ABELL 3266: A Complex Merging Cluster

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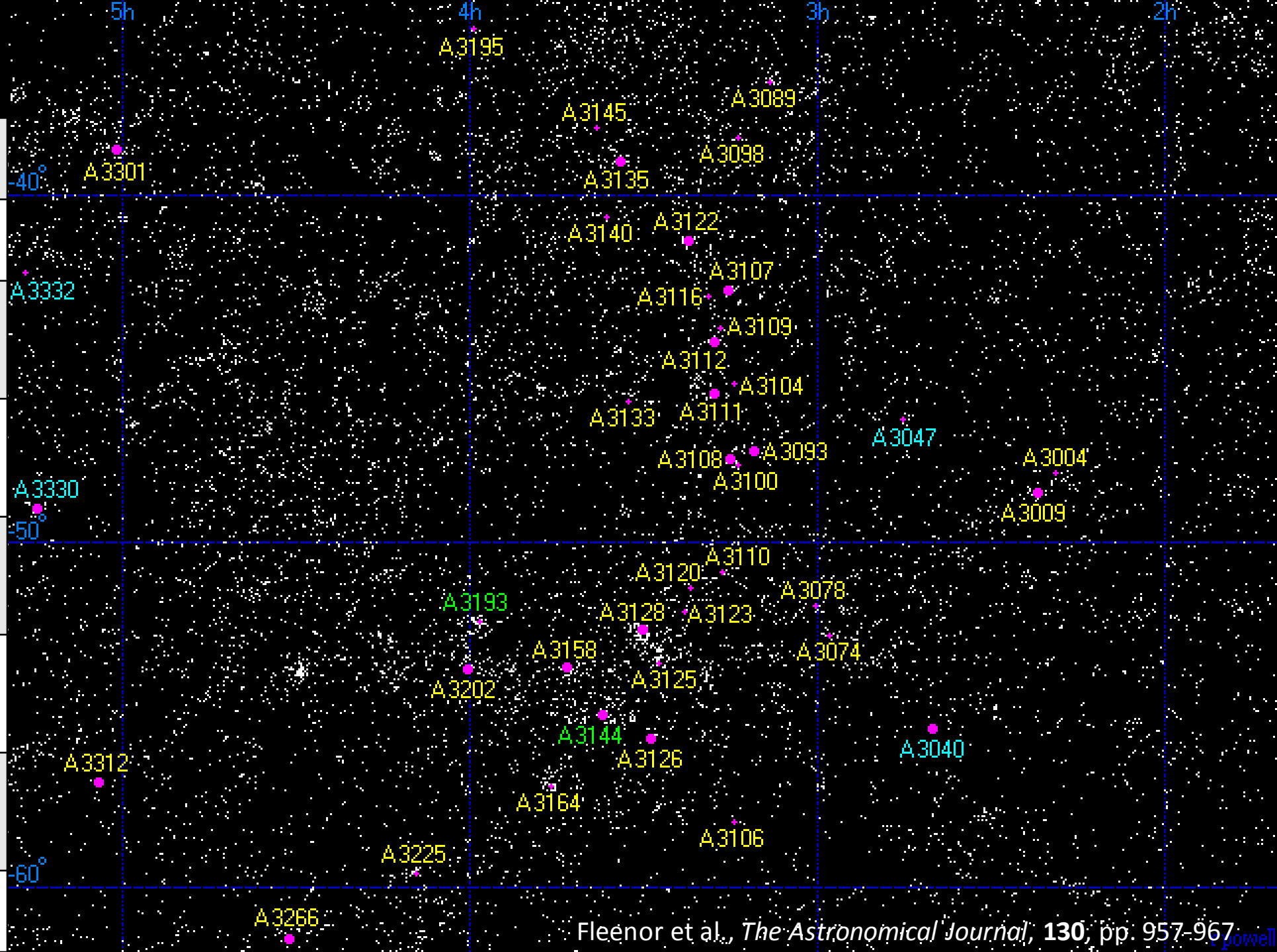
Horologium-Reticulum Supercluster

Redshift	0.06
Length	550 Mly
Mass	10^17 solar masses
No of Clusters	34
No of Groups	5000
No of Large Galaxies	30000
No of Dwarf Galaxies	300000
No of Stars	10^15



Fleenor et al., *The Astronomical Journal*, **130**, pp. 957-967

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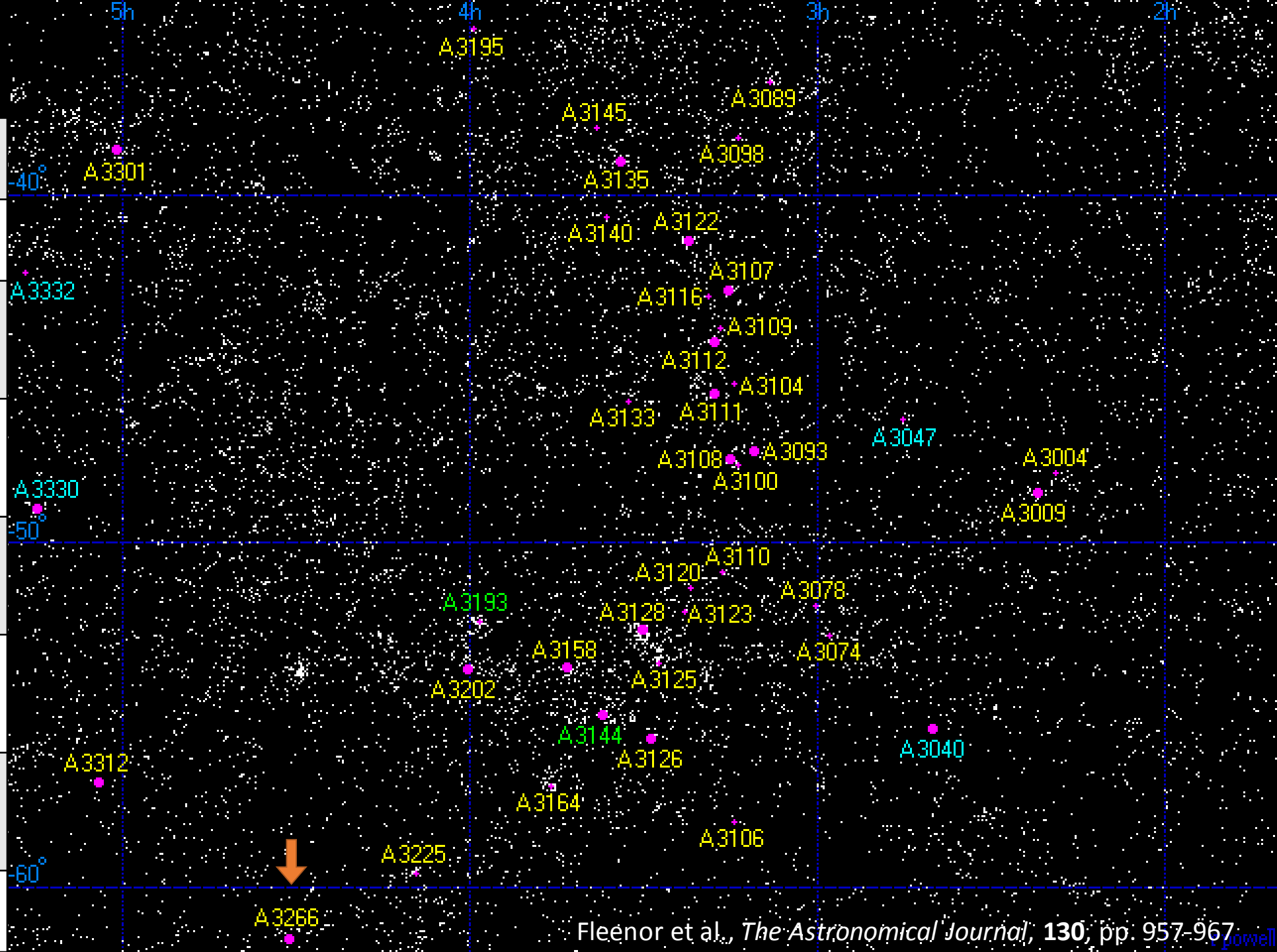

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A3266: General Properties

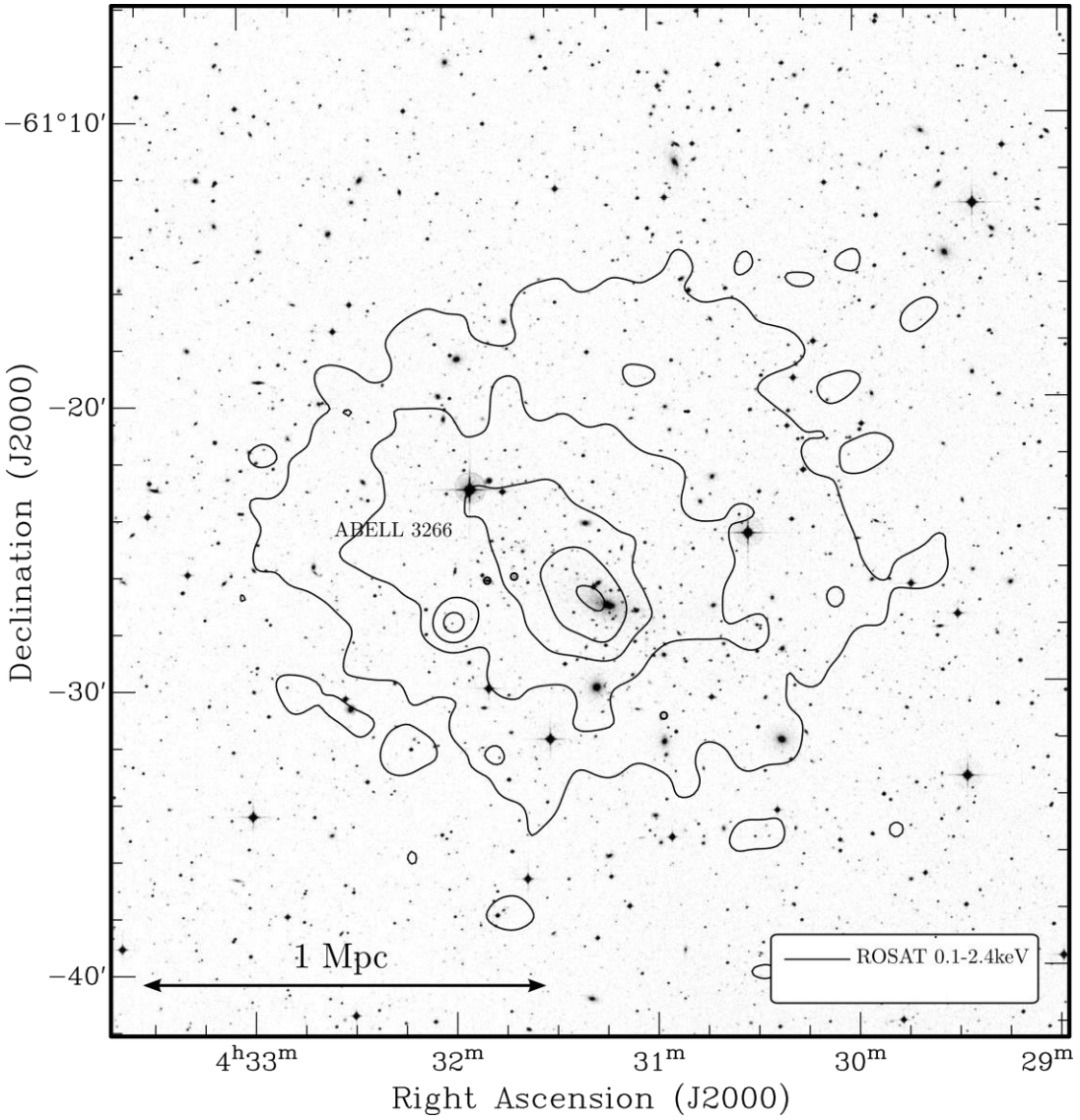
- Located at the bottom of the HRS, at about 250 Mly away in constellation Reticulum.
- One of the largest clusters in the southern hemisphere with hundreds of galaxies, most of which are red ellipticals.
- A merging system; elongated X-ray emission from the ICM and high velocity dispersion.

