Understanding galaxy clusters with Contrastive Learning

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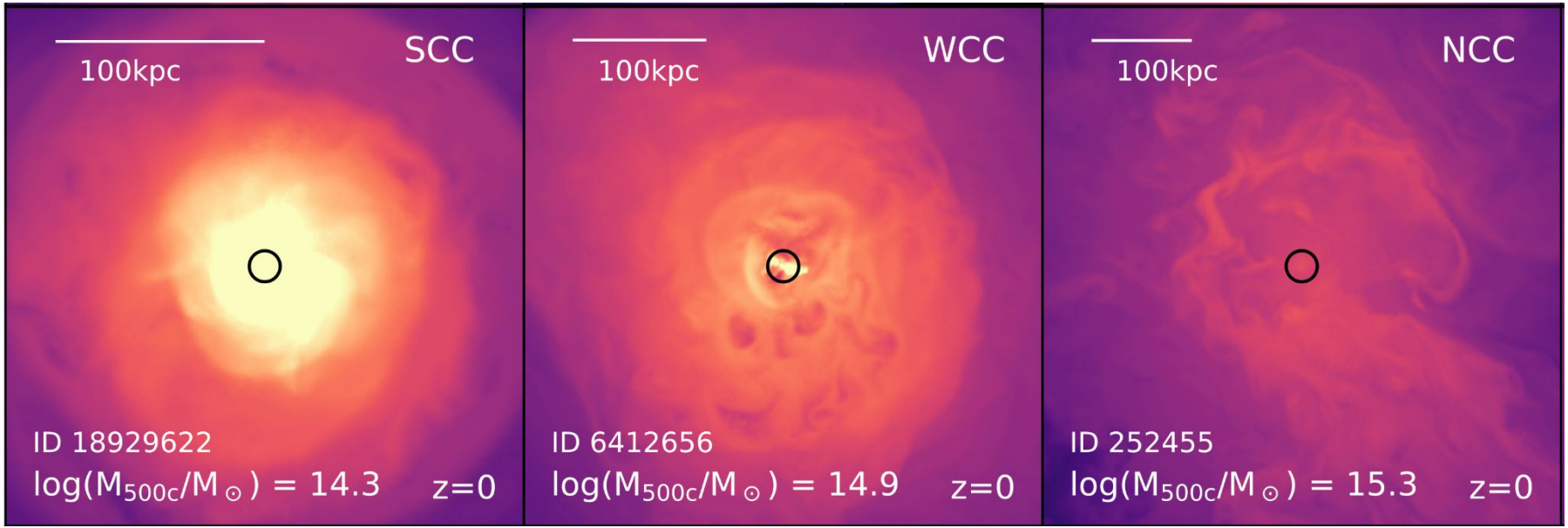
Clusters are very diverse

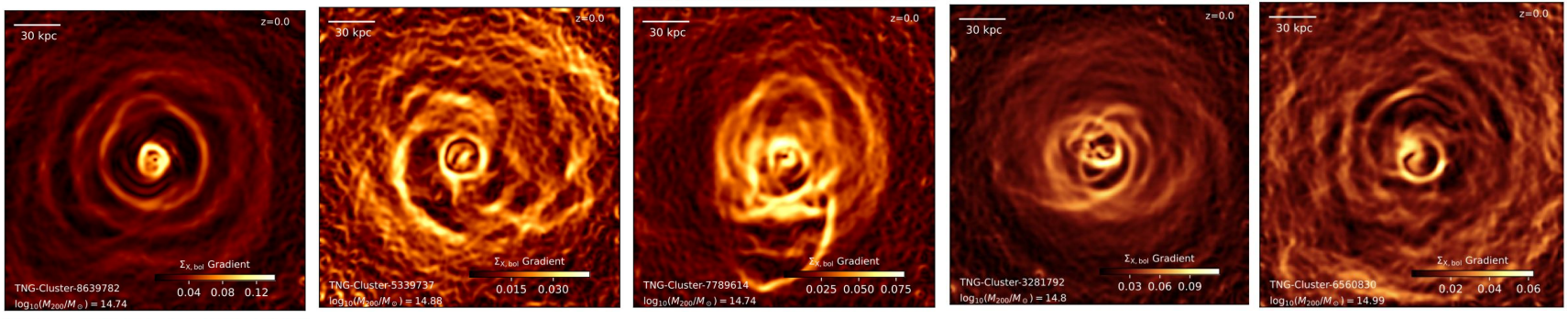
They have a wide variety of core thermodynamic profiles



