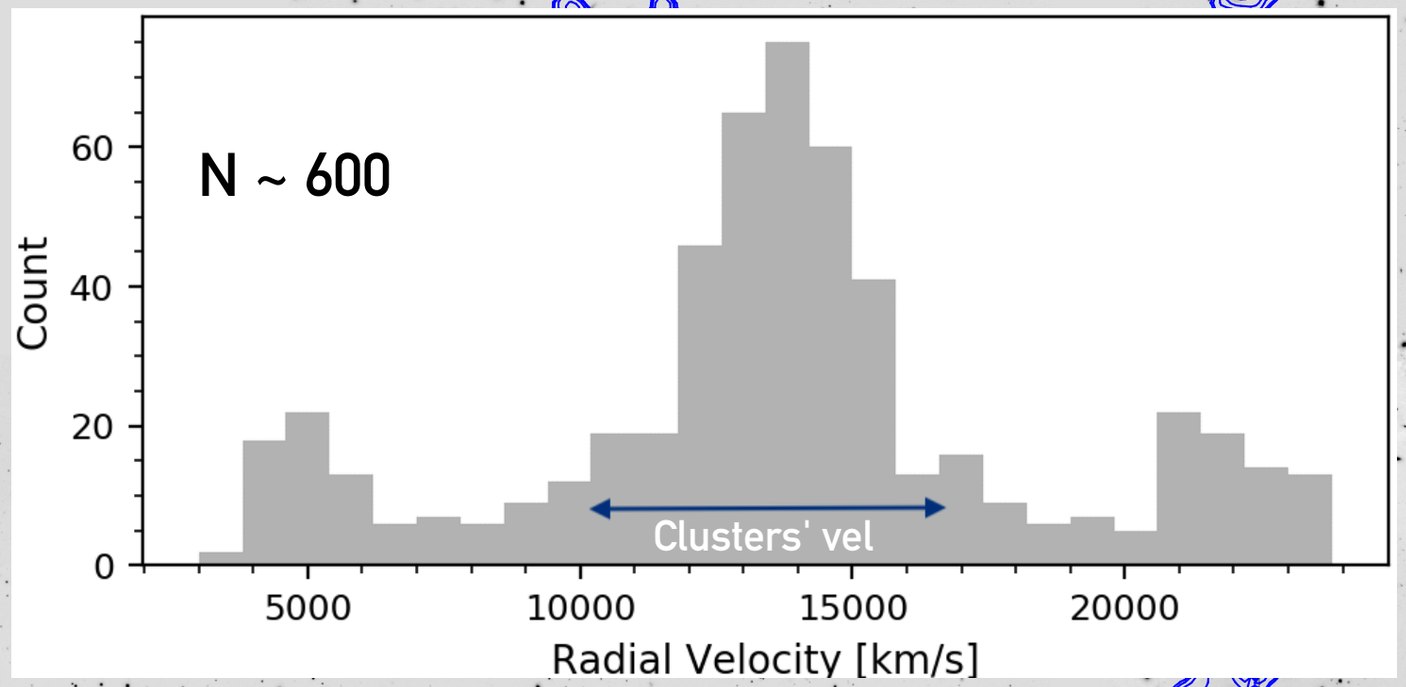
N_{HI} ~ 3 x 10^{19} cm^{-2} (3σ, 45 km/s)

