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BL Lac or FR I? A MeerKAT spectropolarimetric analysis of PKS 2316-423

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Active Galactic Nuclei are among the most powerful phenomena in the Universe. They play a crucial role in the formation and evolution of galaxies and, in the case of the most powerful sources, in shaping the properties of galaxy clusters.

In this work I analyse a BL Lac object, named PKS 2316-423, located at the centre of the galaxy cluster Abell S1111, using MeerKAT L-band observations. Despite its classification as a blazar, this source exhibits a complex morphology, with some characteristics typical of an FR I radio galaxy. It displays a bright compact core together with very diffuse and filamentary extended emission (~ 400 kpc), which is revealed thanks to the high sensitivity and resolution of MeerKAT.

By performing an in-band spectral mapping analysis, I determined for the first the spectral index on point-by-point with unprecedented resolution in literature. The spectrum steepens from $\alpha \approx -0.2$ in the core to $\alpha \approx -1.8$ in the outermost regions of the lobes, with $\propto \nu^\alpha$. Fitting a Jaffe-Perola model to these results yields radiative ages ranging from ~ 25 to 120 Myr.

I performed a polarimetric analysis that has been crucial to provide additional insights into the source properties and the interaction between the jets and the surrounding intracluster medium. The rotation measure synthesis results show evidence of the Laing–Garrington effect, which further contribute in the characterization of the source and that can be used to determine the strength and structure of the magnetic field in the environment in front of the source.

These results demonstrate the unique capability of MeerKAT to probe faint extended emission from AGN, and highlight the potential of the future SKA to push such studies to even higher sensitivity and resolution.

Topics

Galaxy Evolution & AGN

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