

Title

Tracing magnetic field amplification during the process of structure formation

Abstract

With this proposal, we will conduct the first systematic study of magnetic field evolution in galaxy clusters for which we have uniform X-ray coverage (the CHEX-MATE sample). Galaxy clusters are massive objects that form at the intersection of intergalactic filaments by accretion of lower mass groups and clusters. Radio observations have probed since decades the existence of magnetic fields in the intra-cluster medium, but their properties and impact of the cluster evolution are yet unconstrained. This is due to the challenges and time-expensive observations that were needed - until now - to perform this kind of studies. Now, thanks to the sensitivity of MeerKAT, and given the existence of an X-ray sample of clusters for which we have a uniform coverage, it is possible to undertake this project. We have divided the sample of 77 CHEX-MATE clusters observable by MeerKAT in five subsamples in the mass-redshift space, and we aim at studying the magnetic field evolution as a function of mass and redshift. We will derive the Faraday Rotation Measure of sources located inside and in the background of the clusters, and we will use numerical simulations to constrain the magnetic field properties.

Data from a previous pilot project and useful data from the archive demonstrate that our approach will be successful.

Hence, we propose observations for the clusters that are neither part of our pilot project nor present in the archive.

This project will open additional science cases, and represent a gold mine for a large scientific community.