Title:
Probing the Universe with galaxy clusters: the special case of exotic strong lensing

Abstract :
Strong gravitational lensing is a powerful tool for investigating the universe's large-scale structure and understanding the properties of dark matter and dark energy. The magnification and distortion of distant background sources by strong lenses produced by galaxy clusters have enabled us to study them in unprecedented detail, making them promising candidates for precision cosmology.

While classic strong lenses are well-understood, much remains to be explored for exotic lenses, which produce unique telescopic effects and uncommon images when very precise geometrical conditions are verified looking at the source-cluster system. In this talk, I will focus on these special and rare lenses, trying to characterize their structures, their identification and their density.

Specifically, the objective is to develop a numerical approach for detecting these configurations from the convergence and shear maps, with the aim of refining existing galaxy cluster models using the unique observational constraints provided by these exotic lenses.

Another challenge is to estimate, simply and quickly, the predisposition of a cluster to produce exotic images. In preparation for current and future large surveys (JWST, EUCLID), I will present a new statistical method for selecting the most favorable clusters for the formation of exotic images. This will help to efficiently follow-up these intriguing objects, which open new doors to our understanding of the Universe's large-scale structures.