

MERGHERS: evolution of cluster scale radio sources through cosmic time

Abstract

Steep spectrum, Mpc-scale diffuse radio emission has been found in approximately 80 galaxy clusters, typically in dynamically disturbed systems, indicating a strong link between its formation and the energetic processes which occur during cluster mergers. Observations of statistical X-ray and Sunyaev-Zel'dovich (SZ) effect-selected cluster samples have determined scaling relations between the radio emission and thermal properties of the host clusters. However, these samples have been restricted to relatively low redshift ($z < 0.4$) systems. In order to better understand the formation of these diffuse signals and their link to cluster evolution and the hierarchical build-up of structures in the Universe, the cluster discovery space must be expanded. The MeerKAT Exploration of Relics, Giant Halos, and Extragalactic Radio Sources (MERGHERS) project is a planned multi-semester, large-scale radio cluster study that will compile observations of ~ 200 SZ-detected clusters over wide ranges of mass and redshift.

We propose here to begin the MERGHERS programme with a self-contained project to study a high-mass, mid-to-high-redshift sample ($M500_{SZ} > 7 \times 10^{14} M_{\text{sun}}$; $z=[0.3,0.7]$) of 45 SZ-selected Atacama Cosmology Telescope clusters at L-band. With this sample we will investigate cluster magnetic fields at high redshift, analyse the high-redshift diffuse emission occurrence rate in high-mass clusters, and (preliminarily) study the evolution of the scaling relations at high-redshift. This observing proposal is designed to be readily extendible to larger complete cluster samples that expand the scientific scope of our programme. Our total time request is 99.4 hours.