Image Credit: Michael Hudson and Russell Smith and Gemini Observatory

What is going on?

Abell 3266 is known to be a merging system. However, detailed structure analysis of the cluster has been somewhat hindered due to the lack of sufficient spectroscopic redshifts.

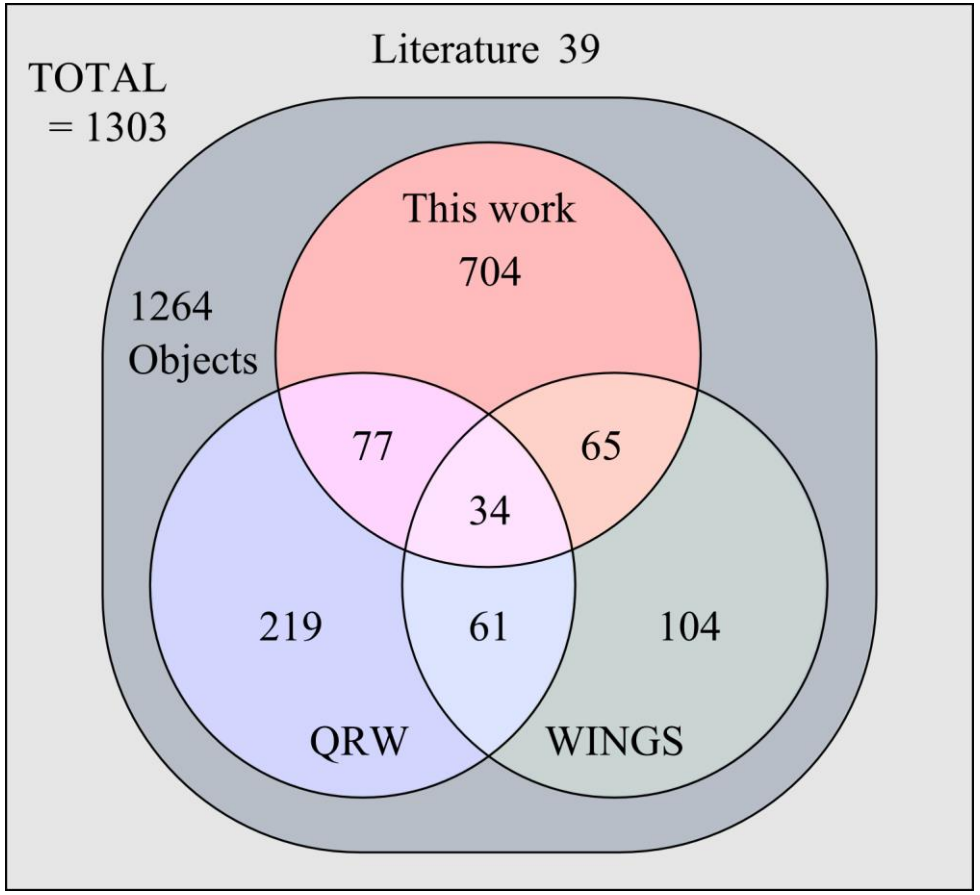
Although most of the previous studies note the existence of substructure, there are some disagreements on the exact merger status of the cluster; explicitly, there is a lack of consensus about the phase of the core passage (pre- or post-merger) and the current direction of the cluster and subcluster motions.



Spectroscopic Observation

In this work we attempt to clarify the dynamical situation in A3266 using optical analysis. We observed the cluster with the 2dF instrument on the Anglo-Australian Telescope (AAT) and obtained Spectroscopic data for 880 galaxies.

Data from these observations were combined with available spectroscopic observations from the literature to produce the largest spectroscopic sample in the region of A3266.



Quintana, Ramirez, and Way, *Astronomical Journal*, 1996, **112**, 36.
Cava et al., *Astronomy and Astrophysics*, **495**, 2009, pp.707-719.

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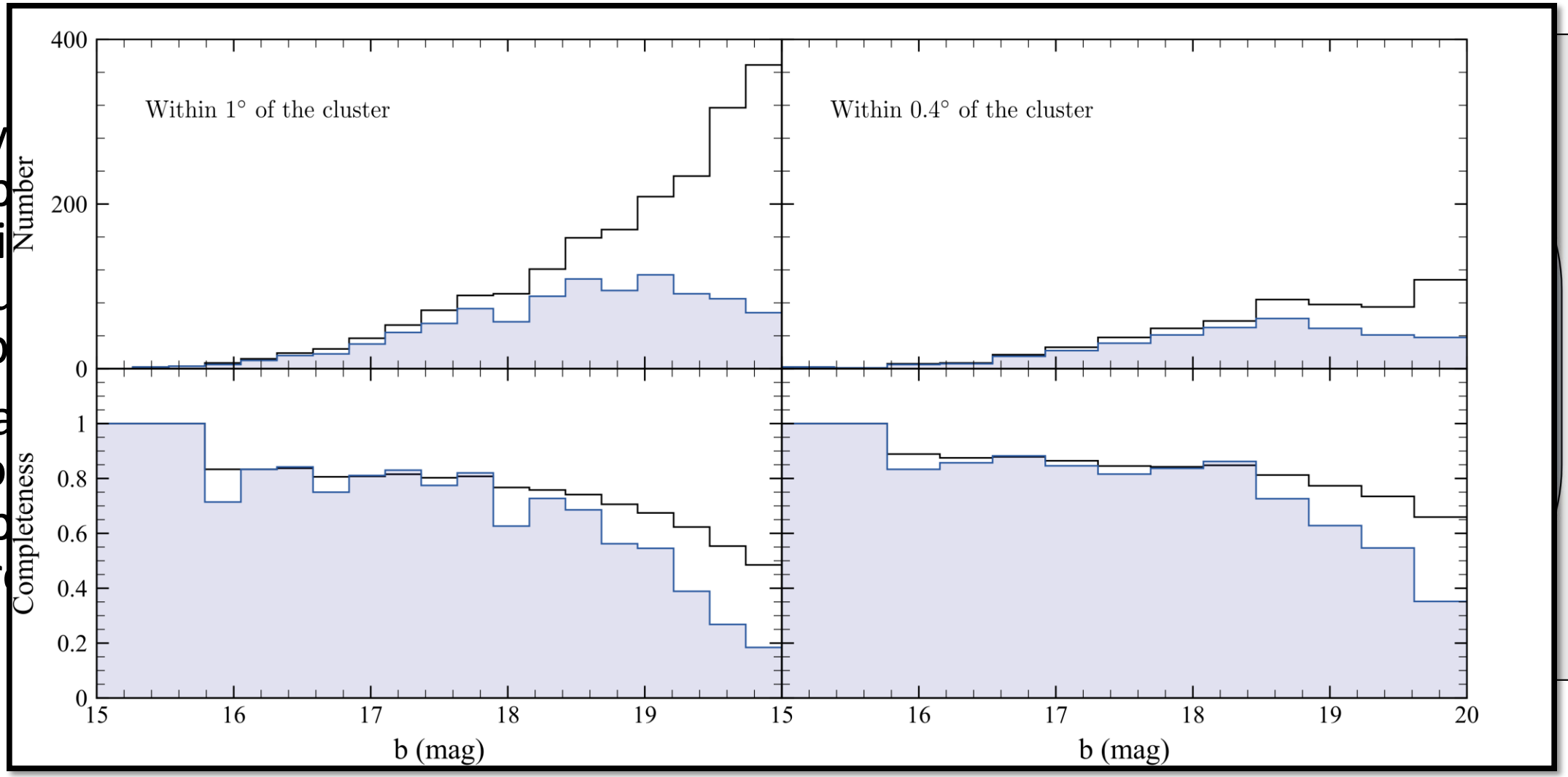

