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# Probing the intracluster magnetic field with Faraday rotation

## Abstract

Merging galaxy clusters hosting diffuse polarized emission in the form of radio relics offer a unique possibility to study intra-cluster magnetic fields. The Faraday rotation caused by the magneto-ionized intra-cluster medium affects both background sources and cluster sources, including relics. In this talk, I will explain how we can use this effect to probe the 3D structure of intra-cluster magnetic fields and to search for a possible amplification of magnetic fields by weak shocks. In particular, I will show the case of Abell 2345. This cluster hosts two radio relics that were detected in polarization with 1-2 GHz Jansky Very Large Array observations. The rotation measure (RM) of five polarized sources within  $\sim 1$  Mpc from the cluster center was derived by applying the RM synthesis. The average RM and the RM dispersion radial profiles probe the presence of intracluster magnetic fields. Using the thermal electron density profile derived from X-ray analysis and simulating a 3D magnetic field with fluctuations following a power spectrum derived from magneto-hydrodynamical cosmological simulations, we build mock RM images of the cluster. We constrained the magnetic field profile in the eastern radio relic sector by comparing simulated and observed RM images.