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MeerKAT's view of the interaction between intra-cluster magnetic field and jets of a radio galaxy

Galaxy clusters are known to harbour magnetic fields, the nature of which remains unresolved. Intra-cluster magnetic fields can be observed at the density contact discontinuity formed by cool and dense plasma running into hot ambient plasma, and the discontinuity exists near the second brightest galaxy, MRC0600-399, in the merging galaxy cluster Abell 3376 (redshift 0.0461). Elongated X-ray emission in the east–west direction shows a comet-like structure that reaches the mega-parsec scale. Previous radio observations detected the bent jets from MRC 0600-399, moving in same direction as the sub-cluster, against ram pressure. Here we report radio observations of MRC 0600-399 that have 3.4 and 11 times higher resolution and sensitivity, respectively, than the previous results. In contrast to typical jets, MRC 0600-399 shows a 90-degree bend at the contact discontinuity, and the collimated jets extend over 100 kiloparsecs from the point of the bend. We see diffuse, elongated emission that we name ‘double-scythe’ structures. The spectral index flattens downstream of the bend point, indicating cosmic-ray re-acceleration. High-resolution numerical simulations reveal that the ordered magnetic field along the discontinuity has an important role in the change of jet direction. The morphology of the double-scythe jets is consistent with the simulations. Our results provide insights into the effect of magnetic fields on the evolution of the member galaxies and intra-cluster medium of galaxy clusters.

Apply to be considered for a student ; award (Yes / No)?

No

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