Thesis subject

Laboratory : LAM

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Title of the thesis subject : Testing dark matter with joint analysis of kinematics, strong and weak lensing data from DESI and Euclid

Description of the thesis subject :
Numerical simulations predict that the inner profile of overdensities, and the mass function of subhalos are observables sensitive to the nature of dark matter (Robertson et al. 2019, Bose et al. 2017). Unfortunately, these observables are also affected by baryonic physics, although in a different manner. For instance, axion-like particles produce a flat DM inner profile (Schive et al. 2014) and prevent the formation of low-mass halos. In contrast, baryons might counter act these effects, and result in observables very similar to the standard cold DM.
DESI and Euclid are currently surveying a large fraction of the sky, thus providing the largest sample of galaxies ever characterized in spectroscopy, photometry and morphology.
In this thesis, we will measure the inner density profile and the subhalo mass function of galaxy groups, for which DESI spectroscopy of the central galaxy is available, strong lensing arcs have been detected, and weak lensing is available from Euclid observations.
We will use a simulation-based inference method as well as machine learning accelerating techniques to test different models of dark matter and baryon physics, following the seminal work of Sonnenfeld et al. 2021.

References :
Robertson et al. 2019, https://arxiv.org/abs/1810.05649
Bose S. et al. 2017, https://arxiv.org/abs/1604.07409
Schive et al. 2014, https://arxiv.org/abs/1406.6586
Sonnenfeld, Cautun et al. 2021, https://arxiv.org/abs/2102.08973