ID de la contribución : **70** Tipo : **Oral presentation**

AMICO galaxy clusters in KiDS-1000: cosmological constraints from the two-point correlation function

martes, 15 de septiembre de 2026 12:15 (25)

We study the clustering of an optically identified galaxy cluster catalogue from the fourth data release of the Kilo Degree Survey (KiDS-1000). The photometric sample was identified by the Adaptive Matched Identifier of Clustered Objects (AMICO) algorithm and consists of 9049 clusters with $S/N \geq 3.5$, in redshift range $0.1 \leq z < 0.8$, spread over an effective area of 838.78 deg^2. They are selected according to their observed intrinsic richness, with thresholds of $\lambda^*_{\rm ob} \geq 20 - 25 - 30$ within $0.10 \leq z < 0.30$, $0.30 \leq z < 0.45$ and $0.45 \leq z < 0.80$, respectively. We measure the multipoles of the two-point correlation function over a variable range of scales from 5 Mpc h^{-1} to 150 Mpc h^{-1}. We model the clustering signal in the context of the Λ-Cold Dark Matter cosmology, accounting for the main observational systematics, such as geometric and redshift-space distortions, and photo-z uncertainties. The effective bias of the cluster sample is estimated via a mass-richness scaling relation, calibrated in a previous work through a joint modeling of weak gravitational lensing and cluster abundance measurements. For the Markov Chain Monte Carlo (MCMC) analysis, we adopt Gaussian priors on the parameters of the mass-richness relation, and broad, uniform priors to derive cosmological constraints on the matter density parameter, the power spectrum amplitude and the structure growth parameter, $S_8 \equiv \sigma_8 \sqrt{\Omega_{\rm m}/0.3}$. Specifically, we find $\Omega_{\rm m} = 0.25^{+0.02}_{-0.02}$, $\sigma_8 = 0.89^{+0.11}_{-0.11}$ and $S_8 = 0.81^{+0.08}_{-0.08}$, representing an improvement over both the 2D and 3D clustering analyses performed on the previous KiDS data release. These results are also in 1σ agreement with the KiDS-1000 number counts constraints derived from the same catalogue, as well as with external early- and late-Universe data sets. Our work strengthens the cluster clustering as a competitive and complementary probe, to be included in the final KiDS-Legacy cluster cosmological analysis, and for other ongoing and future photometric redshift surveys.

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Clasificación de la sesión : Morning Session (Tuesday)