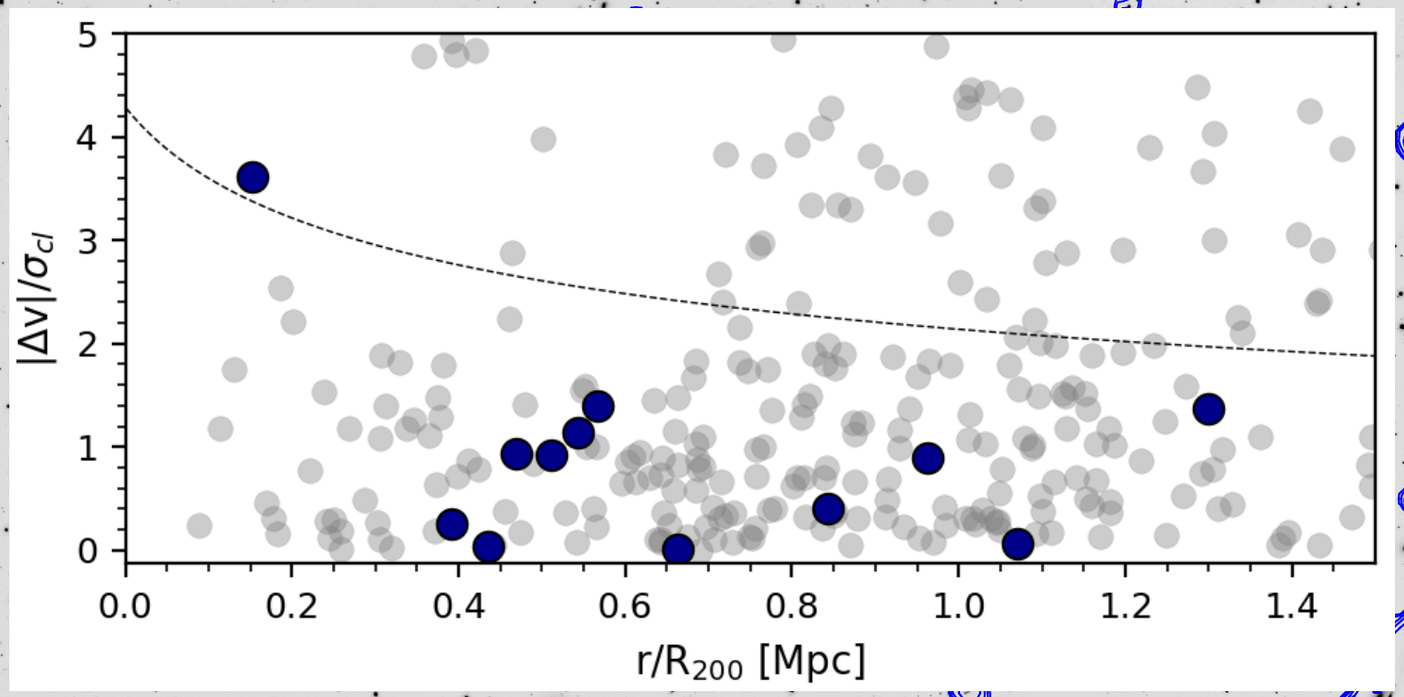
Searching for HI emission

SoFiA
Source Finding Application

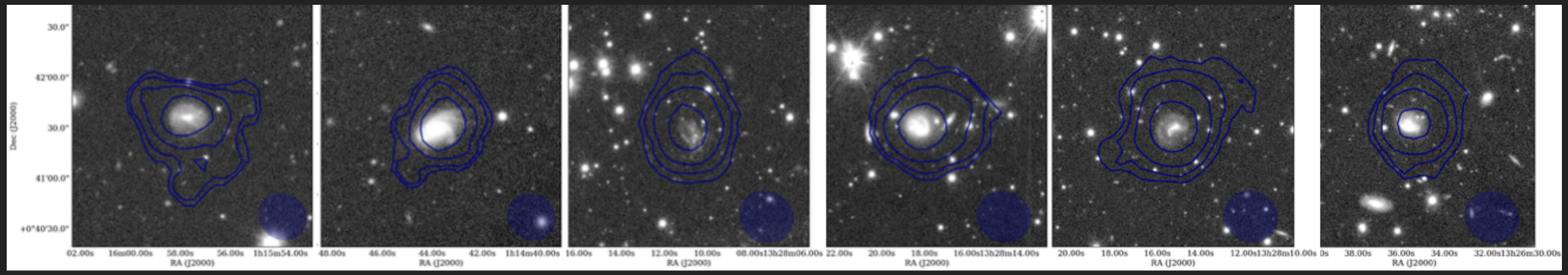
“Blind” source detection

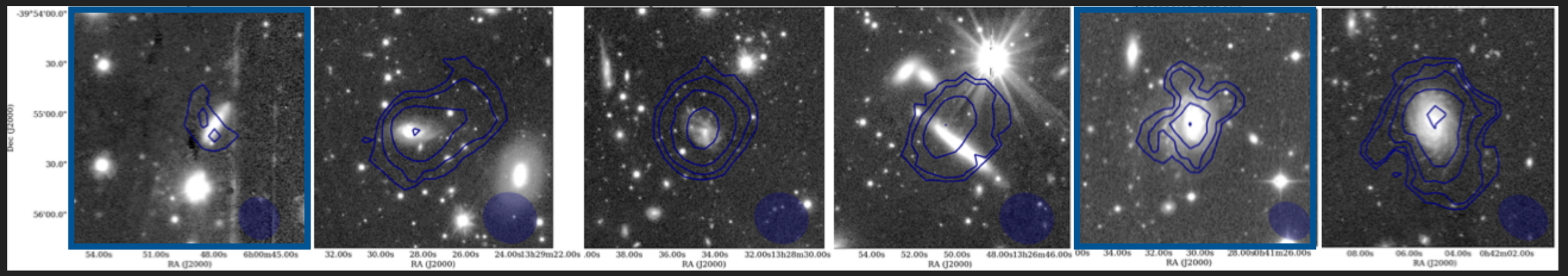
Normal galaxies and jellyfishes