Lehle+ 2024

Clusters are very diverse

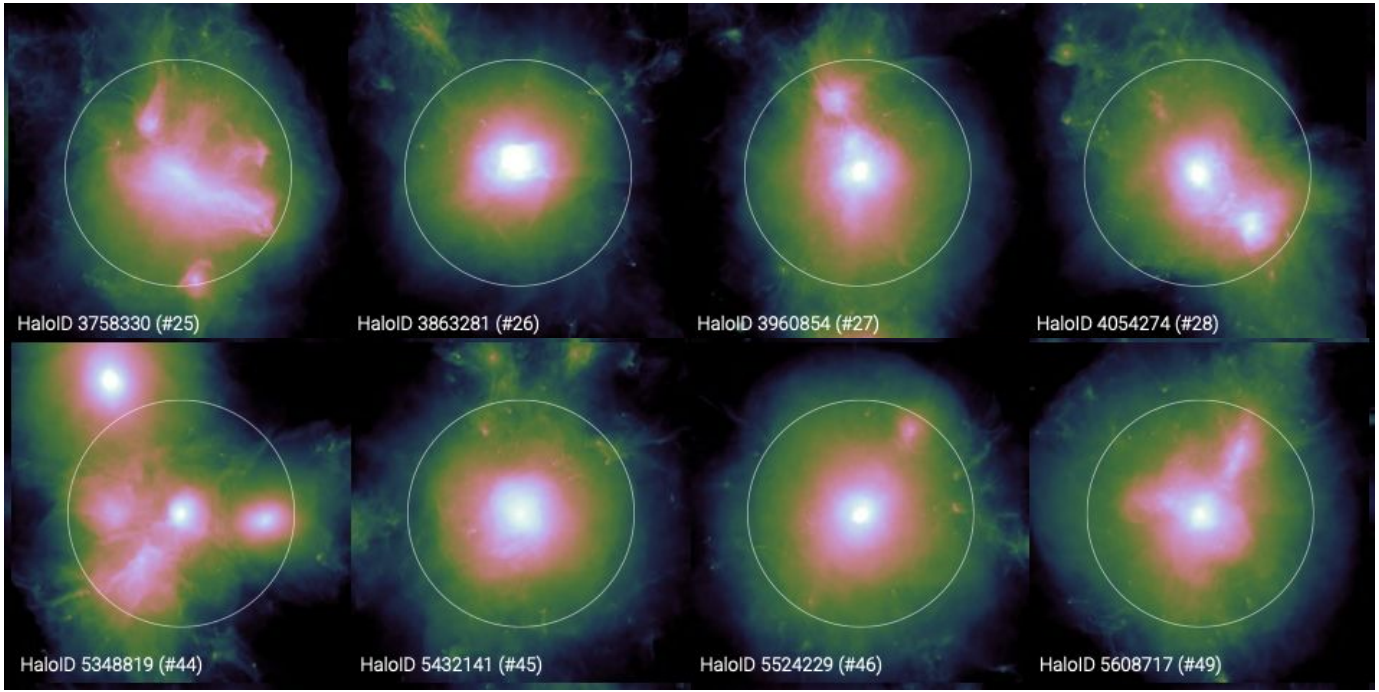
They have a wide variety of histories of AGN activity, in different phases



Truong+ 2024

Clusters are very diverse

They can be in very different stages of merging



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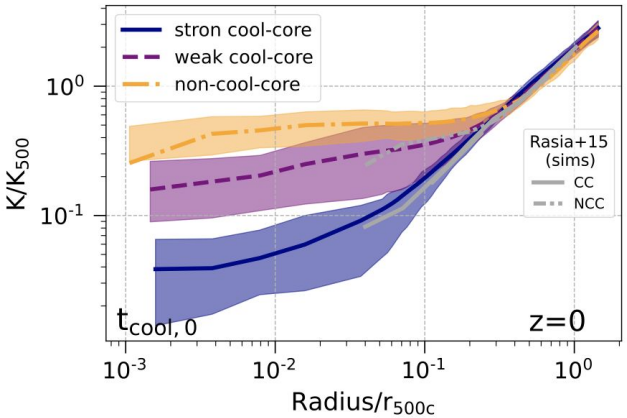
Clusters are very diverse