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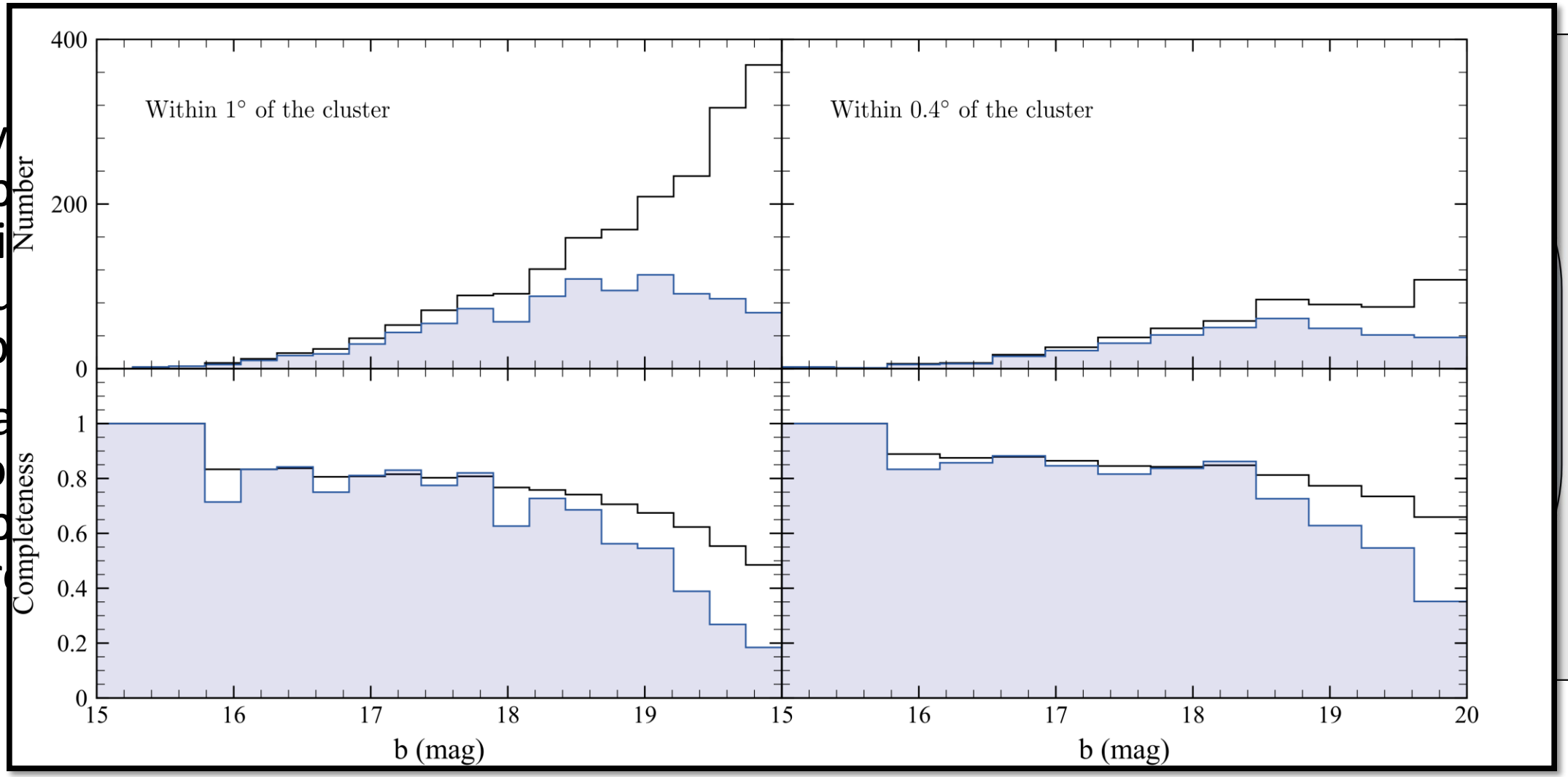

Spectroscopic Analysis

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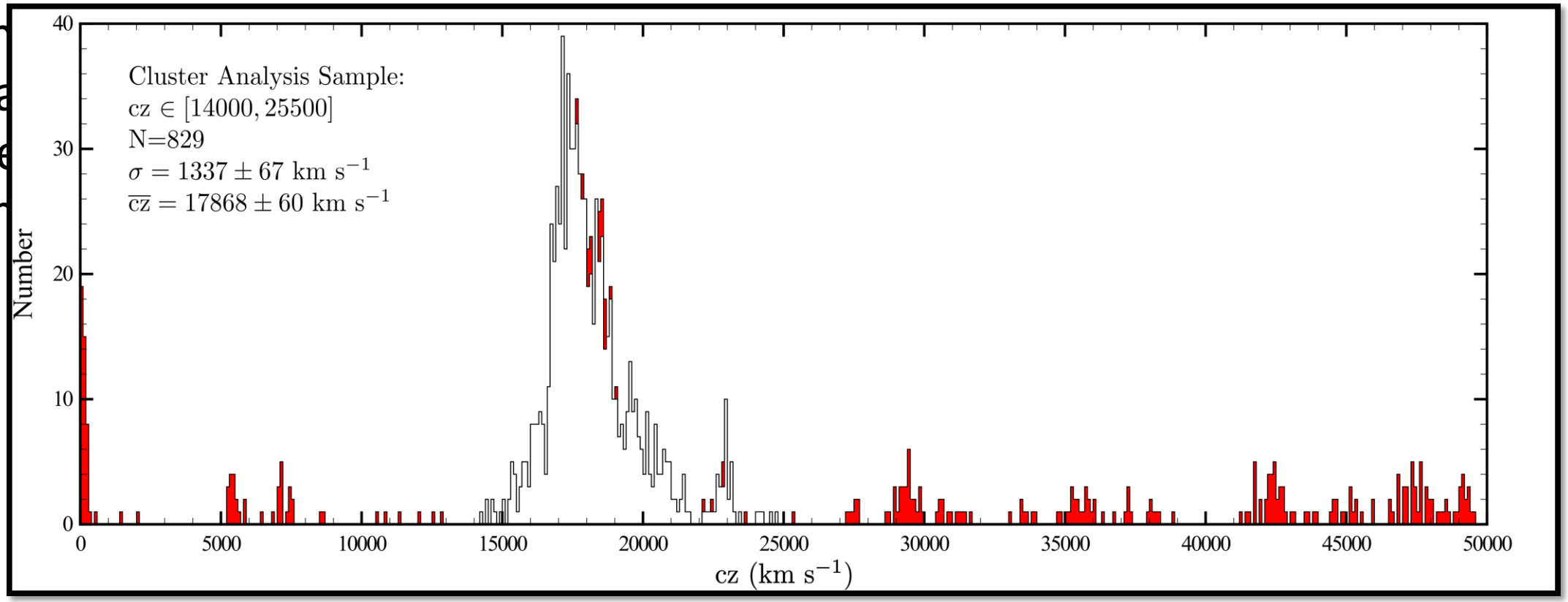

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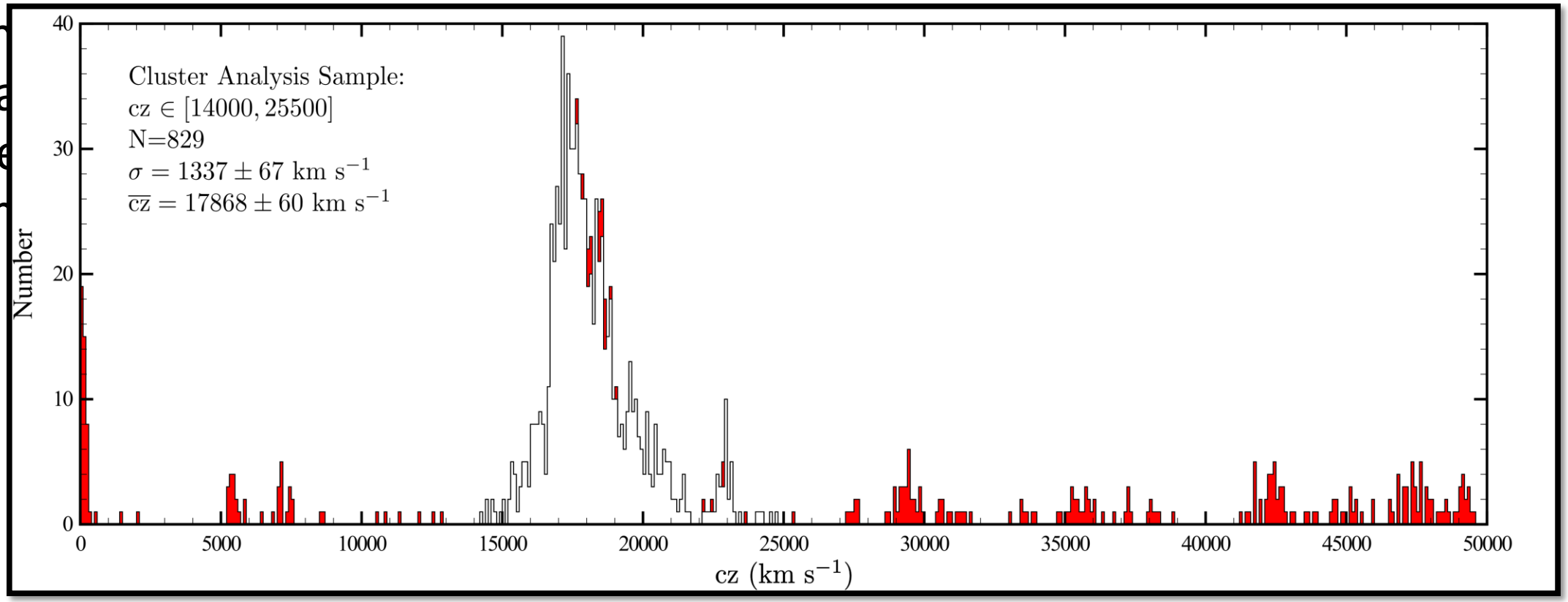

Spectroscopic Analysis

In order to examine the substructure in the cluster, we restricted the sample to the 829 galaxies within 1 degree of the nominal cluster centre within the velocity range of 14,000-25,500 km/s, where the main population of galaxies corresponding to the cluster resides.

The Density Based Spatial Clustering of Applications with Noise (DBSCAN) algorithm was used. DBSCAN is a friend-of-friend clustering method that uses two input parameters, the neighbouring distance (Eps) and a minimum number of points which determines the detection thresh old for objects that should be considered to be grouped.

