Cosmic filaments around galaxy clusters

On large scale, the galaxy distribution forms a complex network, the so-called the cosmic web. At the intersection of cosmic web filaments, at the nodes, are found clusters of galaxies.
Cosmological simulations predict that after their initial collapse at z>1-1.5, galaxy clusters keep accreting matter along cosmic web filaments through cosmic time.

This impacts galaxy properties in galaxy clusters. It was found in simulations (Old et al. 2018) that the mass-richness scaling relation is different in *relaxed* clusters compared to *disturbed* ones. Such effects are however poorly constrained using observations so far.

In this talk, I will present the effort of our team towards using the DisPerSE algorithm (Sousbie 2011) to reconstruct cosmic filaments around galaxy clusters in current and upcoming large spectroscopic and photometric surveys.
I will present our methodology and its validation using mock data, focusing on our forecast for the detectability of cosmic filaments in cluster's vicinity in the upcoming Euclid data at $0.2 < z < 1.8$.

I will then discuss preliminary results obtained on real data at lower redshift, where we selected a sample of 100 X-ray detected galaxy clusters at $z < 0.1$ located in the SDSS footprint from the XCLASS survey (Koulouridis et al., 2021).
Cosmic filaments detected with DisPerSE in the SDSS (Kraljic et al., 2020; Malavasi et al., 2020) allow us to correlate galaxy cluster properties with their connectivity to their surrounding cosmic web.

Bibilography

Koulouridis et al., 2021, A&A, 652, 12
Kraljic et al., 2020, MNRAS, 491, 4294
Malavasi et al., 2020, A&A, 642, 19
Old et al. MNRAS, 475, 853
Sousbie, 2011, MNRAS, 414, 350