We try to characterise them in scalars or azimuthally averaged profiles



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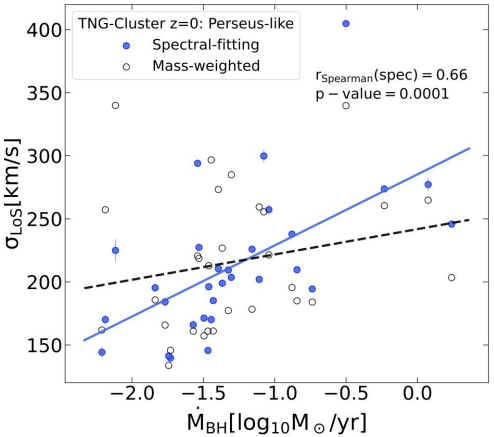

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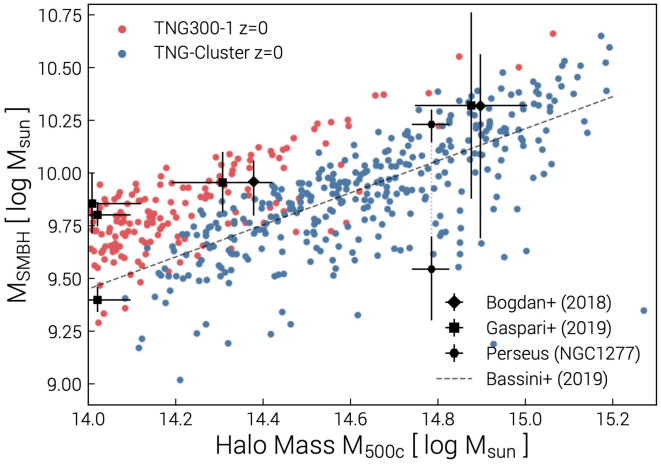

