Australian Government
Department of Industry and Science

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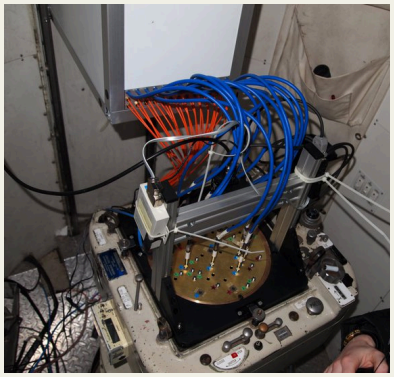
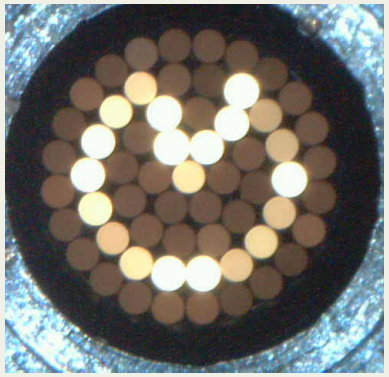
The SAMI Galaxy Survey:

The impact of the cluster environment on the star formation of infalling galaxies



Matt Owers (MQ/AAO)

+SAMI Galaxy Survey team



sami galaxy survey

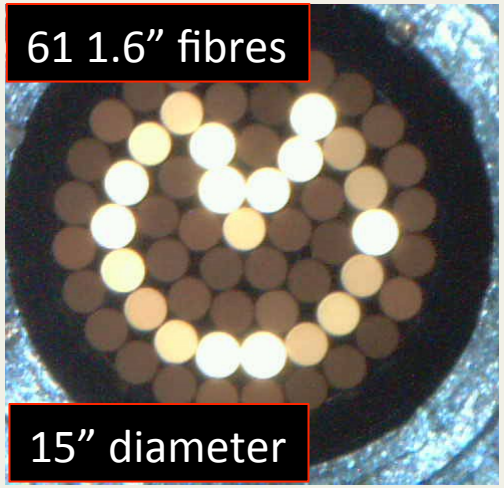
@SAMI_survey

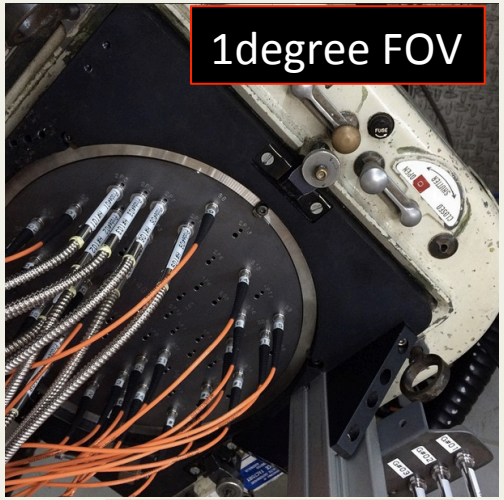
The SAMI Galaxy Survey

SAMI=Sydney-Australian-Astronomical-Observatory Multi-object Integral-Field Spectrograph

Resolved spectroscopy for 3400 galaxies -> 2200 galaxies to date (see Bryant+2015 for survey details)

1. Primary fields from GAMA (http://www.gama-survey.org).
   - Three 4x12 deg equatorial regions at 9hr, 12hr & 15hr
   - Deep, complete, spectroscopy to r=19.8
   - Robust group catalogue (Robotham et al. 2011).
   - 21-band photometry: far UV to far IR (Driver+2016).
2. Wavelength coverage/resolution:
   - Blue: 3700-5800A, R~1750, σ=70km/s
   - Red: 6300-7400A, R~4500, σ=30km/s
3. **8 Clusters targeted (~880 gals -> ~700 to date).**