The impact of the ram pressure stripping event on the neutral ISM of JF





One sided HI compression + offset between the peak HI and optical centre

HI masses ~ $10^8 M_\odot$ - $10^9 M_\odot$

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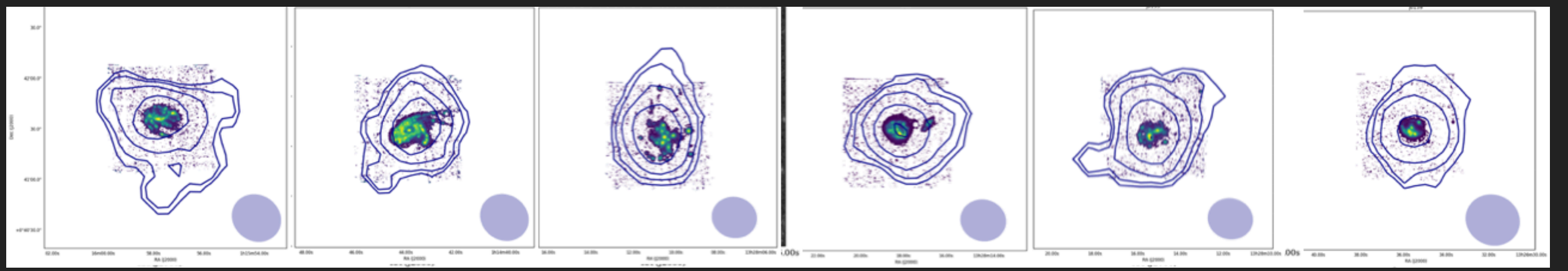

