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Galaxy Cluster Cosmology: the need for high-angular resolution follow-up studies

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Upcoming optical/IR surveys will have both the sensitivity and the area to push cluster detection to $z > 2$. The $Euclid$ and LSST cluster catalogs will contain of the order of $100,000$ cluster detections, which is two orders of magnitudes more than the number of clusters detected by $Planck$. As the largest gravitationally bound systems in the universe, galaxy clusters provide a low-redshift cosmological probe that is complementary to BAO, SN Ia, and CMB. Thus, it will be essential to use these objects to alleviate inherent degeneracies between cosmological parameters estimated with each individual probe and to unveil potential new limits of the standard cosmological model that are hitherto not significant. This will only be feasible if all sources of systematic uncertainties associated with cluster cosmological constraints are characterized in details. In particular, the mass-richness relation and the halo mass function are both key ingredients driving the size of the final cosmological contours. The high-angular resolution SZ and X-ray follow-up of $Euclid$ and LSST richness-selected clusters will enable investigating the Intra-Cluster Medium properties at high redshift and improve our understanding of cluster formation. Such studies will be fundamental to precisely calibrate the mass-richness relation and the sub-grid physics in the numerical simulations used to infer the halo mass function.

I will present the on-going SZ/X-ray follow-up program of 10 high redshift clusters (z > 1) selected from the MaDCoWS and IDCS optical/IR surveys and its main goals. I will then describe the characterization of the first cluster of this sample: the very massive, high redshift, and morphological disturbed cluster MOO J1142+1527 from the first joint analysis of Chandra and NIKA2 data.

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