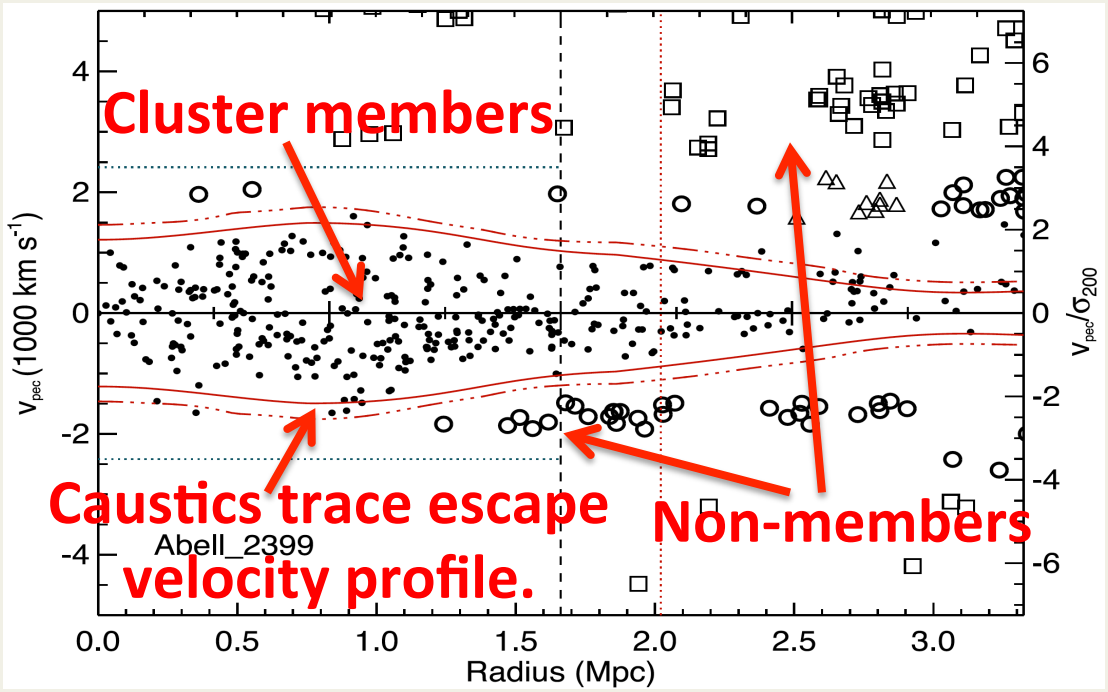


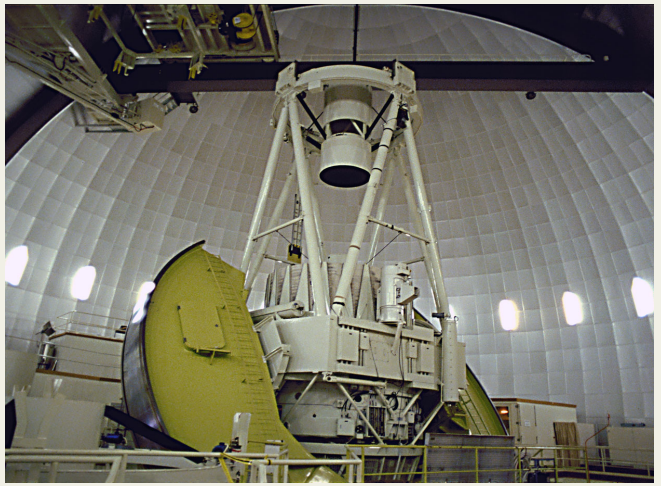


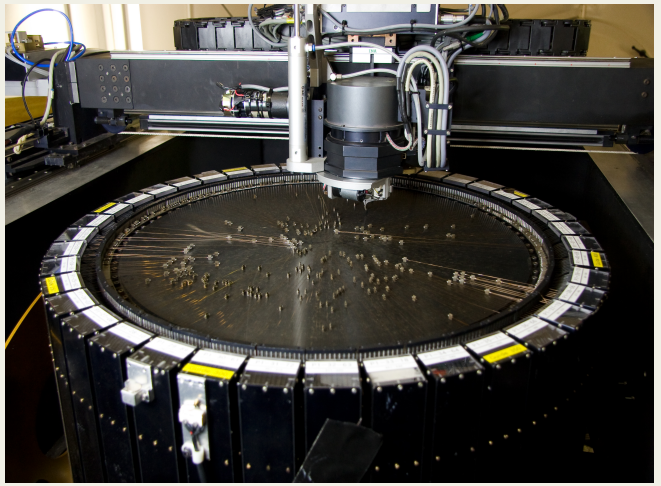
The SAMI Cluster Redshift Survey

(Owers+2017)

- 7 nights using 2dF/AAOmega on the AAT.
- ~21,000 spectra to $r_{petro} < 19.4$, $R < 2\text{-}3R_{200}$.
- Completeness ~95% to $r_{petro} = 19.4$, $R<R_{200}$.
- Around 2850 cluster members ($R<2R_{200}$).