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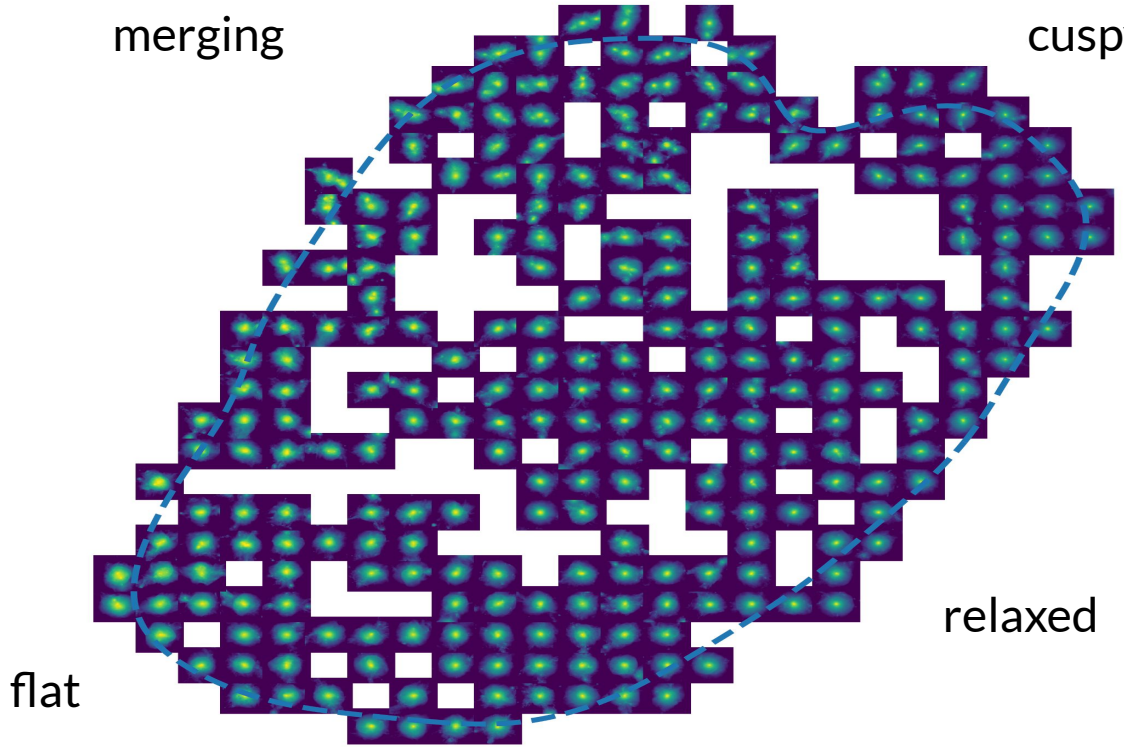
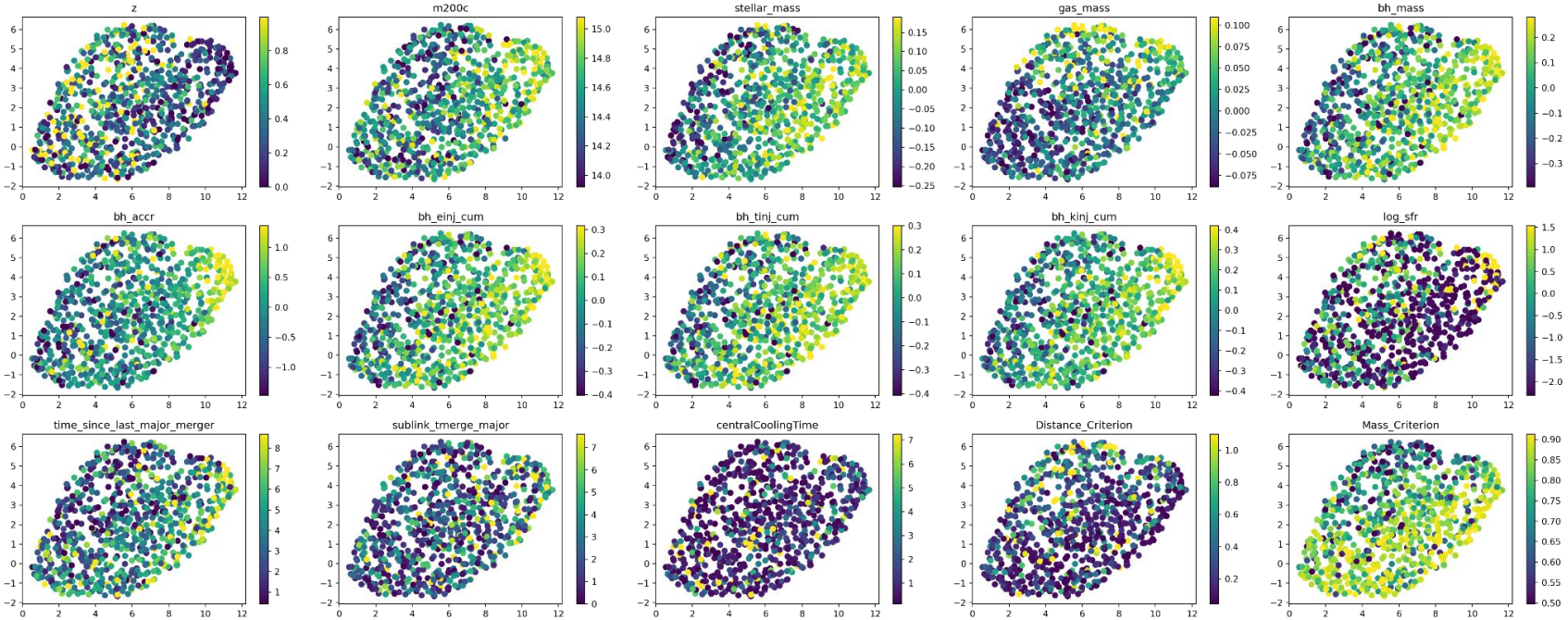
So what can we learn from cluster images?

2. We can sort the cluster images by similarity and identify cluster populations in image space



So what can we learn from cluster images?

2. The image-based sorting retains a lot of information about cluster mass, feedback and merger history - *even after correcting for halo mass*



Understanding correlations between feedback, mergers, and cluster cores

2. The image-based sorting retains a lot of information about cluster mass, feedback and merger history - *even after correcting for halo mass*

The median values of feedback, merger and cool-coreness metrics are more correlated with each other in similar regions of the representation space (bottom) than without image-based sorting (above)