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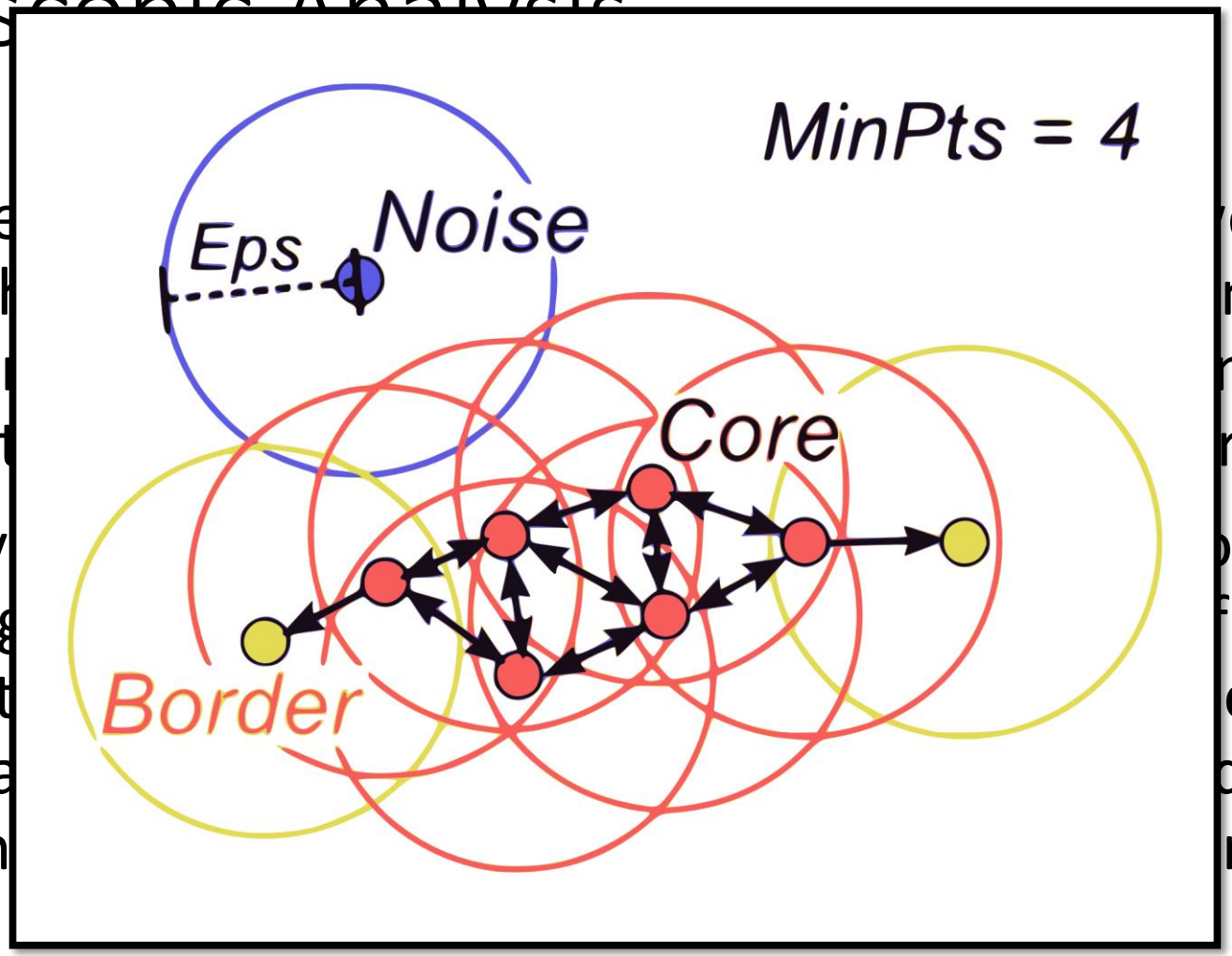

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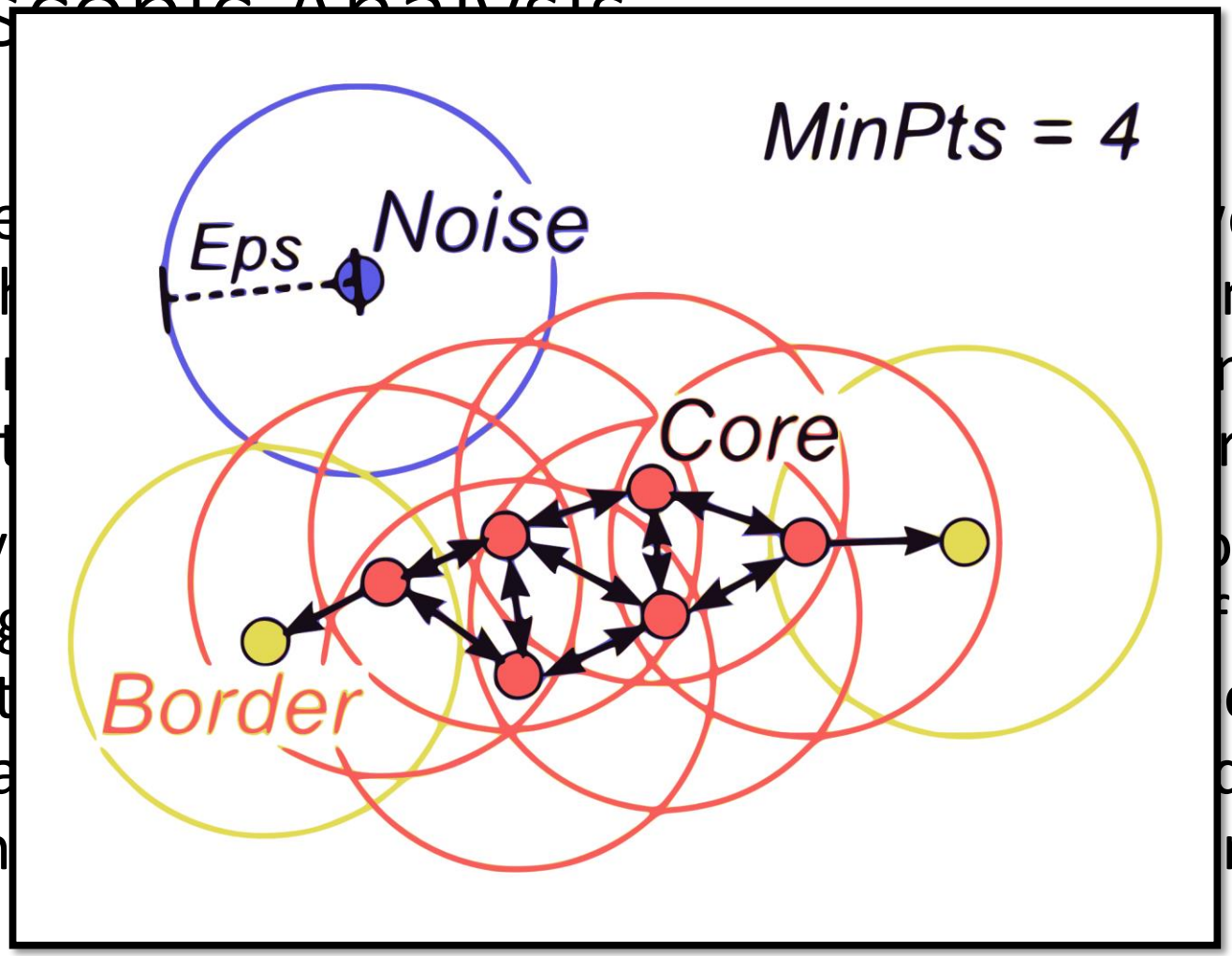
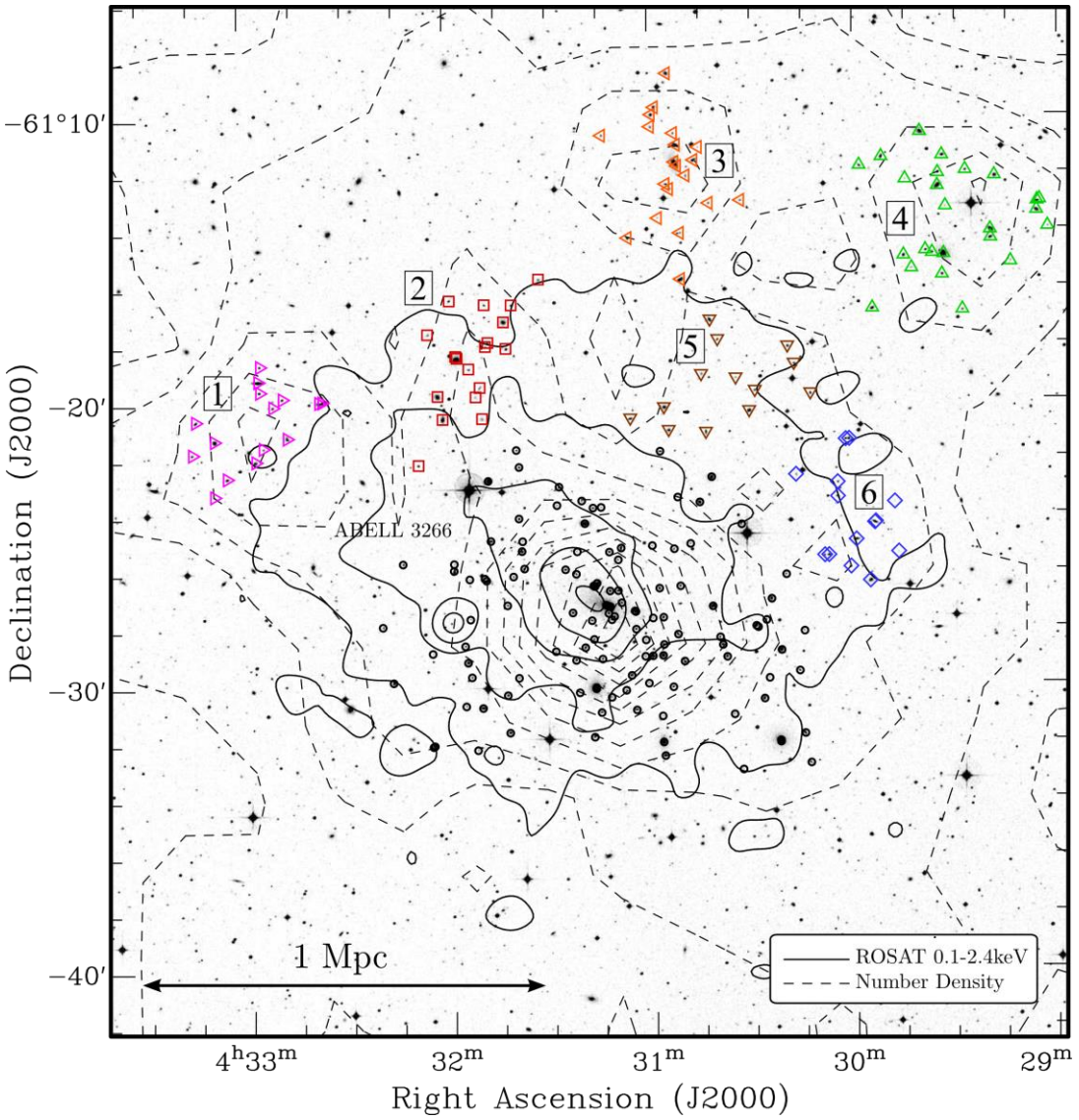