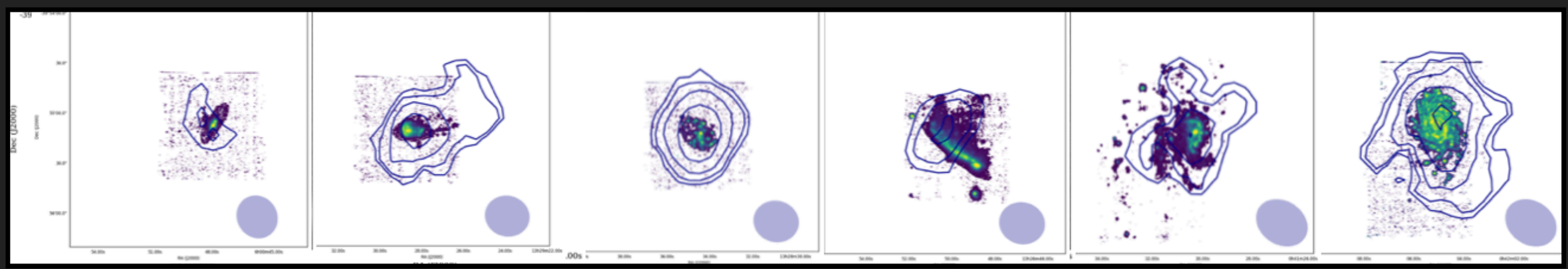

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