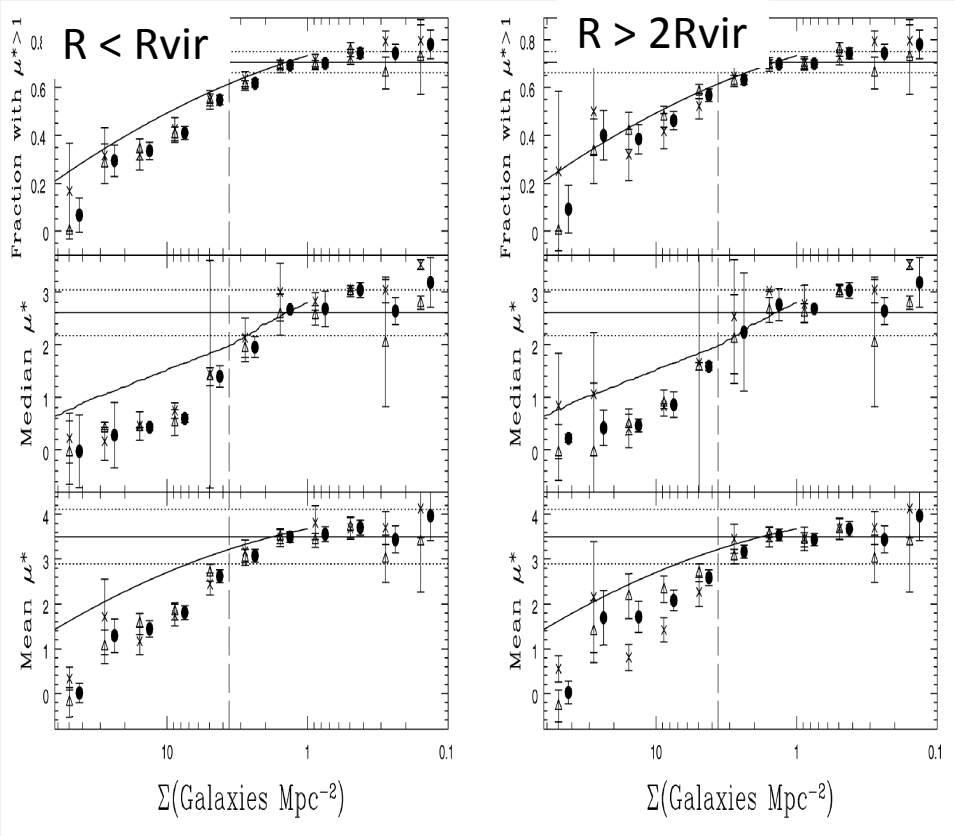




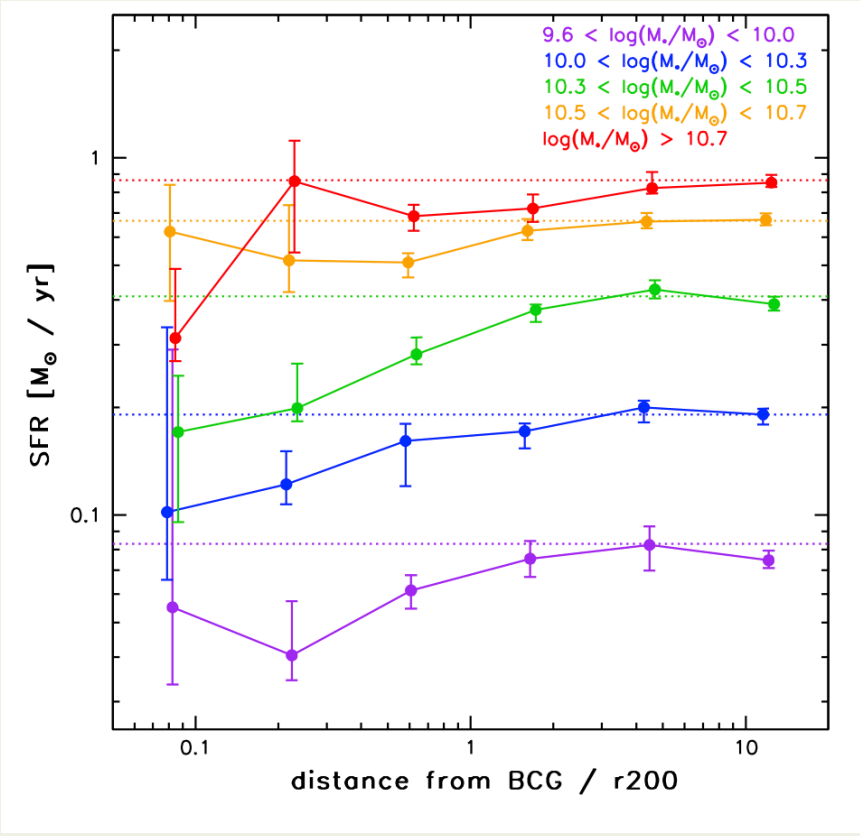


Correlation between galaxy properties and environment.

Fraction of SFR gals lower cf field (Lewis 2002)

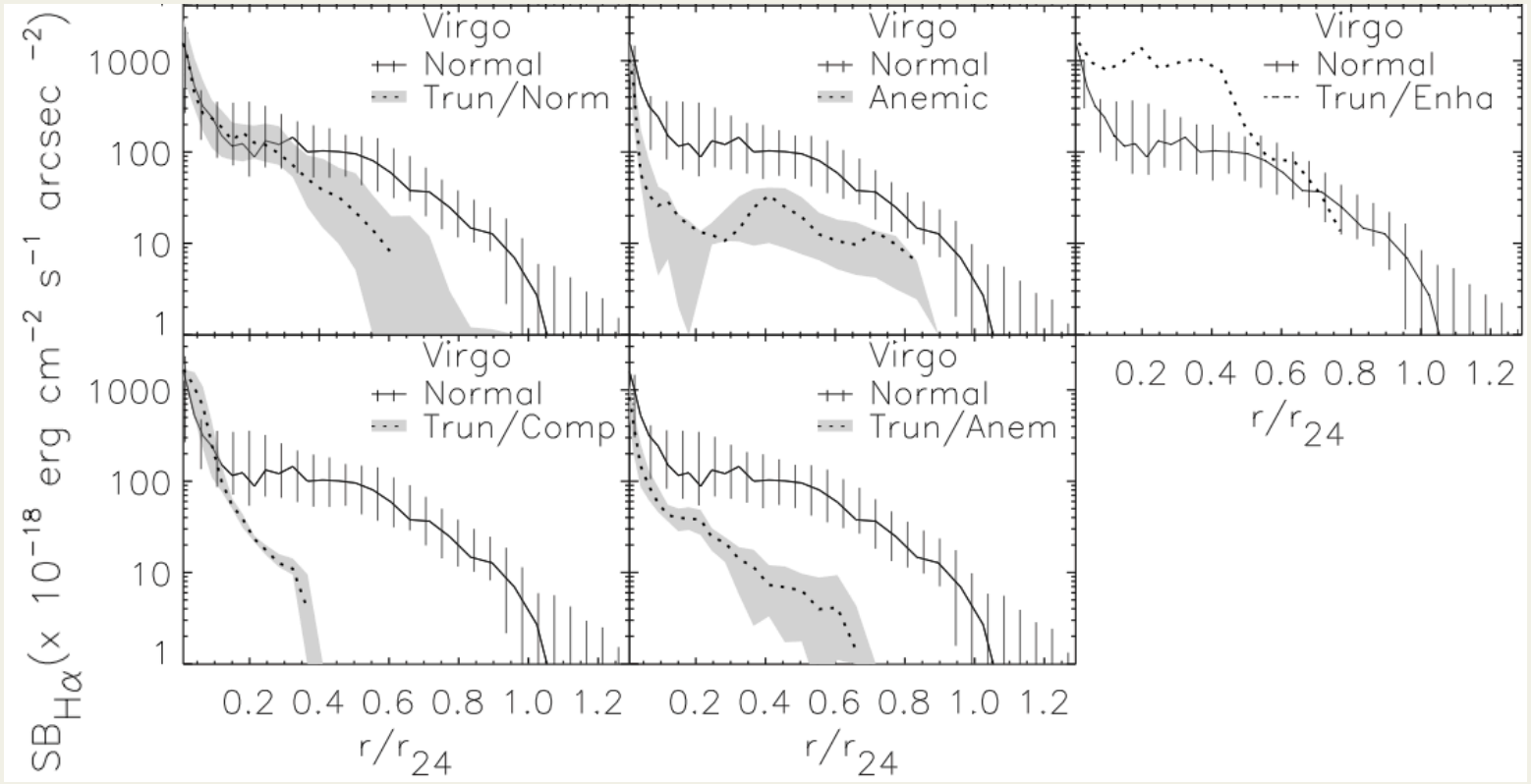


Decline in SFR with radius (von der Linden 2010)