The Neighbours

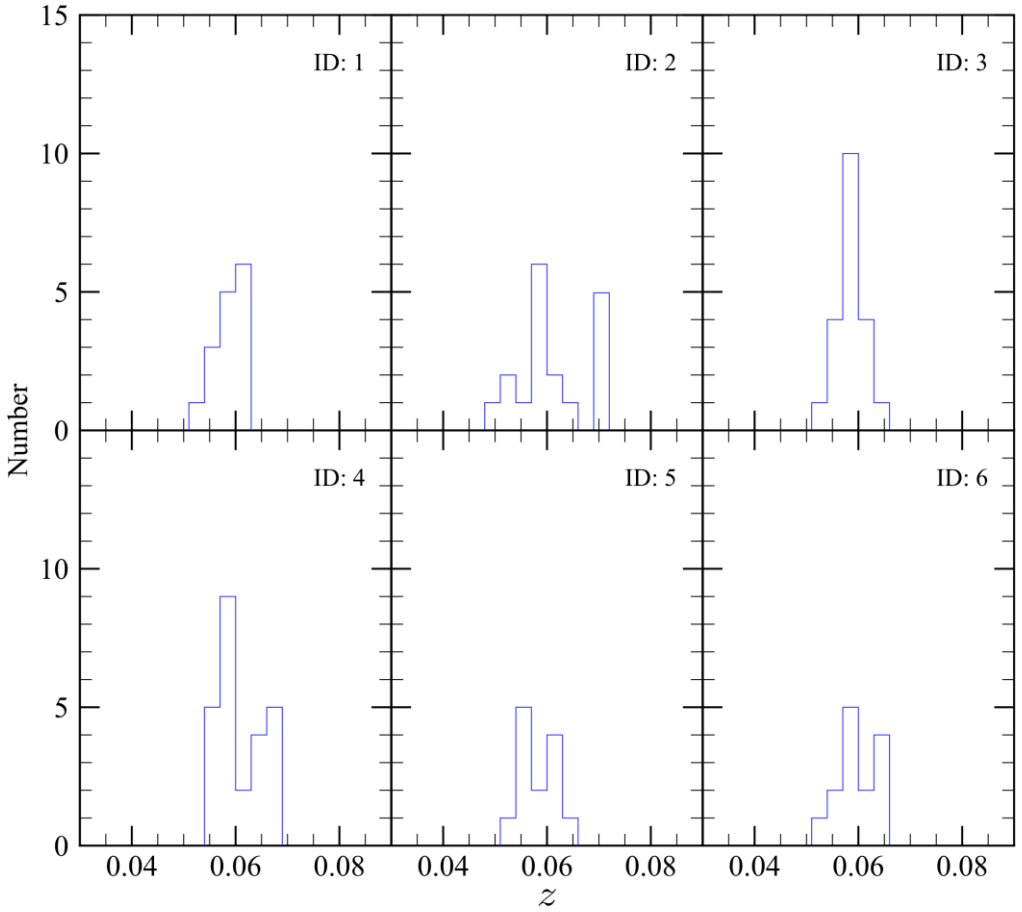
DBSCAN algorithm was applied to the spatial and velocity restricted catalogue to determine the structures surrounding Abell 3266. Based on spatial distribution, the overall population was divided into six groups and filaments, along with the cluster core.



Disturbed

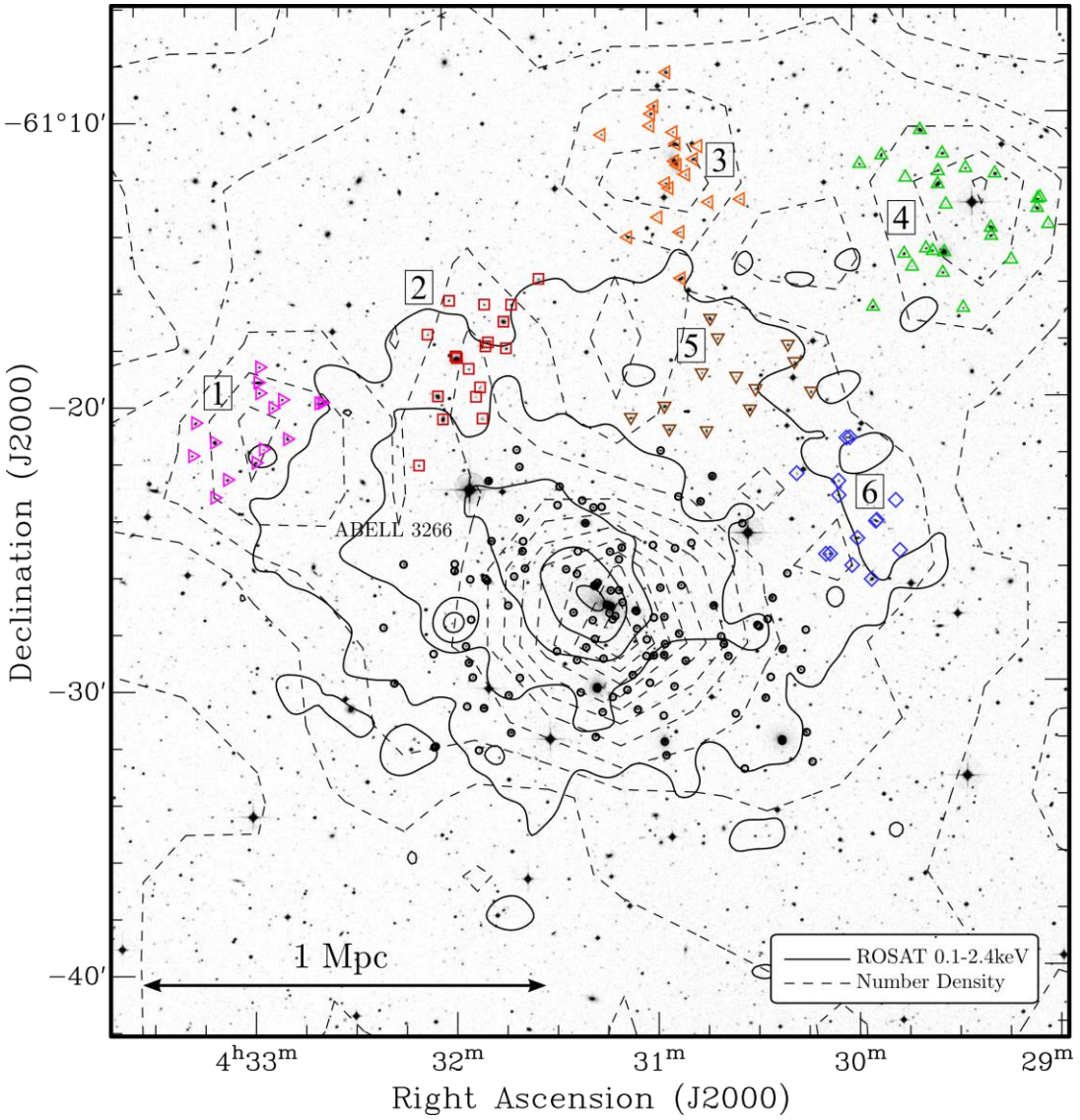
The Neighbours

All the structures detected by DBSCAN, except one relatively compact group, have filamentary morphologies either in the plane of sky or in the redshift space. Even the mentioned group, ID 3, has a broad velocity distribution, well over the typical velocity dispersion of compact groups, and is possibly tidally disrupted group impacted by the cluster's massive gravitational field.

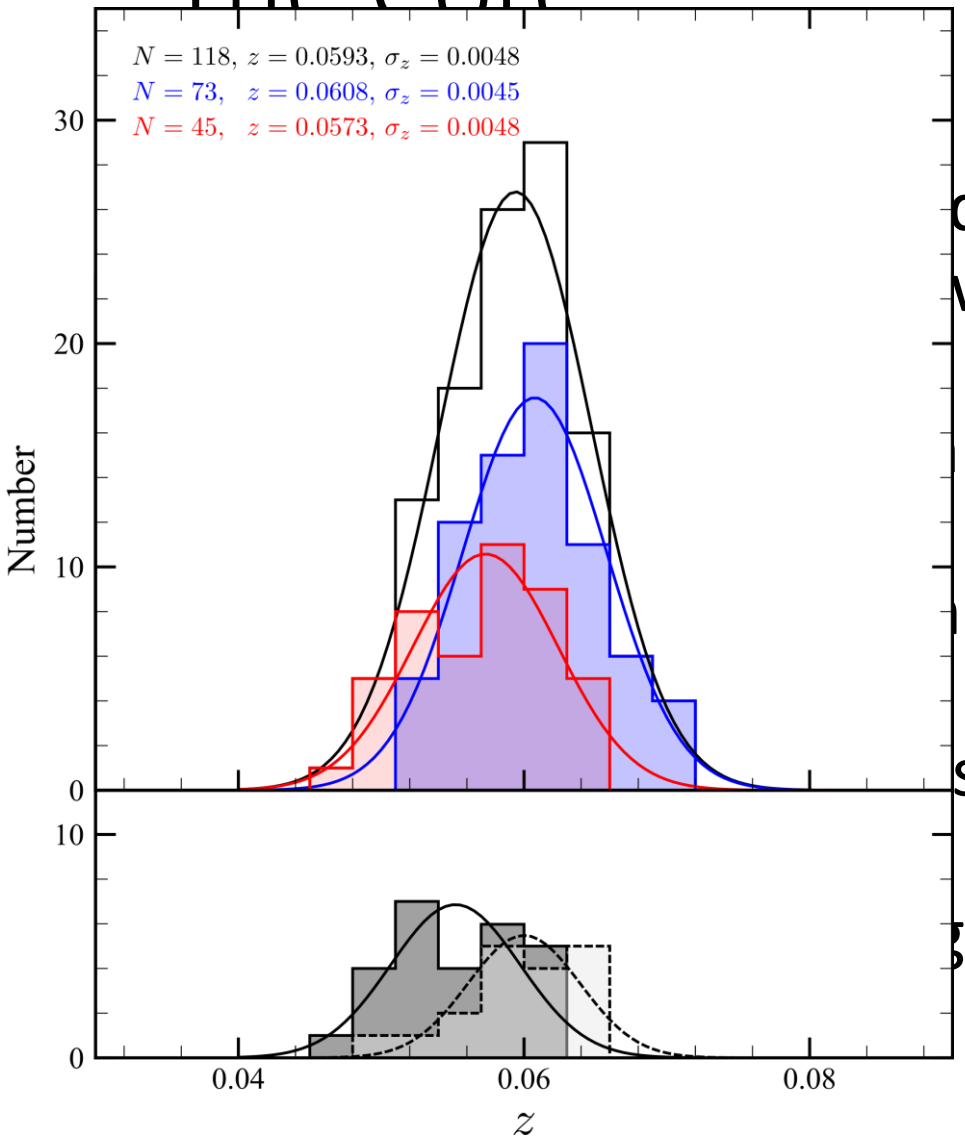


The Core

In the DBSCAN analysis, a population of 118 galaxies in the core region were separated from surrounding groups and filaments. This population represents an elongated structure aligned with the X-ray gas morphology, which is typically found in the clusters in a merger process. To detect possible substructure in this population of galaxies the Lee3D test was performed.



