

Diffuse emission in a mass-complete sample of galaxy clusters at high redshift

Abstract

Steep spectrum, Mpc-scale diffuse radio emission has been found in a growing number of 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 investigated scaling relations between the radio emission and thermal properties of the host clusters, which are key to understanding the origin of non-thermal phenomena in clusters. However, these samples have been restricted to relatively low redshift ($z < 0.4$), high mass ($M_{500} > 6 \times 10^{14} M_{\text{sol}}$) 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, their discovery space must be expanded. We aim to study diffuse radio emission in the first statistical mass-selected sample at high redshift ($0.4 < z < 0.6$; $M_{500} > 4.5 \times 10^{14} M_{\text{sol}}$), consisting of 55 SZ-detected clusters. With this sample we will investigate the properties of cluster magnetic fields at high redshift, analyze the high-redshift diffuse emission occurrence rate, and start to investigate the evolution of the scaling relations at high-redshift. This observing proposal is designed to be readily extendible to complementary complete cluster samples that expand the scientific scope of our programme. Our total time request is 79 hours.