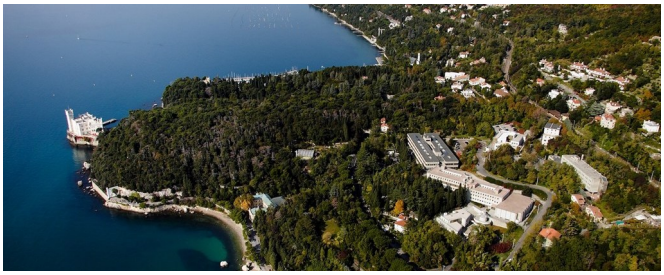

Contribution ID: **124** Type: **not specified**

Cosmology with multiple halo sparsities

Monday 28 August 2023 16:15 (25 minutes)

The dark matter halo sparsity, i.e. the ratio between spherical halo masses enclosing two different overdensities, provides a non-parametric proxy of the halo mass distribution which has been shown to be a sensitive probe of the cosmological imprint encoded in the mass profile of haloes hosting galaxy clusters. Mass estimations at several overdensities would allow for multiple sparsity measurements, that can potentially retrieve the entirety of the cosmological information imprinted on the halo profile. Here, we investigate the impact of multiple sparsity measurements on the cosmological model parameter inference. For this purpose, we analyse N-body halo catalogues from the Raygal and M2Csims simulations and evaluate the correlations among six different sparsities from Spherical Overdensity halo masses at Δ =200/500/1000 and 2500 (in units of the critical density). Remarkably, sparsities associated with distinct halo mass shells are not highly correlated. This is not the case for sparsities obtained using halo masses estimated from the Navarro-Frenk-White (NFW) best-fit profile, which artificially correlates different sparsities to order one. This implies that there is additional information in the mass profile beyond the NFW parametrisation and that it can be exploited with multiple sparsities. In particular, from a likelihood analysis of synthetic average sparsity data, we show that cosmological parameter constraints significantly improve when increasing the number of sparsity combinations, though the constraints saturate beyond four sparsity estimates. We forecast constraints for the CHEX-MATE cluster sample and find that systematic mass bias errors mildly impact the parameter inference, though more studies are needed in this direction.

Presenter: LE BRUN, Amandine

Session Classification: Parallel