The Core



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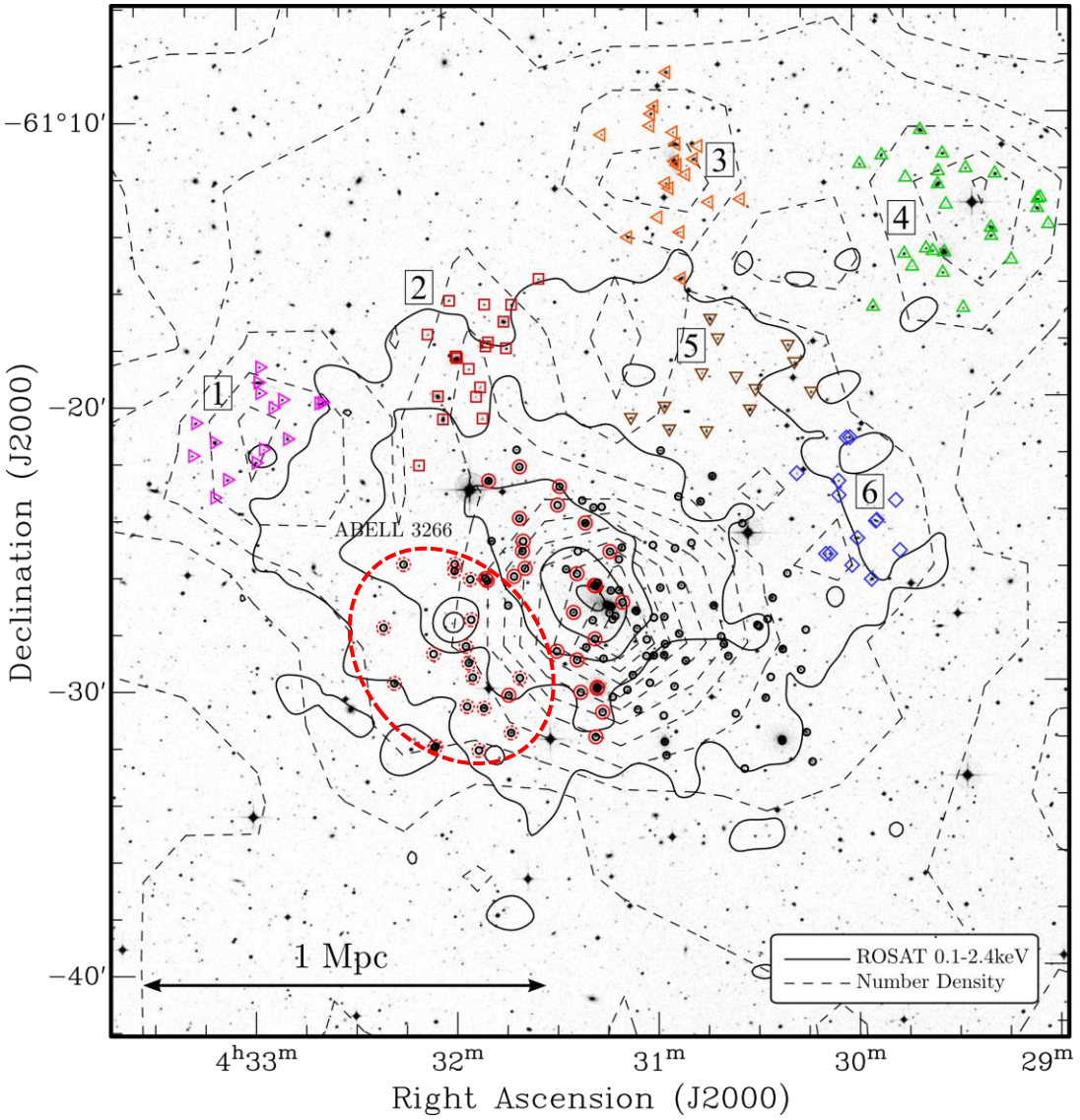


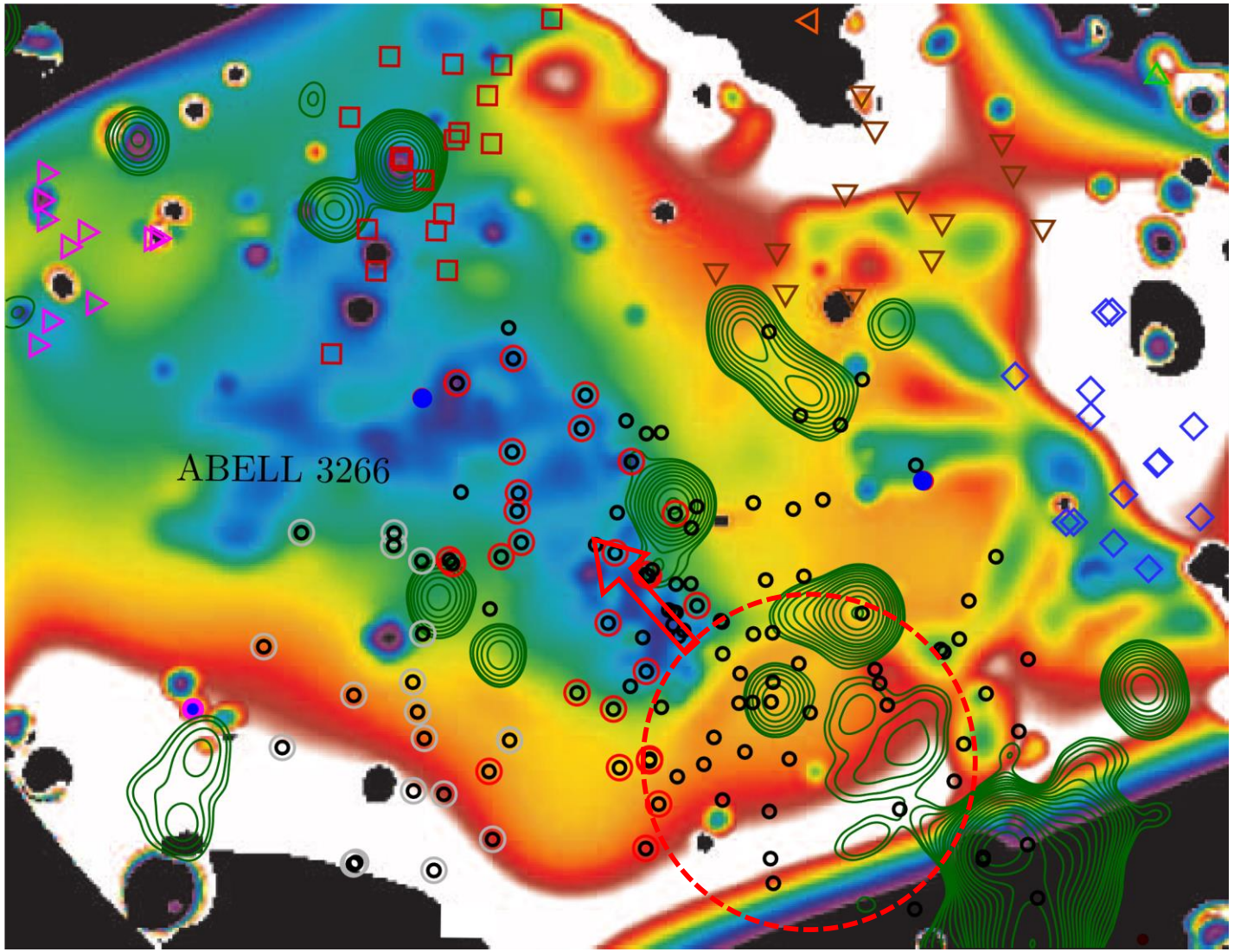
Spectroscopic Analysis: Overview & Facts

- There are six high velocity structures surrounding the cluster core.
- From the Lee-Fitchett analyses we find that the core is decomposed into two major components, of which the northeastern one further breaks up into two parts.
- The majority of the galaxies in the eastern component of the northeast subgroup are located on the edge of the X-ray emission

What do these mean?

A3266 is a really complicated system.

What Is Going on?



Finoguenov et al., *The Astrophysical Journal*, **643**, pp. 790-796.

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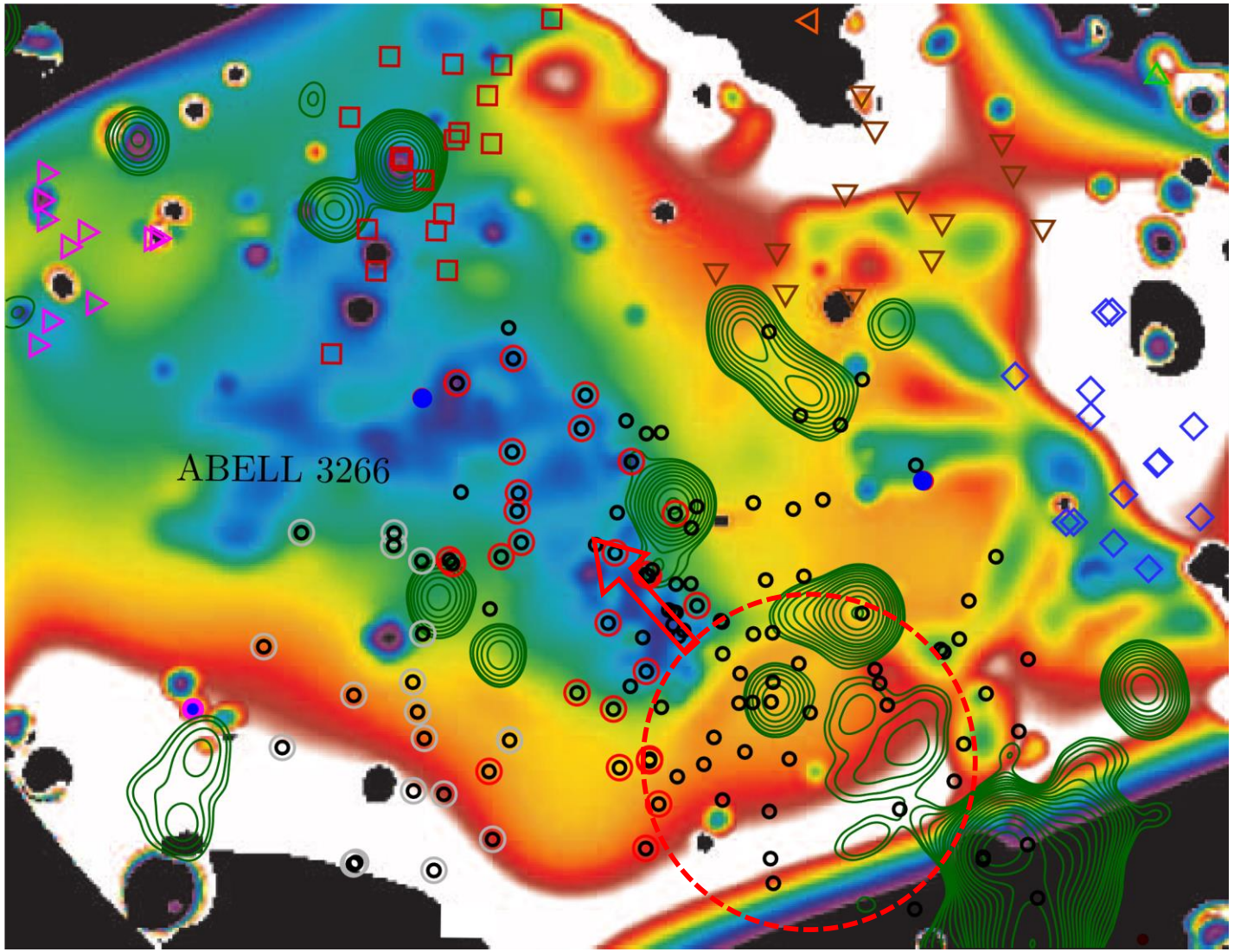