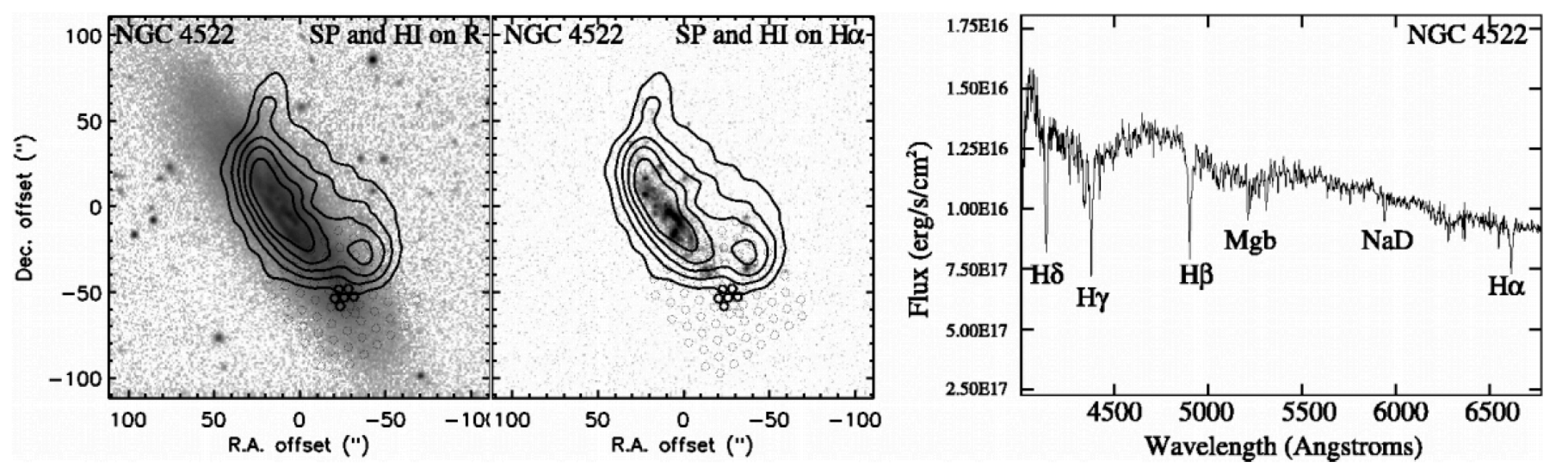
Correlation to Causation: Identifying environment-driven transformation.

- Koopmann & Kenney (2004) show 50% of spiral galaxies in Virgo cluster have truncated Hα distribution.



Moving from Correlation to Causation.

- Crowl & Kenney (2006, 2008): IFU spectra show stellar pop. ages outside truncation radius <500Myr -> rapid shutdown of star formation.



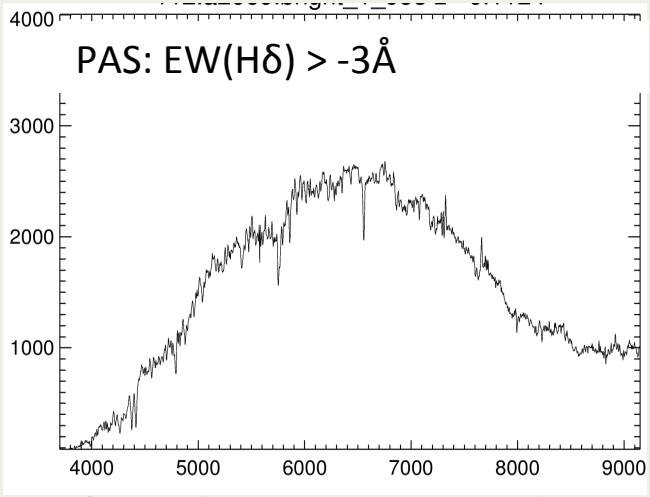
10 galaxies in Virgo cluster – representative?
Answer with IFU data for large sample across range of clusters.

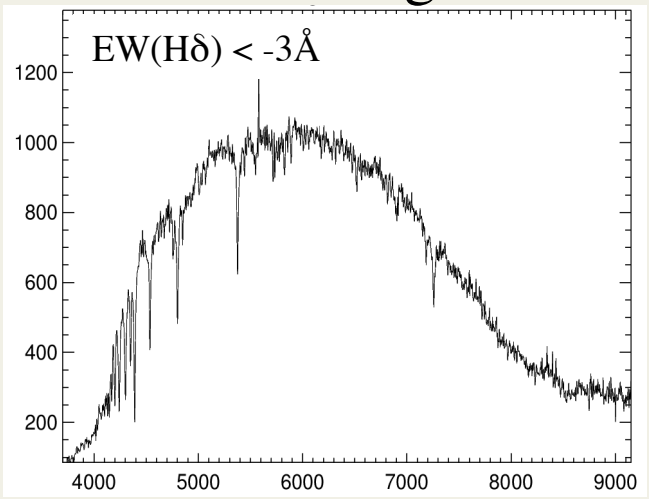
SAMI data: Resolved Spectroscopic Classification

