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Insight into intracluster magnetic fields by wideband polarimetry of radio relics

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Merging galaxy clusters host diffuse megaparsec-scale radio emission in the form of radio relics. These synchrotron sources are usually found at the cluster outskirts and originate from cosmic-ray electrons which are (re-)accelerated by merger-driven shocks in the intracluster medium (ICM). These merger-induced shocks are believed to ‘’order”magnetic fields, causing the synchrotron emission to be highly polarized. However, the actual strength and topology of these magnetic fields is still poorly understood. The new generation of radio telescopes permits wide band polarimetric observations with unprecedented sensitivity and spatial resolution. This allows us for the first time to investigate the finest details of the magnetic field distribution in these sources. Here, I present a detailed analysis of wideband polarimetric data of the spectacular radio relic in the complex galaxy cluster MACS J0717.5+3745. We find that Rotation Measure and depolarization vary strongly across the relic, consistent with an intervening magnetized screen that arises from the dense ICM. I will discuss the consequences of the resulting Rotation Measure distribution and the depolarization for the ICM magnetic fields. The advent of SKA will boost this kind of studies over wide frequency ranges and will provide crucial insights into the ICM magnetic field properties, leading ultimately to a comprehensive and unified picture of the magnetic field structure and underlying particle acceleration mechanisms in galaxy clusters.

Reasearch area

Extragalactic Continuum (galaxies/AGN, galaxy clusters)

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