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Abell 3667: understanding the nature of radio relics

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Galaxy clusters are the most massive virialized objects in the Universe, and they evolve through mergers of smaller substructures. Such cluster mergers are extremely energetic events, dissipating energy through shocks and turbulence in the intra-cluster medium (ICM). The most spectacular results of such merging activity can be observed in the radio band in the form of radio halos and radio relics. The latter are elongated and polarised sources found at the clusters outskirts, and their presence has been related to large cluster merger shocks induced in the ICM. The galaxy cluster Abel 3667 hosts a spectacular radio relic, unique for its brightness and size, and has been already observed in the L band (856–1711 MHz) using the MeerKAT telescope (de Gasperin et al. 2022). In this work, we present the MeerKAT's UHF band (544–1087 MHz) observation of such target, in order to combine the extracted information with the L-band one, allowing the derivation of resolved wide-band spectra and precise rotation measure measurements. As a consequence, we study the particle acceleration and fading processes locally, in isolated filaments, rather than analysing spectra integrated over larger regions, where this information is hidden. Furthermore, the 3D reconstruction of the filament geometry allows an extremely precise comparison with the predictions made by current cosmological and non-cosmological MHD simulations, where different models for particle acceleration can be explored. Moreover, the images of the shock front region at such low-frequency band enable a more robust Mach number estimation. Finally, the UHF-band view of this cluster allows for a spatially resolved study of the faint and extended radio halo formed as a consequence of a bullet-like merger.

keywords

Galaxy clusters, radio relics

In-person or online?

in-person

Career level

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