Passive

Hδ strong

Absorption line



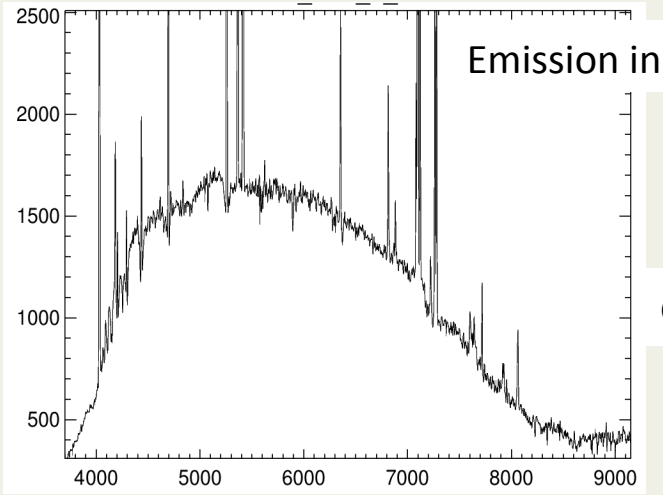


Starforming/Starbursting

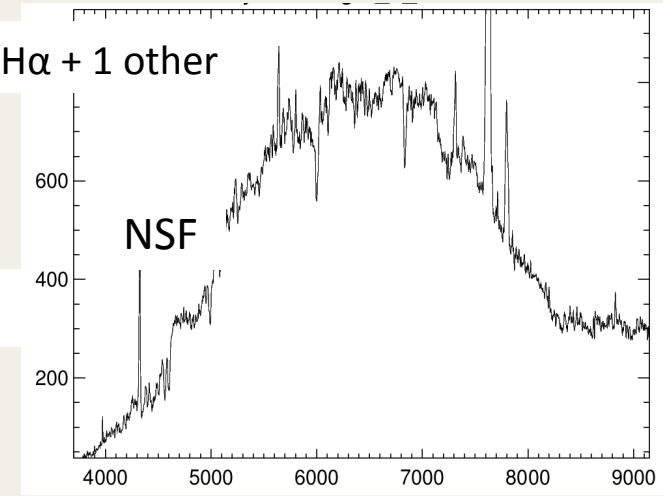
Non-Starforming

Emission line

Emission in at least Hα + 1 other



COMP

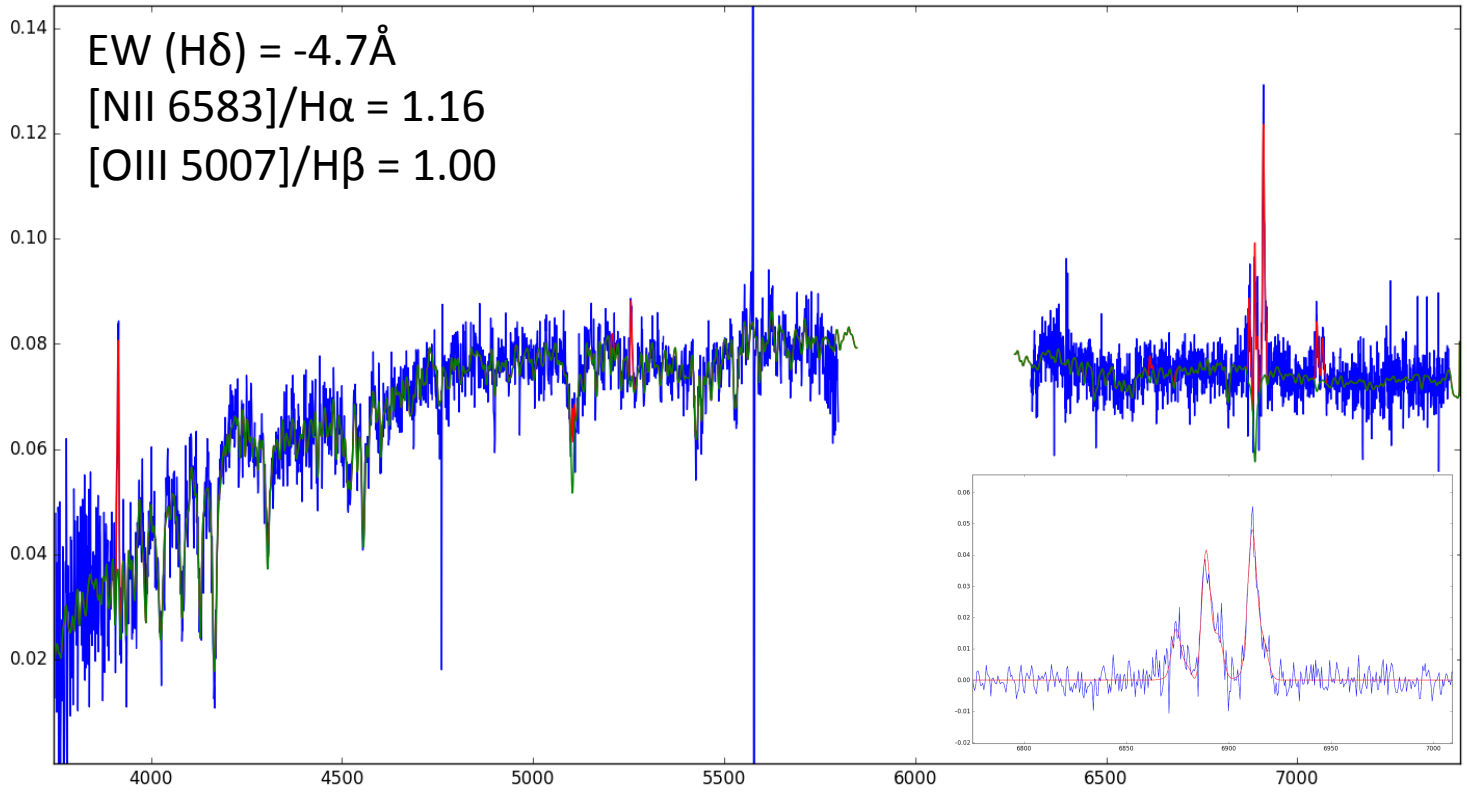


