Contribution ID: **106** Type: **Talk**

Revealing the complex shock features in the double-relic in MACS J1752.0+4440

Wednesday, 8 May 2024 13:55 (15 minutes)

Radio relics are extended, diffuse radio sources tracing particle (re-)acceleration due to ICM shock waves in merging galaxy clusters. Characterized by elongated arc-shapes, they are typically found in cluster outskirts, with sizes ranging from 0.5 to 2 Mpc, highly polarized emission (up to $\sim 60\%$) and brightness profiles decreasing toward the cluster center. MACS J1752.0+4440 hosts a double-relic system, a phenomena in which two radio relics form from a single merging event and whose observability is aided by the shock happening near the plane of the sky. The NE relic shows a peculiar morphology, with two parallel filaments possibly tracing a double shock front.
In my talk, I will report on results from the spectral and curvature analysis of the two radio relics, using LOFAR (144MHz), new uGMRT (416MHz and 650MHz) and archival VLA (1.6GHz) radio data. The high resolution of the instruments, allowed us to detect substructures along the NE relic main axis. Surprisingly, we measured spectral indexes for the two relics that are flatter than those predicted by the DSA theory. Furthermore, the newly produced color-color plots and the spectral curvature map show evidence for concave spectra, in opposition with spectral aging models. The combinations of all these results suggests that strong projection effects are in action. This is also supported by depolarization observed in the two relics observed with the VLA.
Despite that double radio relic clusters are usually considered as systems where projection effects are minimized, our results on MACS J1752 demonstrate that caution is needed even in the interpretation of these only apparently simple systems.

keywords

galaxies; clusters; intracluster medium; non-thermal; radio continuum; shock waves; polarisation; radio relics;

In-person or online?

in-person

Career level

Student

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Session Classification: Clusters/LSS