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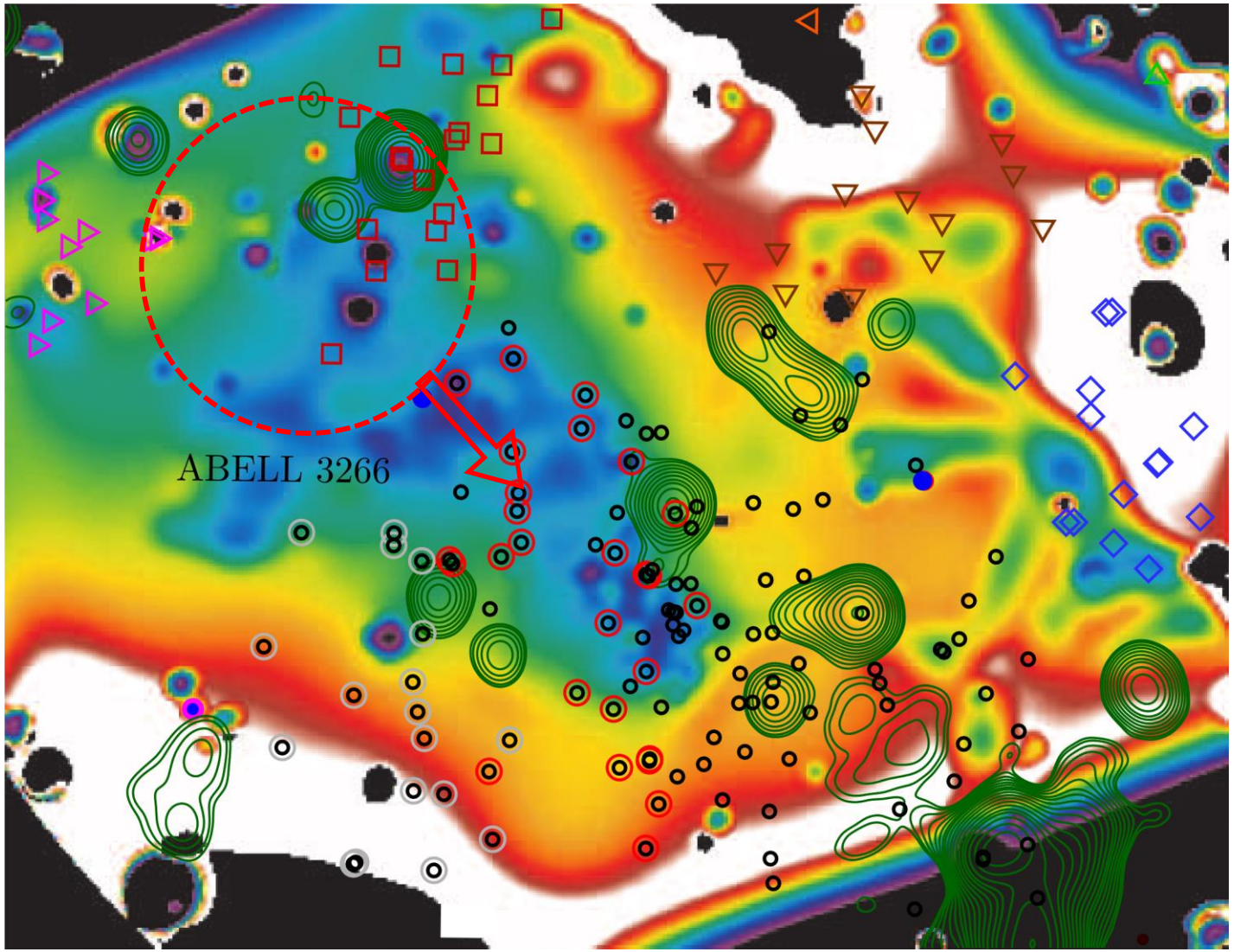

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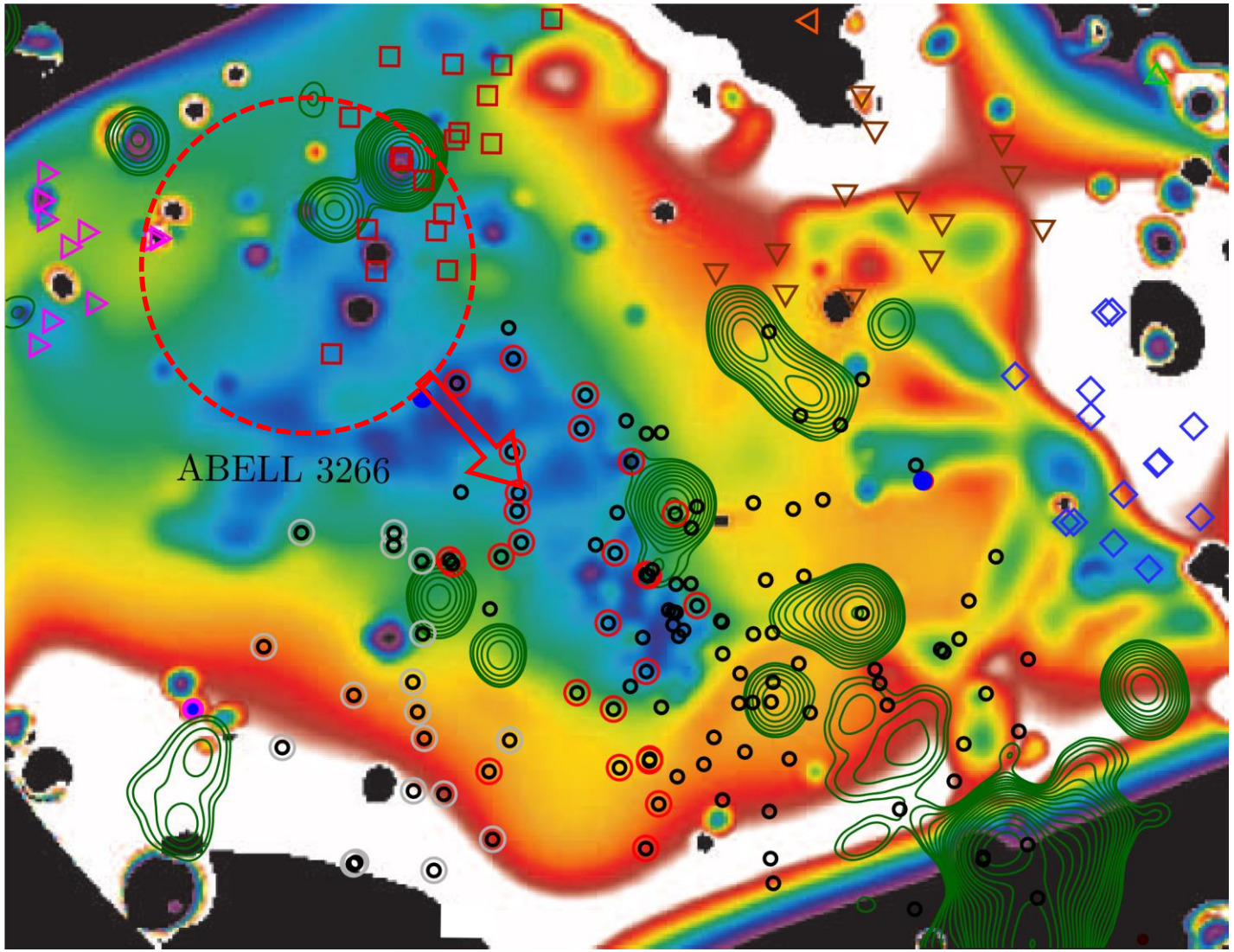

