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Unsupervised classification reveals new evolutionary pathways

While we already seem to have a general scenario of the evolution of different types of galaxies, **a complete and satisfactory understanding of the processes that led to the formation of all the variety of today's galaxy types is still beyond our reach**. To solve this problem, we need both large datasets reaching high redshifts and novel methodologies of dealing with them.

The statistical power of the *VIPERS* survey which observed ~90,000 galaxies at z>0.5 and the application of an **unsupervised** FEM clustering algorithm allowed us to select 12 galaxy classes at z~1: 3 passive, 3 intermediate, 5 star-forming, and a class of broad-line AGNs. Physical properties - in particular, those which were not used for classification purposes - of all these subtypes differ from each other, and the transition between different subtypes is not smooth.

Studies of environmental dependence indicate that **the FEM classification may actually reflect different evolutionary paths of diff of passive, star-forming, and intermediate subtypes of galaxies**. For instance, the most passive class of red galaxies, residing in dense environments is the most compact and ~20% smaller than other red galaxies of a similar stellar mass. This indicates that **unsupervised machine-learning techniques were able to automatically distinguish a rare population of red nuggets**, a population of red compact galaxies that avoid merger processes and give us a unique opportunity to study the formation and evolution of red galaxies. In my talk, I discuss the clustering methodology and emerging scenarios of galaxy evolution.

Main Topic

Supervised/Unsupervised/Semi-supervised Learning

Secondary Topic

Classification and regression

Participation mode

In person

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Session Classification: Unsupervised Learning and Pattern Discovery