

Does steep spectrum radio relic spectra steepen at high frequencies?

Abstract

Merging galaxy clusters host Mpc-scale, highly polarized radio relics illuminated by relativistic electrons accelerated at shock fronts. The origin of these energetic electrons and the high degree of polarization is still unclear. The majority of relics show a power-law radio spectrum with a slope of about -1.1. There is convincing evidence that relics trace merger-induced shock waves. However, the apparently very high acceleration efficiency indicates that our understanding of the origin of relics is only sketchy. To advance our understanding of relics, we propose S-band MeerKAT observations of 3 clusters that host steep spectrum relics. To date, it is unknown if the steeper spectrum reflects a different phase in the evolution of relics or if it depends on the environment. Our main goals are to (1) investigate if the overall spectrum of the proposed relics steepens at high frequency or not, (2) uncover the origin of steep spectrum relics that may be formed under specific physical conditions or merger configurations using one-to-one comparison with simulations, and (3) understand the magnetization of the ICM and the physical processes in the interaction between shocks and the magnetized plasma.