

The Planck clusters in the LOFAR sky: latest statistical results

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Many galaxy clusters show diffuse cluster-scale emission in the form of radio halos and relics, showing that magnetic fields and relativistic electrons are mixed in with the intracluster medium (ICM). Although there is broad consensus that the formation of these sources is connected to turbulence and shocks in the ICM, the details of particle acceleration, magnetic field and sources of highly energetic particles are still poorly known. Statistical studies of large samples of galaxy clusters have the potential to unveil the connection of these sources with the cluster mass and formation history. However, previous studies were limited by the observing frequency and sensitivity of radio observations to the most massive clusters and therefore they were based on a small number of radio diffuse sources. LOFAR has allowed us to overcome these limitations. We analysed the low-frequency (140 MHz) radio emission from all 309 clusters in the second catalog of Planck Sunyaev Zel'dovich detected sources that lie within the 5634 deg^2 covered by the Second Data Release of the LOFAR Two-meter Sky Survey (LoTSS-DR2). We found 83 clusters that host a radio halo and 26 that host one or more radio relics. We derived upper limits to the diffuse emission of clusters without radio halos. The majority of the clusters of the sample have available X-ray data, which we analysed to derive their dynamical status. We studied the occurrence of radio halos as a function of cluster mass, redshift and dynamics. We derived the correlation between radio power and host cluster mass, and investigated the distribution of clusters without radio halos with respect to this correlation. We studied the occurrence of radio relics and their scaling relations. In this talk I will show the main results of this project, which not only allowed us to build the largest sample of clusters with homogenous observations available to date, but it also represents an important preparatory work in view of the statistical studies that will be possible with the SKA surveys.

keywords

galaxy clusters, LOFAR, diffuse emission, statistics

In-person or online?

in-person

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Mid-Senior

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