Wiggling Through the ICM: Multi-Resolution Radio Imaging of a Tailed Radio Galaxy in MACSJ1354.6+7714

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Merging galaxy clusters are among the most energetic sites in the Universe, where turbulence and bulk motions in the intracluster medium (ICM) shape the evolution of galaxies and drive particle acceleration. Tailed radio galaxies in these environments serve as powerful tracers of AGN–ICM interactions and cluster dynamics. We present new high-resolution (0.3″) and intermediate-resolution (1.5″) LOFAR HBA images at 144 MHz, combined with archival uGMRT Band-3 observations at 400 MHz, to investigate a narrow-angle tailed (NAT) radio galaxy in the merging cluster MACSJ1354.6+7714 (z = 0.3967). We created matched-resolution spectral index maps and applied synchrotron ageing models to study the evolution of the electron population along the tail. The galaxy hosts a sharply bent, 324 kpc radio tail with progressive steepening from $\alpha = -0.48 \pm 0.62$ near the core to $\alpha = -2.43 \pm 0.59$ in the outermost regions. Spectral modelling yields a radiative age of 150 ± 10 Myr, which combined with the tail length implies a galaxy velocity of 1957 ± 294 km s^{-1}, nearly twice the cluster velocity dispersion. This high velocity rules out long-term cluster membership and points to a first infall scenario. Our results highlight the role of environmental interactions during cluster assembly and demonstrate how multi-frequency radio observations of tailed galaxies can reveal the interplay between AGN activity, ICM conditions, and cluster assembly.