



Contribution ID : 66

Type : **Contributed talk**

Finding the boundary: Using galaxy membership to inform galaxy cluster extent through machine learning

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The spatial extent of the environment's impact on galaxies marks a transitional region between cluster and field galaxies. We present a data-driven method to identify this region in galaxy clusters with masses $M_{200,\text{mean}} > 10^{13} M_{\odot}$ at $z = 0$. Using resolved galaxy samples from the largest simulation volume of IllustrisTNG (TNG300-1), we examine how galaxy properties vary as a function of distance to the closest cluster. We train neural networks to classify galaxies into cluster and field galaxies based on their intrinsic properties. Using this classifier, we present the first quantitative and probabilistic map of the transition region. It is represented as a broad and intrinsically scattered region near cluster outskirts, rather than a sharp physical boundary. This is the physical detection of a mixed population. In order to determine transition regions of different physical processes by training property-specific models, we categorise galaxy properties based on their underlying physics, i.e. gas, stellar, and dynamical. Changes to the dynamical properties dominate the innermost regions of the clusters of all masses. Stellar properties and gas properties, on the other hand, exhibit transitions at similar locations for low mass clusters, yet gas properties have transitions in the outermost regions for high mass clusters. These results have implications for cluster environmental studies in both simulations and observations, particularly in refining the definition of cluster boundaries while considering environmental preprocessing and how galaxies evolve under the effect of the cluster environment.

Did you give a contributed talk at CASCA 2026?

No

If you are selected for a poster, would you be interested in giving a short flash talk on your work?

Yes

What is your career level?

PhD

Which keyword describes the area of focus of this talk?

Galaxies

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