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Single-Dish Calibration Pipelines and VLBI Simulation Studies for Millimetre Astronomy with the Africa Millimetre Telescope

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This PhD research develops practical tools for millimetre astronomy, supporting blazar monitoring and evaluating the Africa Millimetre Telescope's (AMT) role in global VLBI. A core component is a single-dish calibration and analysis pipeline for continuum blazar observations. Using IRAM 30-m test data, key calibration steps (pointing, opacity, elevation-dependent gain, and polarization) are first applied in GILDAS/MIRA and then independently implemented in Python from the underlying calibration equations. The two reductions are compared to validate the pipeline and deliver a transparent, flexible workflow, with new IRAM observations planned for further testing.

In parallel, two VLBI studies assess AMT's contribution to the EHT. SYMBA imaging simulations test how adding AMT affects array performance and image quality for targets such as M87*and Sgr A*. Separately, Monte-Carlo fringe-detectability analyses at 230 GHz combine realistic atmospheric conditions, baseline sensitivity, and measured coherence times to estimate how often AMT baselines achieve reliable high-SNR detections.

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