Calibration and wide field imaging with PAPER: a catalogue of compact sources

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ABSTRACT

Observations of the redshifted 21 cm HI line promise to be a formidable tool for cosmology, allowing the investigation of the end of the so-called dark ages, when the first galaxies formed, and the subsequent Epoch of Reionization when the intergalactic medium transitioned from neutral to ionized. Such observations are plagued by foreground emission which is a few orders of magnitude brighter than the 21 cm line.

In this thesis I analyzed data from the Donald C. Backer Precision Array for Probing the Epoch of Reionization (PAPER) in order to improve the characterization of the extragalactic foreground component. I derived a catalogue of unresolved radio sources down to a 5 Jy flux density limit at 150 MHz and derived their spectral index distribution using literature data at 408 MHz.

I implemented advanced techniques to calibrate radio interferometric data that led to a few percent accuracy on the flux density scale of the derived catalogue. This work, therefore, represents a further step towards creating an accurate, global sky model that is crucial to improve calibration of Epoch of Reionization observations.