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From Young to Restarted: Investigating Peaked-Spectrum Radio AGN using LoTSS

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Peaked-spectrum (PS) radio sources are often associated with young radio active galactic nuclei (AGN), representing an early stage of radio galaxy evolution. However, some PS sources exhibit compact radio emission embedded within much larger, extended radio structures, suggesting that they may represent a new episode of jet activity in systems with a previous evolutionary history. Identifying such sources provides an opportunity to investigate the episodic nature of AGN activity and constrain the duty cycles of radio galaxies.

In this talk, I will present a systematic investigation of PS radio AGN using the LOFAR Two-metre Sky Survey (LoTSS). First, I will discuss our search for extended radio emission around candidate gigahertz-peaked-spectrum (GPS) and megahertz-peaked-spectrum (MPS) sources from the literature using LoTSS. This study identified 30 candidate restarted radio galaxies, including systems with large-scale radio structures extending well beyond their compact PS components. These sources provide a valuable sample for investigating the connection between compact radio activity and the long-term evolution of radio galaxies. Building on this work, I will present an ongoing project to establish a robust census of PS sources using LoTSS, which covers approximately 89% of the northern sky and contains 13.7 million radio sources. By combining radio catalogues across multiple frequencies and applying systematic spectral-selection criteria, we have identified approximately 12,000 PS candidates. Redshifts have been assembled for around half of the sample, enabling further investigation of their physical properties and large-scale radio morphologies. Preliminary results also reveal extended radio emission associated with a significant fraction of these PS samples. Together, these studies provide a foundation for investigating
the evolutionary diversity of PS radio AGN, identifying promising restarted candidates, and developing a statistically robust sample for future population studies.

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