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Galaxy clusters and beyond with the Upgraded Giant Metrewave Radio Telescope

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Clusters of galaxies are the Universes' most massive gravitationally bound systems that hold most of their baryonic mass in the form of diffuse medium called the intra-cluster medium (ICM). The ICM is magnetised to micro Gauss levels and in about a third of galaxy clusters with masses greater than 5×10^{14} $M_{\odot}$, is found to emit synchrotron radiation that is detectable in radio bands. These sources are broadly classified as radio halos and relics. Hadronic collisions in the ICM, re-acceleration of seed relativistic electrons at shocks and via cascade of magneto hydrodynamic turbulence are mechanisms that can produce relativistic electrons ($\sim GeV$) responsible for the radio emission in the cluster magnetic fields. Radio relics are proposed to be tracers of shocks and radio halos of turbulent reacceleration [1]. The origin and properties of the seed relativistic electrons are not studied well and are likely important to understand the spectra of radio relics and halos. The signatures of the associated processes can be studied in the low frequency spectra of these extended sources. The recently Upgraded GMRT (uGMRT) offers sensitive observations in the suitable sub-GHz frequency bands that are useful to distinguish between the models. I will present our first results from the 300 - 500 MHz and 1050 - 1450 MHz band uGMRT observations of a dead radio galaxy in a galaxy cluster revealing the curvature in the spectra of the seed relativistic electrons [2]. Further we are developing a data analysis pipeline for the uGMRT and comissioning an online filtering system for broadband radio frequency interference. I will present early results from our uGMRT observations of radio halos and relics in galaxy clusters and a supercluster using these techniques.

References

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