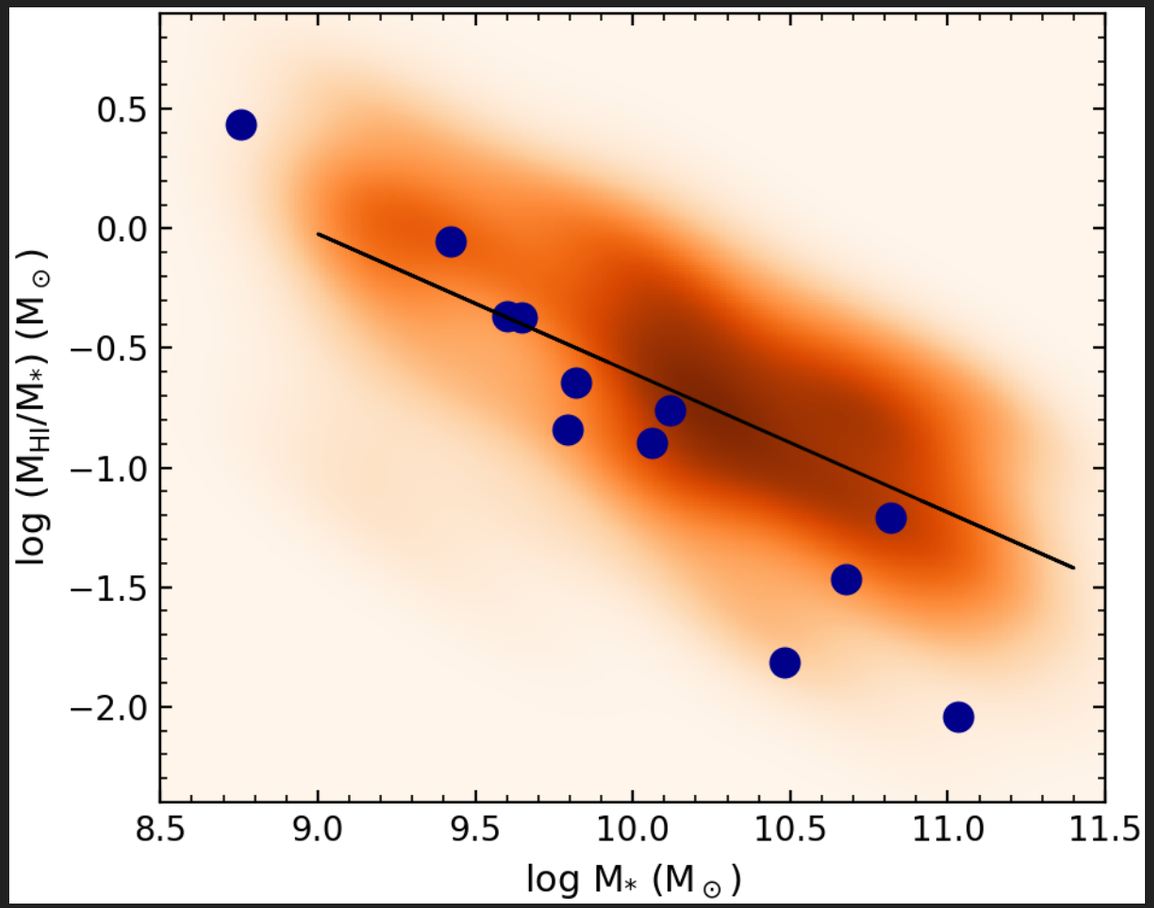
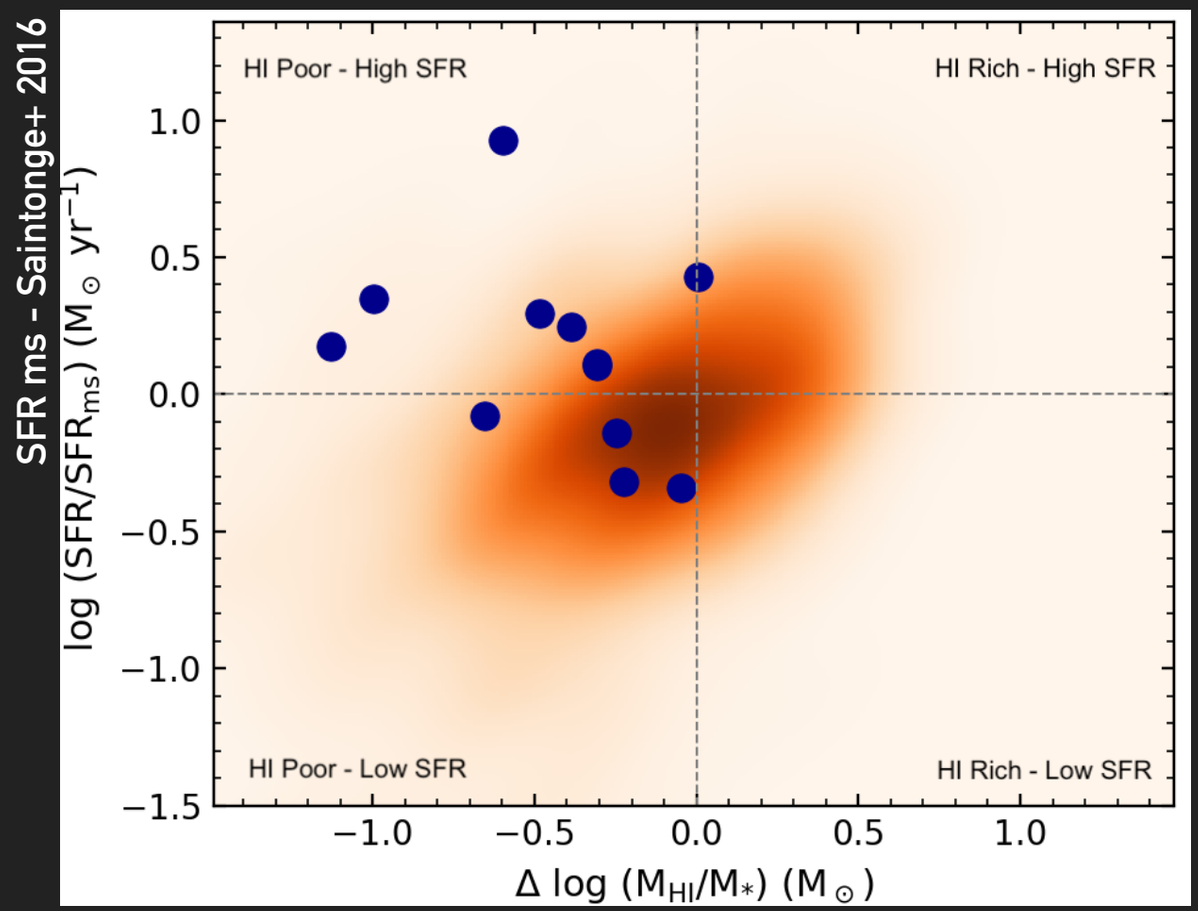
HI masses ~ $10^8 M_\odot$ - $10^9 M_\odot$

