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Luca Di Mascolo - Detection of forming intracluster gas in a galaxy protocluster at $z \sim 2.16$

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Until now, direct observations of the intracluster medium (ICM) have been limited only to mature clusters in the latter three-quarters of the history of the Universe, and we have been lacking a direct view of the hot, thermalised cluster atmosphere beyond $z \sim 2$, the epoch when the first massive clusters formed. Probing the thermal evolution of cosmic structures through $z \sim 2$ —the epoch when intracluster gas starts to assemble and virialise, and cosmic star formation and the activity of active galactic nuclei (AGN) manifest a concurrent peak —is however crucial for exploring the link between galaxy clusters and their over-dense progenitors, as well as finding the observational fingerprint of feedback effects that regulate the later coevolution of the galaxy and intracluster/circumgalactic medium ecosystems. In my talk, I will present our recent detection of the thermal Sunyaev-Zeldovich (SZ) effect in the direction of the protocluster complex surrounding the famous Spiderweb Galaxy ($z \sim 2.16$), made possible only thanks to the superior capabilities of the Atacama Large Millimeter/Submillimeter Array (ALMA). Such identification of a nascent intracluster halo represents the unambiguous proof that we are witnessing the transition through which a sparse overdensity of galaxies turns into a massive galaxy cluster, providing a statistically meaningful confirmation of long-standing predictions from cosmological simulations, and cluster and galaxy evolution models.

Session Classification: Cosmology, high- z Universe, galaxy clusters