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Sloshing and X-ray spiral structure breeding record steep spectrum radio mini-halo inside the cluster Abell 795

S. K. Kadam [(1)], Sameer Salunkhe [(2,3)], N. D. Vagshette [(4)], Surajit Paul* [(5,6)], S. S. Sonkamble [(7)], P. K. Pawar [(8)] and M. K. Patil [(1)]

(1) School of Physical Sciences, Swami Ramanand Teerth Marathwada University, Nanded-431 606, India
(2) National Centre for Radio Astrophysics, Tata Institute of Fundamental Research, Pune 411007, India
(3) Department of Physics, Savitribai Phule Pune University, Pune 411007, India
(4) Department of Physics and Electronics, Maharashtra Udayagiri Mahavidyalaya, Udgir, Latur-413517, India
(5) Manipal Centre for Natural Sciences, Manipal Academy of Higher Education, Manipal 576104, India; email: surajit.paul@manipal.edu
(6) Raman Research Institute, Sadashivanagar, Bangalore - 560080, India
(7) Centre for Space Research, North-West University, Potchefstroom 2520, South Africa
(8) Department of Physics, Deogiri College, Aurangabad 431005, India

Spiral structures and cold fronts in X-rays are frequently found in cool core galaxy clusters. Such clusters are also occasionally found to host diffuse radio emission structures called radio mini-halo at their centre. However, studies on radio mini-halos associated with these X-ray spirals and their physical connections are rare.

Cluster Abell~795 is a known relaxed cool-core cluster [1] with X-ray spiral features and the indication of extended radio radio emission. We analysed 30~ks of *Chandra* X-ray and 249 and 48 min for 325 and 150 MHz GMRT radio data of this cluster [2].

Here, we present the discovery of a radio-mini-halo type extended diffuse radio emission entrained in the X-ray spiral structure in the cluster Abell 795. Though the cool core is a sign of the relaxed nature, our re-analysed 30 ks *Chandra* X-ray data of Abell 795 confirms the presence of an interesting log spiral structure of X-ray deficit region complemented by an X-ray excess counter spiral in the residual map, exposing its dynamical activity. Moreover, the optical spectral analysis shows a differential movement of cold and hot (two-phase) plasma flowing in the spiral structure. Our new analysis of multi-band GMRT data confirms the detection of a ~180 kpc ultra-steep spectrum ($\alpha > -2.0$) diffuse radio structure. This is the steepest known radio mini-halo that spans the entire spiral structure, enclosed by two previously reported cold fronts. Furthermore, SDSS-DR13 optical spectra and GALEX's FUV data, show a lower total star formation rate of 2.52 M_{sun} yr^{-1} with no significant variation in metallicity distribution.

We argued that the two-phase plasma at the core with differential velocity has plausibly caused the spiral formation and has redistributed the secondary electrons from the BCG or the pre-accelerated electrons, which have been (re-)accelerated by the sloshing turbulence to form the observed steep spectrum radio mini-halo structure [2]. This has been supported by a few previous studies indicating spiral formation and sloshing turbulence quenches star formation and facilitates smooth metallicity distribution by mixing the gas in the core.

1. Ubertosi F.*, Gitti M., Torresi E., Brighenti F., Grandi P. "A *Chandra* study of Abell 795 – a sloshing cluster with an FR0 radio galaxy at its centre," *Monthly Notices of Royal Astronomical Society (MNRAS)*, **503**, 3, May 2021, pp. 4627-4645, doi:10.1093/mnras/stab819

2. S K Kadam, Sameer Salunkhe, N D Vagshette, Surajit Paul*, S S Sonkamble, P K Pawar, M K Patil* "Sloshing and spiral structures breeding a putative radio mini-halo in the environment of a cool-core cluster, Abell 795," *Monthly Notices of Royal Astronomical Society (MNRAS),* **531**, 4, July 2024, pp. 4060–4069, doi:10.1093/mnras/stae1401