Most cases: HI in the tails co-spatial with Hα

The impact of the ram pressure stripping event on the neutral ISM of JF



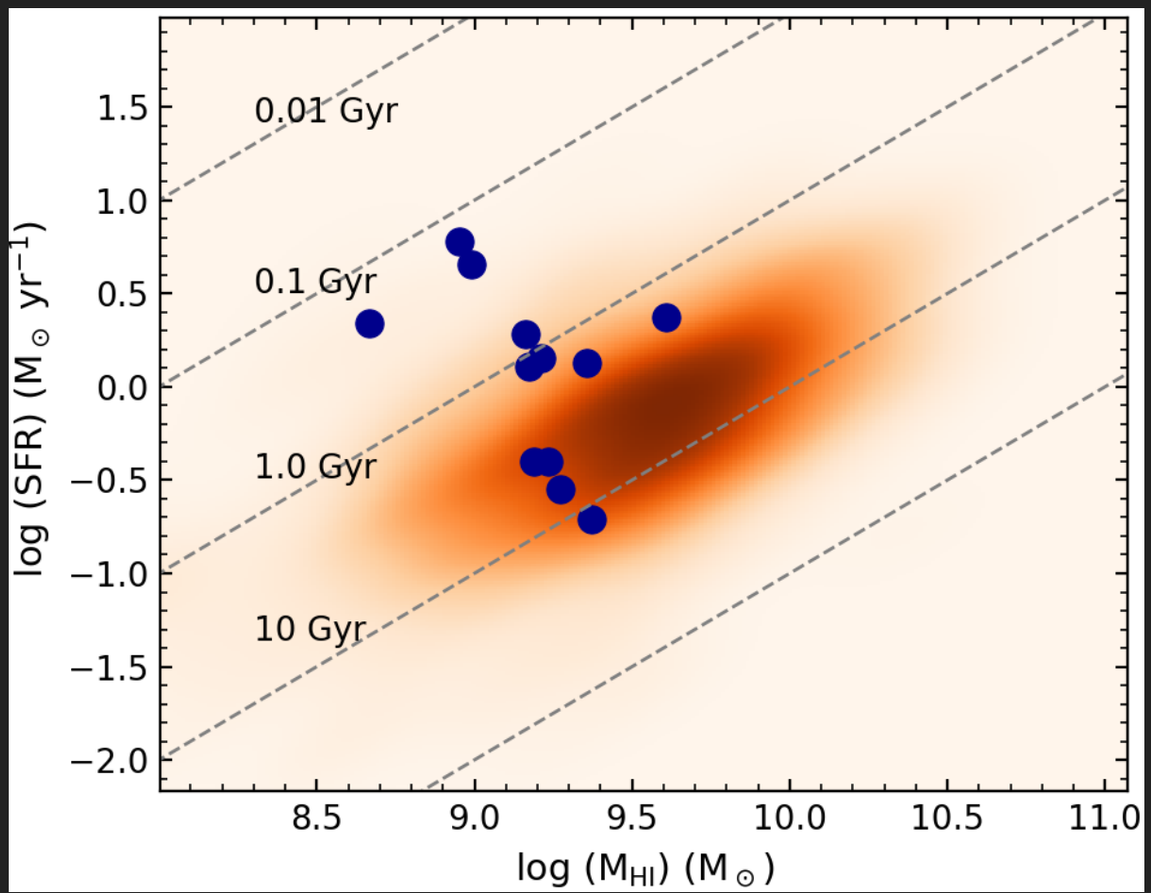


Most massive JF ($M^* > 10^{10}$ $M_\odot$) - below the average HI fraction ~ 0.4 dex

JF HI content ↓ stellar mass

Enhanced star formation rate for the amount of HI

HI depletion time: $\tau_d = M_{HI}/SFR \sim 0.2$ - 0.7 Gyr



Summary

- MGCLS + OmegaWINGS —> GASP Jellyfish galaxies
- Jellyfish galaxies: - Retained their HI gas (10^8 M⊙ - 10^9 M⊙)

  - The HI regions trace Hα emission entirely (in most cases)

  - Enhanced SFE for the amount of HI detect

So many questions

- does the stripped low-density HI gas cool adequately in the tails resulting in the dense gas and stars?
- how long and why —> does HI survive long even when displaced from the disc? (Müller et al, 2021)
- Timescales for HI to H2? How does it relate with ISM conditions?