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The properties of radio relics and the connection with radio halos in galaxy clusters and their correlation with non-thermal phenomena

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Abstract :

Galaxy clusters are the largest gravitationally bound structures and the largest storage rooms for cosmic rays and magnetic fields in the Universe. They have been successfully observed in radio, mm., optical, soft and hard X-ray wavelengths. Radio observations, show the evidence of relativistic particle from diffuse synchrotron radio emissions in a growing number galaxy clusters. The origin of these diffuse emissions (radio relics & radio halo) is still unknown and is one of the hot topics on the discussion table of radio astronomy today. Basically, two main scenarios have been proposed for the origin of relativistic particle in galaxy cluster: i) the primary models, which predict that electrons are accelerated by shocks and or turbulence induced during cluster mergers; ii) the secondary models, in which relativist electrons are continuously injected by hadronic collisions between the thermal ions of the intracluster medium (ICM) and relativistic protons. In order to investigate the properties of radio relics and the connection with radio halos in galaxy cluster, and then analyse their correlation with non-thermal phenomena, it's important i) to provide a self-consistent theoretical modelling for the interpretation of the available and future observations in the context of leptonic and hadronic model for the origin of relativistic particle; ii) to provide a consistent scenario for the origin of magnetic fields in large-scale structures of the universe. We discuss here theoretical and data analysis procedures on existing radio relics and halos, following by the establishment of reference cluster samples which will be used for theoretical predictions and simulations for future experiments (MeerKAT and SKA). A specific galaxy that we observed with KAT-7 is at the focus of our analysis as a starting point.

Award :

Yes

Level :

PhD

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Paper :

No

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