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Unveiling the spectacular off-centre cluster merger AC114 with MeerKAT

Abstract

We propose deep MeerKAT L-band observations (in full Stokes, 4k channels, and 8s dump time, in total for 10hrs) of a unique massive off-centre cluster merger of AC114, with the aim of fully revealing the low surface brightness radio relics and halo, and hence study the system in detail, for the first time. Merging galaxy clusters are unique laboratories to study cluster/group mergers, different cosmic-ray acceleration, and physical properties of the intracluster medium (ICM). Being located at Dec=-35 deg the cluster can be observed with a limited number of radio telescopes. The unprecedented sensitivity of MeerKAT to large angular scales and high resolution at L-band with a continuous frequency coverage (900–1670 MHz), provides the only opportunity to study the unique cluster merger AC114. The proposed observations will allow us to (i) detect and confirm the nature of two faint diffuse sources (radio relic or revived fossil AGN emission) at the cluster outskirts; ii) detect the radio halo emission at the cluster center; (iii) relate the radio halo properties to the ICM in order to obtain crucial information on the origin of the non-thermal cosmic-ray component, probe the turbulent re-acceleration model and the cluster's evolutionary stage; (iv) investigate the magnetic field radial profile and the effect of ICM on the polarisation properties of background sources.