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Exploring techniques to eliminate systematic effects in data observed with Hydrogen Epoch of Reionization Array (HERA).

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The 21 cm transition from neutral hydrogen is one of the most promising probes of the Epoch of Reionization (EoR). Precise measurements from this era can better constrain cosmological parameters and shed light on the evolution of galaxies across cosmic time. The new generation of low-frequency radio interferometric arrays, including the Hydrogen Epoch of Reionization Array (HERA), have been built specifically to probe this period.

The main challenge in detecting the 21 cm signal lies in the presence of bright foregrounds, which demand extremely accurate interferometric calibration. However, the non-smooth instrumental response of antennas, caused in part by mutual coupling, introduces non-smooth calibration errors. These are further compounded by the use of incomplete sky models, which are unavoidable given the limited depth and resolution of current source catalogues. The combination of instrumental effects and incomplete models can significantly compromise 21 cm detection.

In this work, we investigate the use of fringe-rate filters to mitigate calibration errors arising from mutual coupling and incomplete sky models. We present the first results from applying these filters to actual HERA observations, demonstrating significant improvements in calibration quality.

Author: CHARLES, Ntsikelelo (SARAO)

Co-author: Prof. BERNARDI, Gianni (INAF)

Presenter: CHARLES, Ntsikelelo (SARAO)