Line ratio -> SF ionising src

Line ratio -> nonSF ionising src

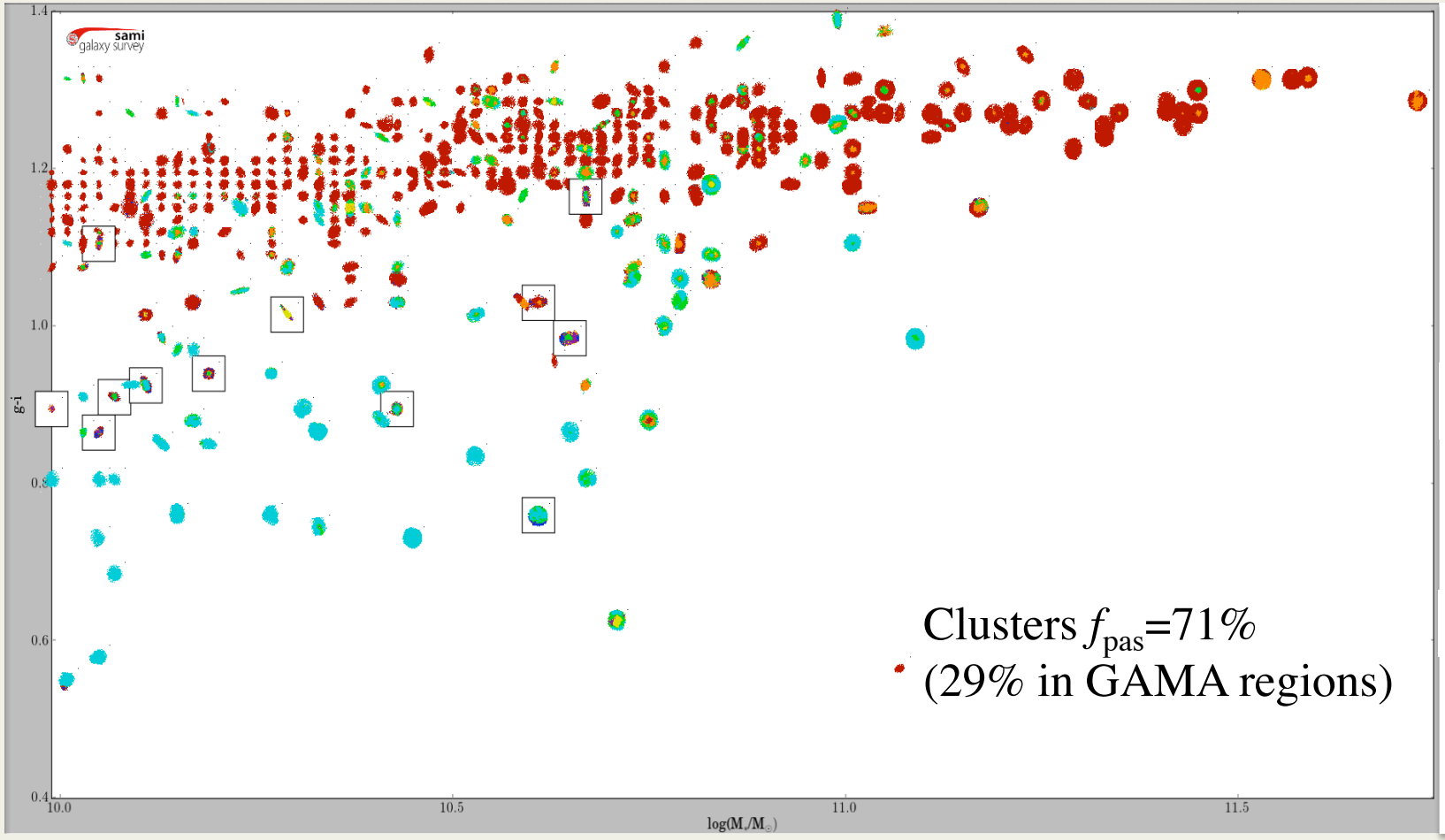
Also, Non-SF HDS

- Strong Balmer with non-SF emission lines:

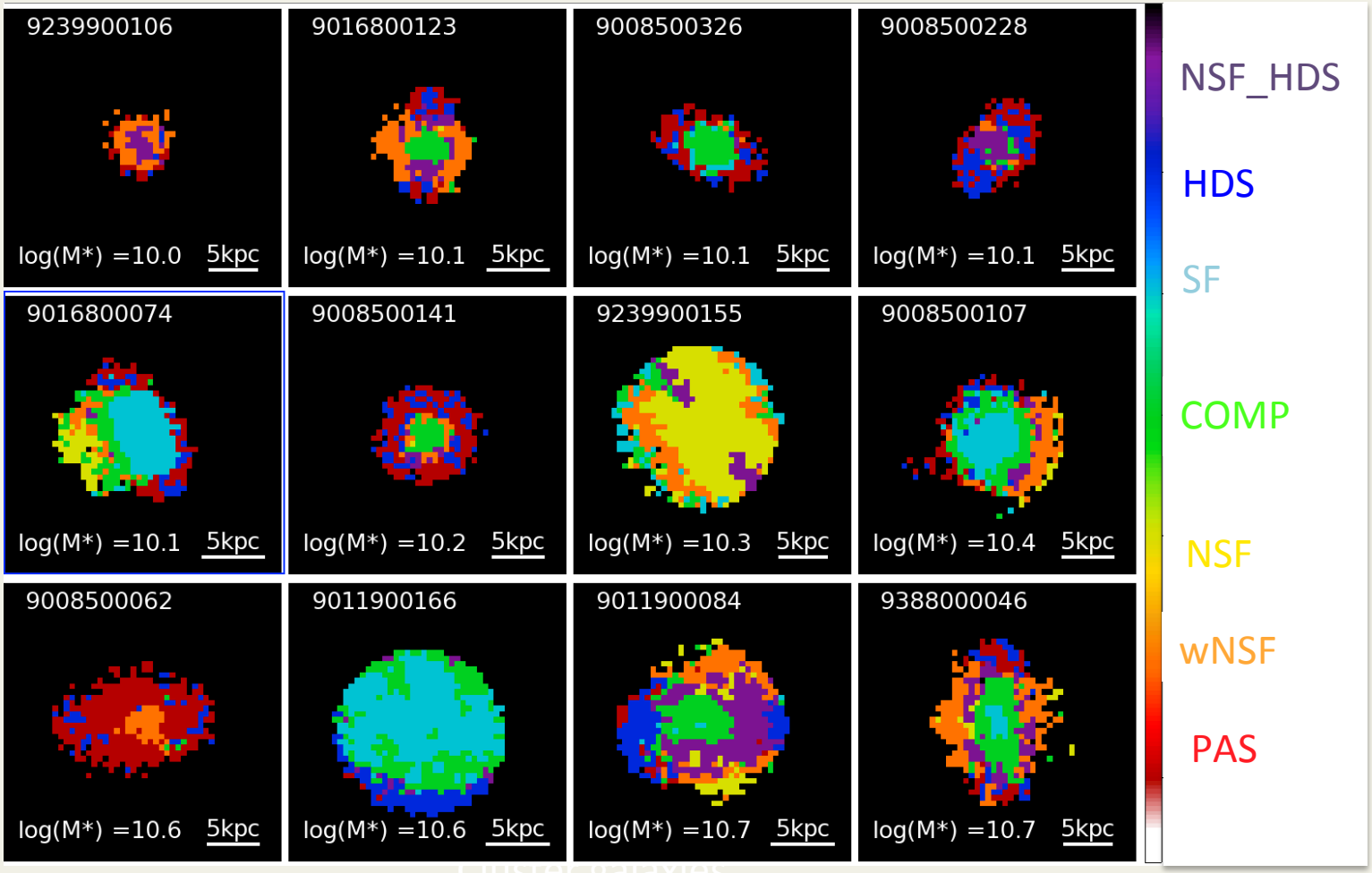


Red-sequence is dominated by spectroscopically passive galaxies.

