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The NIKA2 Sunyaev-Zeldovich Large Program: precise galaxy cluster physics for an accurate cluster-based cosmology

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Current cosmological studies based on clusters of galaxies are limited by the accuracy with which the mass of these objects can be inferred. The Sunyaev-Zel'dovich (SZ) effect is a direct probe of the thermal pressure of the Intra-Cluster Medium (ICM). When combined with X-ray data, the SZ effect can also provide a valuable measure of the mass of the galaxy clusters under the hydrostatic equilibrium assumption. With an angular resolution comparable to that of the XMM-Newton space observatory, NIKA2 will unveil the pressure distribution of the ICM and will allow the full deployment of combined SZ and X-ray methods to infer the hydrostatic mass.

The Guaranteed-Time SZ Large Program (LP-SZ) is dedicated to the high-angular resolution SZ mapping of a representative sample of 45 galaxy clusters drawn from the SZ-selected catalogues of the Planck satellite, or of the Atacama Cosmology Telescope. The LP-SZ sample spans a mass range from 3 to $11 \times 10^{14} M_{\odot}$ and a redshift range from 0.5 to 0.9 , extending to higher redshift and lower mass the previous samples dedicated to the cluster mass calibration and universal properties estimation. The main goals of the LP-SZ are the measurement of the average radial profile of the ICM pressure up to R_{500} by combining NIKA2 with Planck or ACT data, and the estimation of the scaling law between the SZ observable and the mass using NIKA2, XMM-Newton and Planck/ACT data. Furthermore, combining LP-SZ data with existing or forthcoming public data in lensing, optical/NIR or radio domains, we will build a consistent picture of the cluster physics and further gain knowledge on the mass estimate as a function of the cluster morphology and dynamical state. In this talk, I will present the LP-SZ, the recent results obtained within this framework, the status of the observation and analysis, and the future implication for cosmology with galaxy clusters.

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