

A wide-band characterisation of the lives of radio galaxies in galaxy clusters

Katlego Morakile¹

Kshiti Thorat¹, Tiziana Venturi², Etienne Bonnassieux³

¹ Department of Physics, University of Pretoria, Hatfield, 0083

² Istituto Nazionale di Astrofisica (INAF) - Istituto di Radioastronomia (IRA), Bologna, Italy

³ OASU/Laboratoire d'Astrophysique de Bordeaux, Univ. de Bordeaux, Floirac Cedex, France



Science Goal

We investigate how the cluster environment (core vs. periphery) shapes the dynamics and energetics of peculiar radio galaxies (bent-tailed, asymmetric, and disrupted sources). We take particular interest in the influence of the local environment on the properties and evolution of these radio galaxies by looking at their:

- Radio morphology: This reveals galaxy kinematics and jet/medium interaction where features like bending trace the effects of ram pressure and jet-medium interactions.
- Spectral Index: Traces synchrotron ageing and restarted activity.

Multi-Frequency Coverage

For this study we focus on four Planck-selected galaxy clusters within the LOFAR-MeerKAT overlapping zone. We use multi-frequency data, which provides an almost continuous spectrum to trace both young and aged plasma.

Telescope	Frequency	Pipeline
LOFAR	~120-168 MHz	
uGMRT	~250-500 MHz & ~1050-1450 MHz	CAPTURE [1]
MeerKAT	~580-1015 MHz	CARACal

Table 1: Multi-frequency data and calibration pipelines used in this study.

Multiband Imaging Results

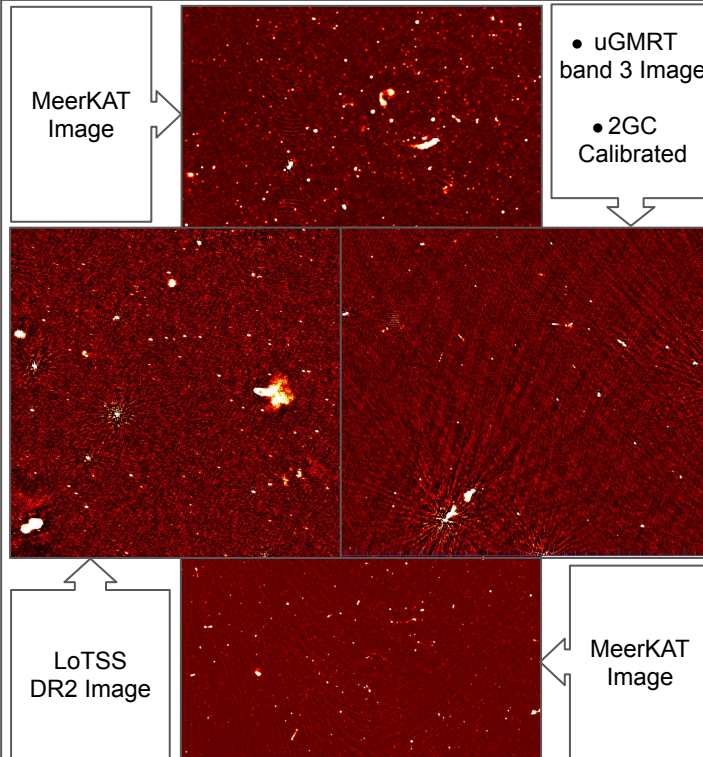


Figure 1: Snapshots from the four Planck clusters fields, with different telescopes.

Spectral Index Analysis

BRATS [2] was used to make spectral index maps.

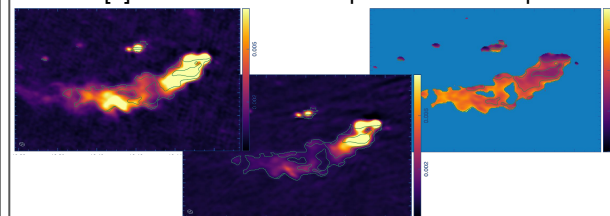


Figure 2: Spectral index map (left), made using LOFAR (right) and uGMRT band 3 (center) data.

- Flat spectral index (α) observed near the AGN core indicate young, recently accelerated plasma, while steeper α in the tail, indicate older plasma.

Summary & Future Outlook

- We discover low luminosity components ($\mu\text{Jy}/\text{beam}$) in our bent-tailed sources, which detail the pressure and temperature of both the jet and local environment, allowing us to put constraints on the environment properties. The spectral steepening, ranging from flat (0.5-0.7) at the core to steep (1.2-1.4) in the tail supports our analysis, where plasma ages as it is stripped from the host galaxy by ram pressure.
- **Future Work:** Estimate statistical properties of the sample of bent-tailed sources, quantify the impact of the local environment on radio morphology.

References