Passive galaxies: >90% spaxels have passive spectral type

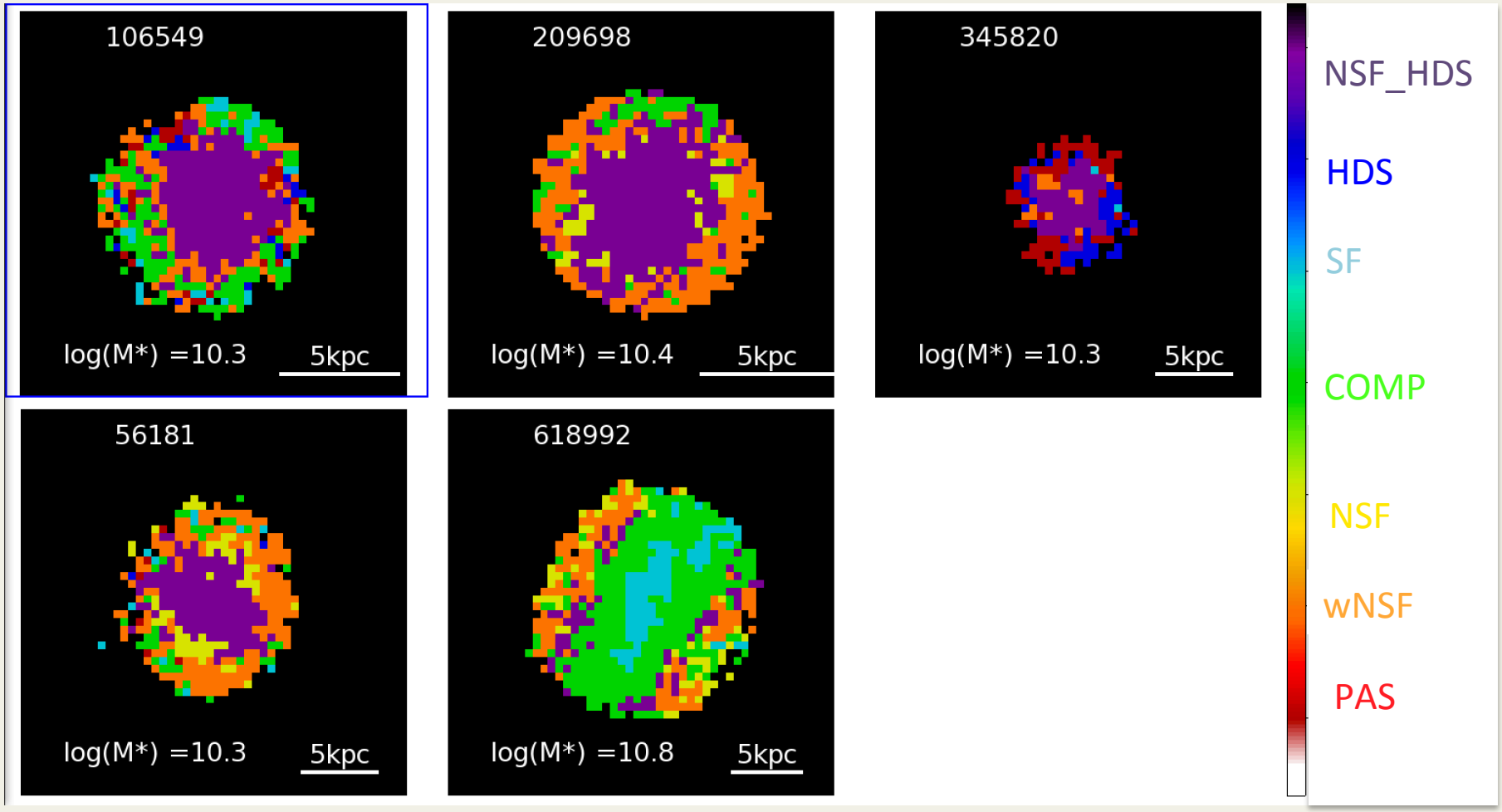


Clusters: 11% of non-passive galaxies have >10% HDS classified spaxels.



Cluster galaxies

GAMA: Only 2% non-passive galaxies have >10% HDS classified spaxels.

