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NIKA2: a mm camera for cluster cosmology

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Clusters of galaxies are unique cosmological probes sensitive to the primordial density fluctuations, and the expansion history and energy content of the Universe. The thermal Sunyaev-Zeldovich (tSZ) effect is an observable of choice for cluster cosmology due to the low scatter in the relationship between SZ flux and cluster mass, and the construction of large tSZ selected cluster catalogs by Planck, ACT and SPT. However, there exists a weak discrepancy between cluster and CMB cosmological constraints, which may be due to bias in the observable-mass relation. Physical processes at play in clusters may be at the origin of this bias and could affect more importantly high redshift clusters. Thus, accurate cluster cosmology requires detailed mapping of the cluster emission from the core to the outskirts.

This is the purpose of the NIKA2 tSZ large program, aiming at mapping a representative sample of 50 tSZ selected high redshift clusters, $0.5 < z < 1.0$, for a total of 300 hours of observation. NIKA2 is a dual-band camera made of 2680 KIDs operating at 150 and 260 GHz, installed at the IRAM 30 m telescope, with a FOV of $6.5'$, and $18''$ and $12''$ resolution at 150 and 260 GHz. With such instrumental capabilities NIKA2 is a unique instrument for tSZ observations making possible high sensitivity mapping of high redshift clusters in a few hours. The main output of the NIKA2 tSZ program will be the study of the redshift evolution of the cluster pressure profiles as well as that of the scaling laws relating the cluster global properties. X-ray observations of the NIKA2 cluster sample obtained with the XMM Newton satellite will be also used.

We will review current cluster cosmology results and describe the NIKA2 instrument and its prototype NIKA1. We will illustrate the NIKA2 tSZ capabilities using recent NIKA1 results in a pilot sample of high redshift clusters. Finally, we will present the NIKA2 tSZ LP, synergy with the X-ray observations, and cosmological perspectives.

Experimental Collaboration

NIKA2

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