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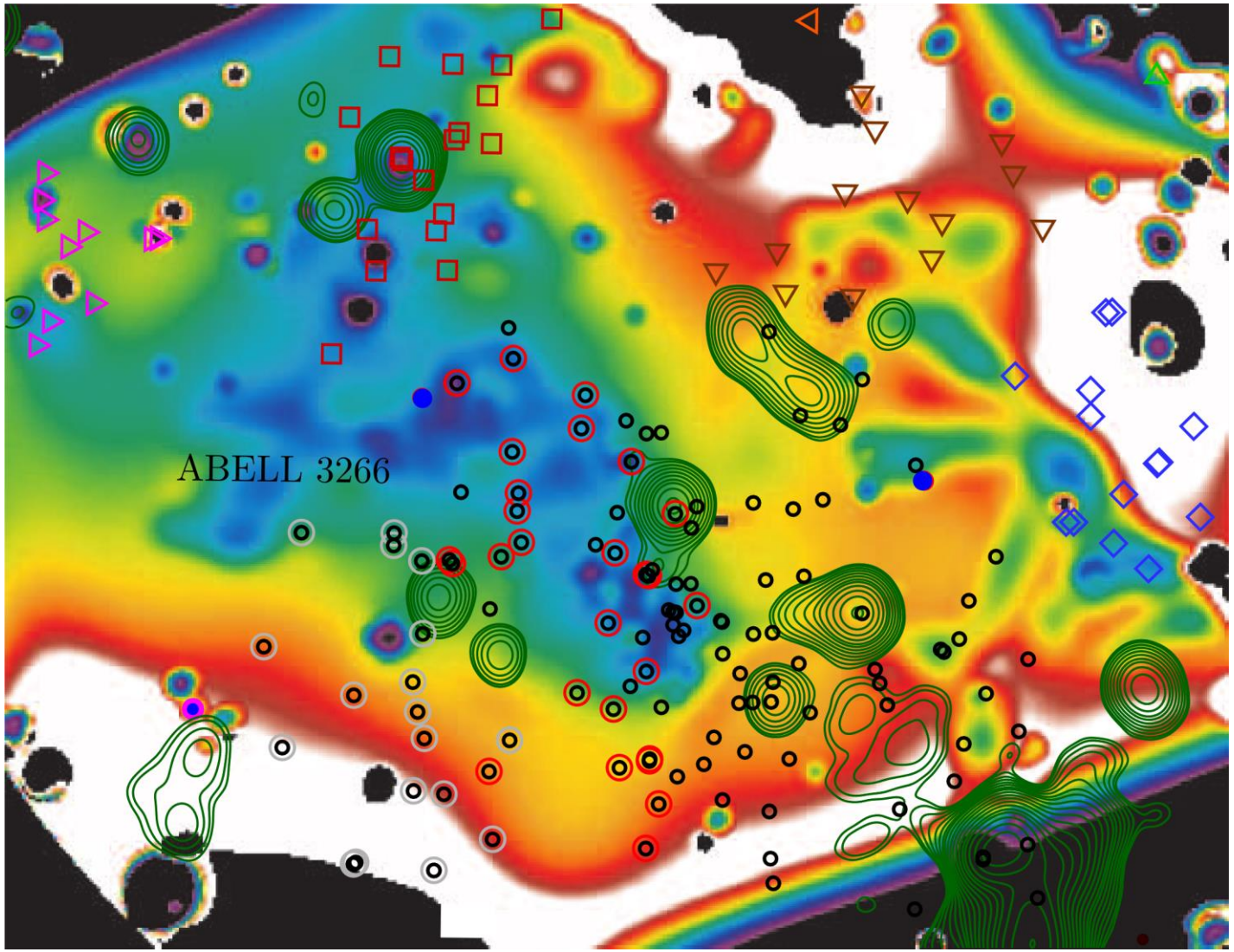

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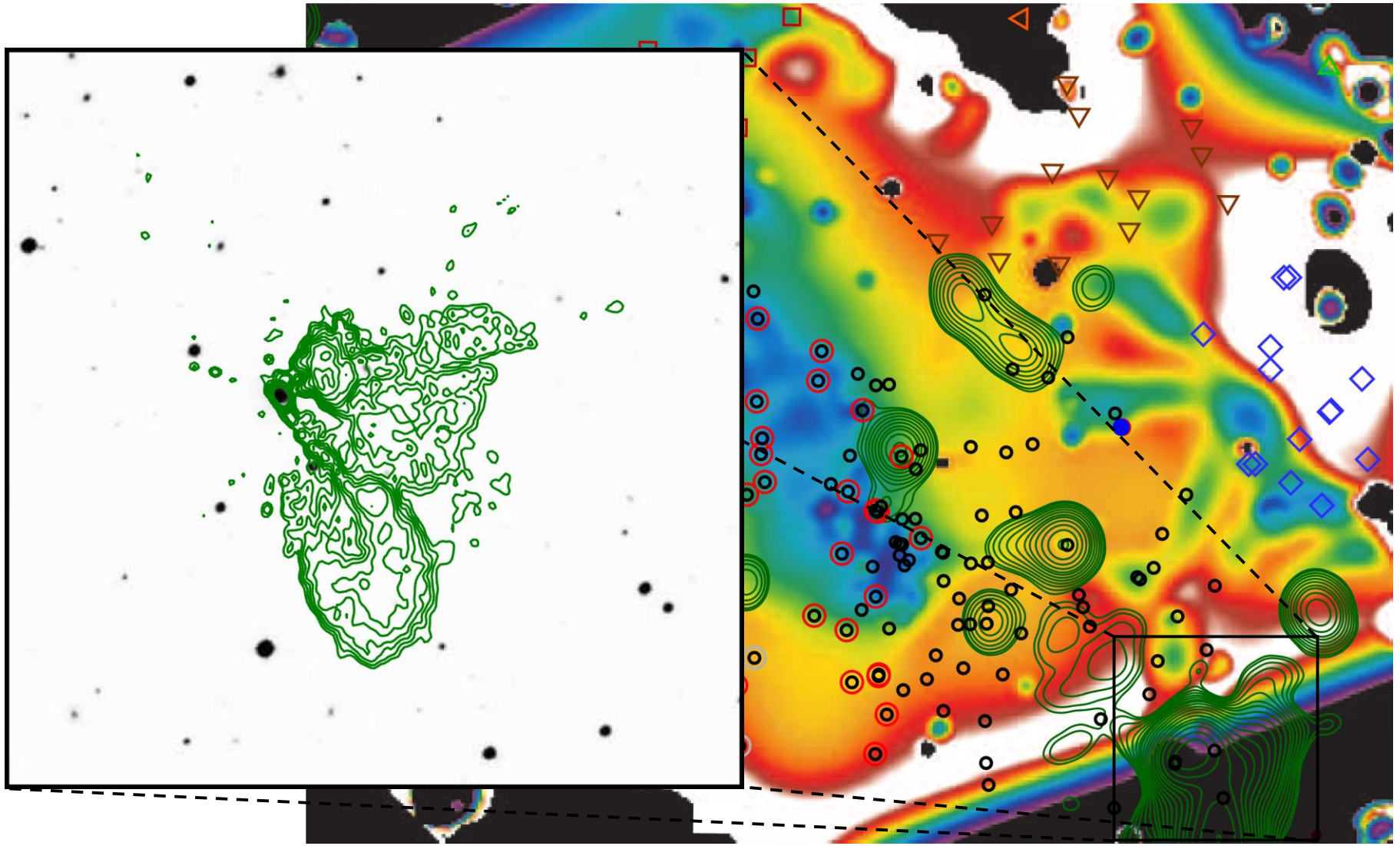

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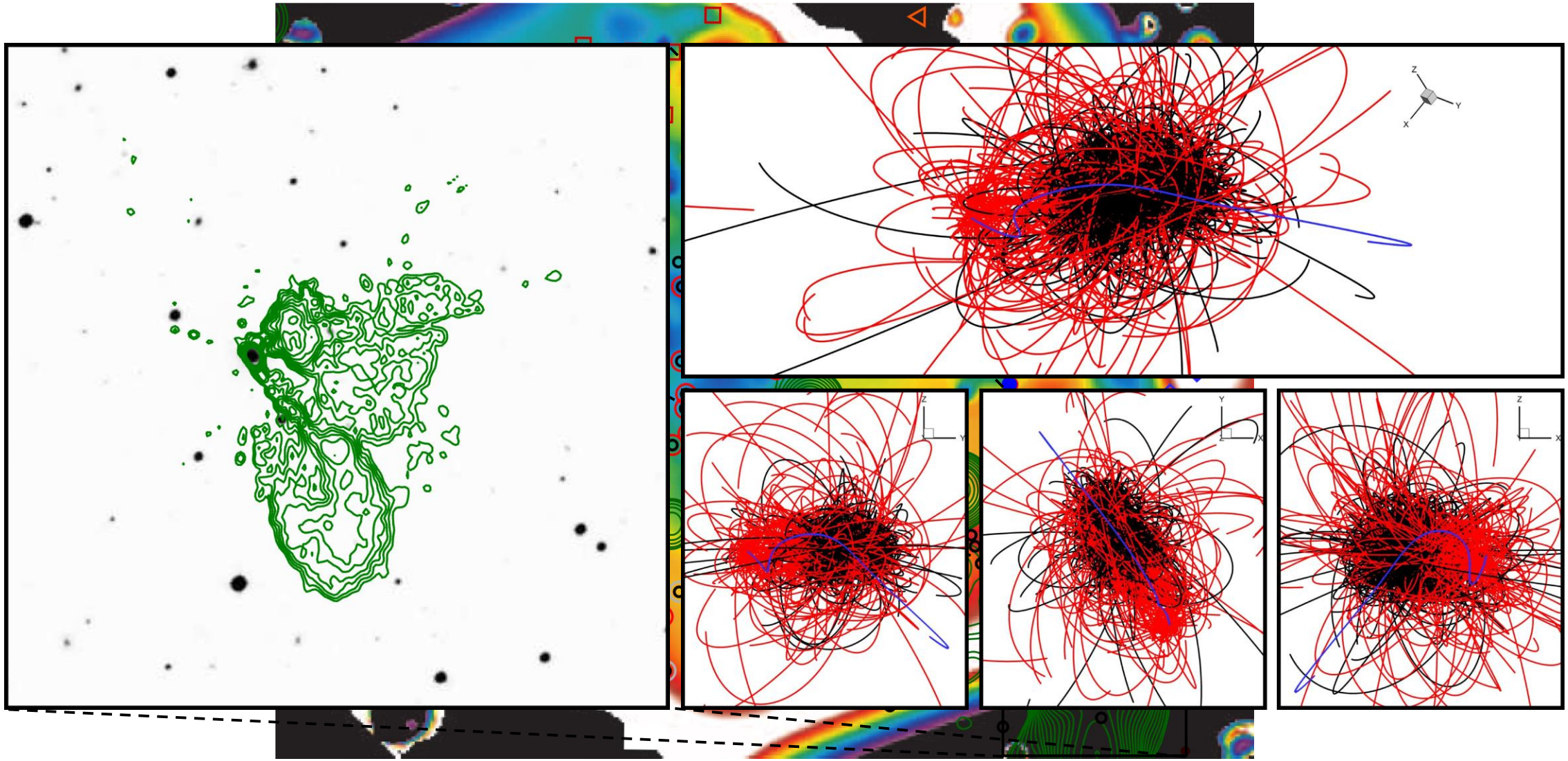

Final Thoughts

- Abell 3266 is an extremely complex system, and a definitive decision on the cluster dynamics requires proper ICM + Galaxy + Dark Matter simulations.
- (Tailed) radio galaxies can be used to determine the dynamics of their environments.
- Physics works ☺

Thank You!