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QSO clustering with the SDSS-IV eBOSS survey

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Summary

The eBOSS multi-object spectrograph has undertaken a survey of Quasars (QSO) in the almost unexplored redshift range $0.9 < z < 2.2$. It will track both the Baryonic Acoustic Oscillations (BAO) and the Redshift Space Distortions (RSD) of the 2-point correlation function to extract cosmological information on the geometry of the universe and the nature of dark energy. In particular, it will measure the growth rate of structures and allow for a test of general relativity modifications and dark energy scenarios. Indeed, at the redshift range of the eBOSS QSO sample, any deviation from general relativity predictions on the growth rate of structures would start being a powerful discriminant between different modified gravity models such as the Galileon. The eBOSS survey started 2 years ago and preliminary results will be presented.

To perform this measurement, special care should be given to the RSD model. The most popular model is the Gaussian Streaming model which convolutes a pairwise velocity probability distribution function (PDF) assumed to be Gaussian with the real space correlation function. In this talk, I will present one of the most recent RSD model based on Convolution Lagrangian Perturbation Theory (CLPT) and its applicability for the QSO tracer.

CLPT provides predictions on velocity and real-space clustering statistics that need to be tuned on N-body simulations. Moreover, the halo occupancy distribution of QSO in dark matter halos which links the properties of galaxies with the ones of their hosted dark matter halos can be investigated and we will examine at which scale this model is valid in the redshift range of eBOSS. In addition, we resort to mock catalogues as a benchmark of our analysis and more specifically to estimate the matrix describing the expected covariance of our measurement.

Finally, recent studies started involving small scales where non-linear evolution has to be taken into account. This will enlarge the range of scales and hence reduce the statistical error. This task is not easy since different scale-dependent effects have to be considered, so it complicates a lot the possibility to have an unique model which describes the distortions in the clustering pattern at all scales. One way of improving RSD models would be to use the N-body simulations to find the relevant quantities to be injected in the description of the full infall velocity PDF such as local environment parameters. Going in that direction, I will present an attempt to parametrize this PDF and then, using a specific streaming model, we plan to quantify the difference with the Gaussian Streaming Model.

Primary author: ZARROUK, Pauline (CEA)

Presenter: ZARROUK, Pauline (CEA)

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