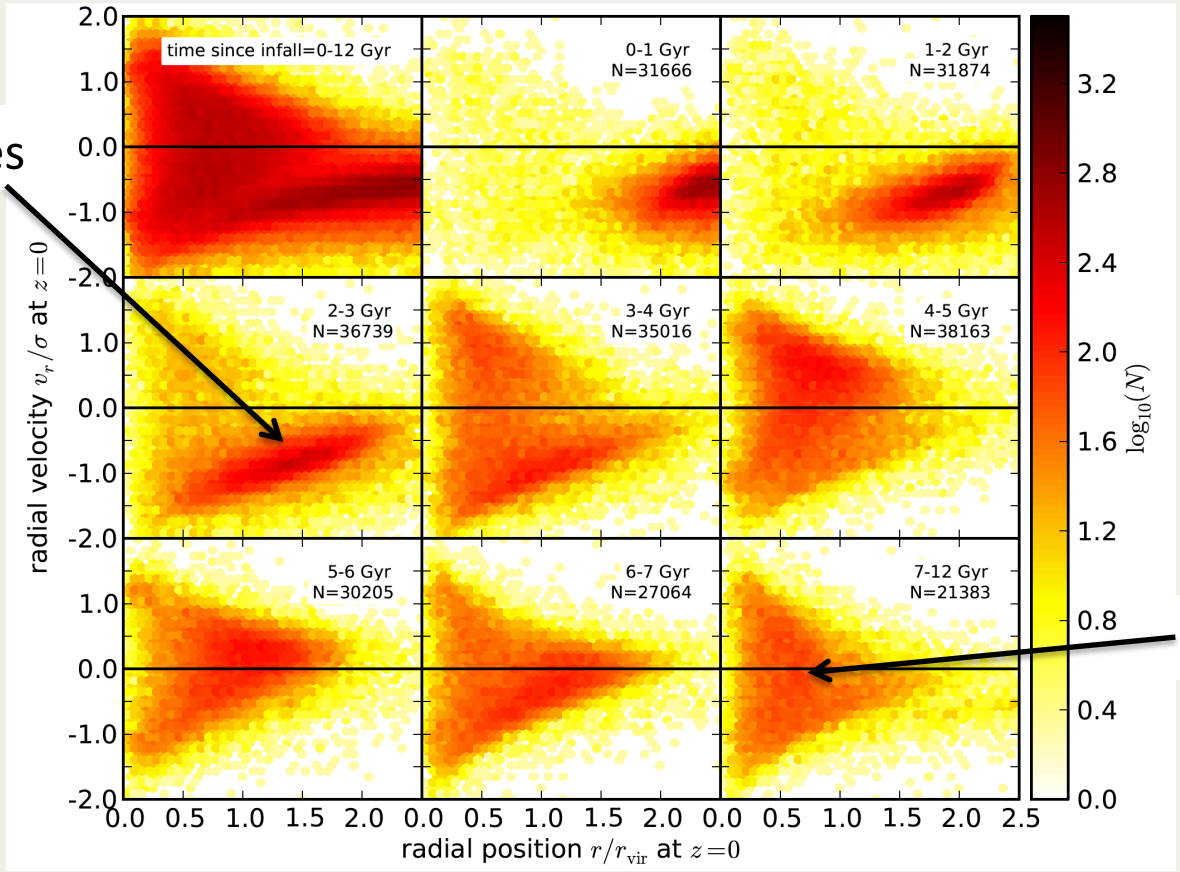


Projected-Phase-Space: a metric for environment.

Oman+13 simulations: infallers inhabit distinct regions of phase space

(also Mahajan+13, Noble+13, Jaffe+15, Muzzin+14, Haines+15, Oman+16).

Infalling galaxies



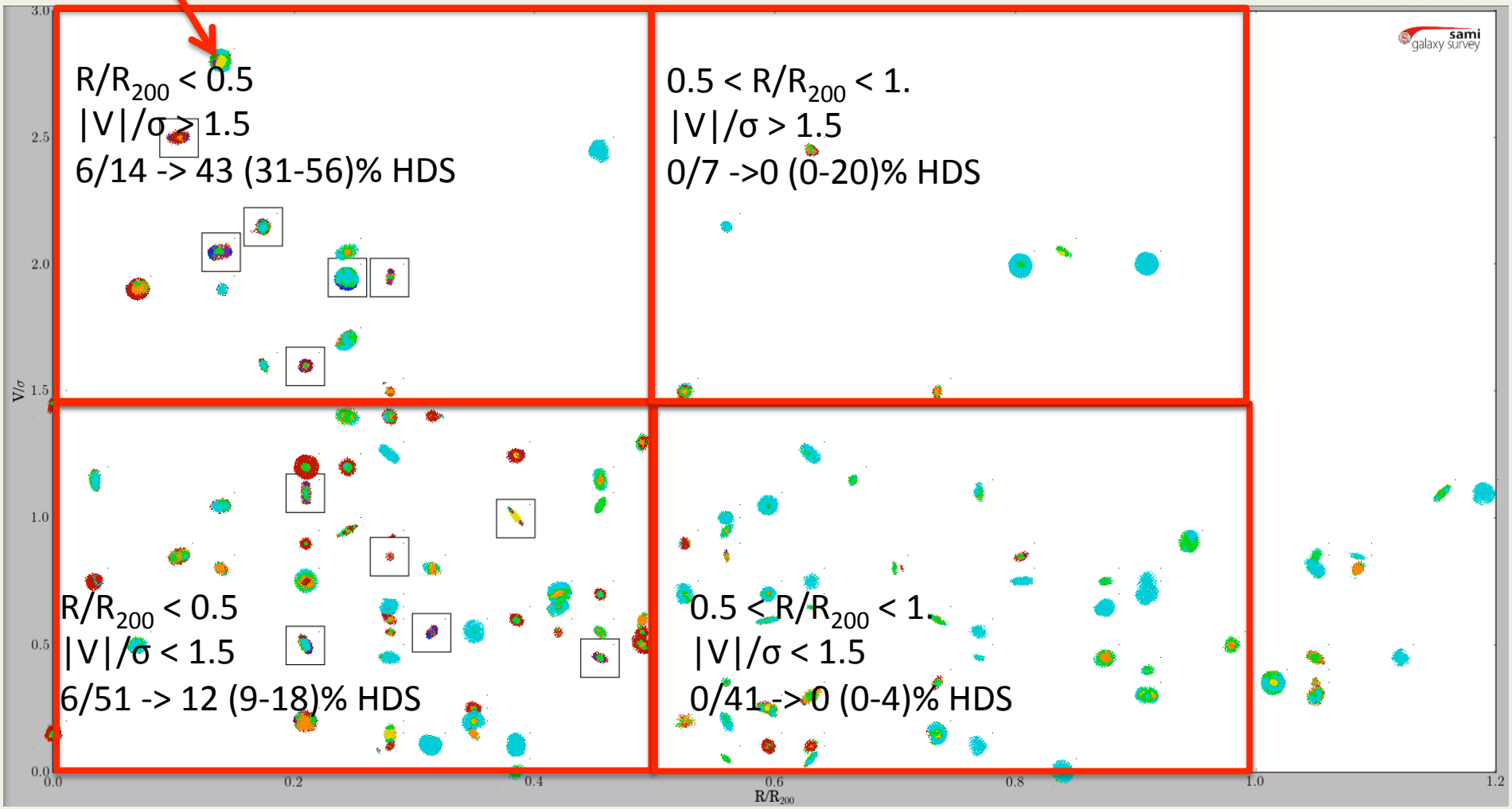
T_0 at $2.5R_{vir}$

T_{cross}~3.5Gyr

Virialised region

JO201 Jellyfish

PPS for non-passive cluster galaxies



Summary.

- 11% of non-passive cluster galaxies have evidence for young stellar populations with no ongoing star formation in >10% of their spaxels.
- This population is rare (~2-3%) in the non-cluster SAMI galaxies in the GAMA regions.
- The HDS galaxies are only found within $0.5R_{200}$ (~19%) with an increased fraction for high velocity galaxies (~43%) cf. lower velocity galaxies (12%).
- Consistent with ram-pressure stripping of gas leading to outside-in truncation of star formation as the galaxy traverses the cluster.
- Stayed tuned for full sample!

Extra slides