Contribution ID: **26** Type: **Oral Presentation**

Unsupervised classification reveals new evolutionary pathways

Tuesday, 31 May 2022 09:50 (20 minutes)

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 different subclasses 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.

Presenter: SIUDEK, Malgorzata (IFAE, Barcelona)

Session Classification: Unsupervised Learning and Pattern Discovery