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The RADIOBLOCKS project continued: building the future of radio interferometry data processing

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The data processing of radio interferometry data has rapidly matured in the last decade, for example with the onset of global mm-VLBI observations. From capturing the signals in the telescope, through correlation, calibration and imaging, this process is well understood, but the parameter space is very broad and includes many assumptions that are rooted in experience and best practices. Modern technological developments in computational hardware and machine learning allow for taking out the human equation in many of these processes, making the steps and choices less biased, more robust and faster. Future observational systems will increase the complexity even further, and therefore understanding the impact of choices made in data processing in radio interferometry is crucial to ensure that we generate reliable scientific data.

The RADIOBLOCKS project aims to improve the entire signal chain, from front-end receivers to data processing, by developing state-of-the-art software and using the capabilities of the newest hardware. This co-design approach aims at speeding up and optimizing correlation as well as calibration strategies, and the exploitation of the developments of new imaging algorithms for very sparse arrays. This work includes the development of new correlator technologies for the latest generation of superchips such as the Grace Hopper, the optimization of calibration strategies and imaging tools, and new high-speed data transportation techniques.

The focus of this talk will be on applications for VLBI experiments, including the next generation of instruments. New processing tools in this field have been successfully developed for high-frequency VLBI experiments like EHT, and can be expanded to be used at existing instruments like ALMA, at the lower frequencies for EVN, and for future instruments such as SKA and ngVLA. In this presentation, the developments of a TensorCore correlator will be addressed, before moving on to the post-processing software. This involves the development of a dedicated set of synthetic data to test and verify the new software and understand the challenges in the lower frequency range, the error propagation in the calibration steps, and the use of Bayesian imaging approaches.