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Searching for primordial gravitational waves in the Cosmic Microwave Background: Why does it matter and why is it difficult? Example through the QUBIC experiment.

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The quest for B-mode polarization of the Cosmic Microwave Background is among the main challenges in Observational Cosmology. Measurement of B-mode polarization in the CMB will be clear evidence of the presence of primordial gravitational waves which are theoretically expected to be produced during inflation about 10^{-35} seconds after the Planck epoch. The B-mode measurement is perhaps the most difficult cosmological challenge because the expected signal is very small. It requires high sensitivity and negligible instrument systematic effects with wide frequency coverage in order to separate the primordial signal from foreground emissions.

QUBIC (QU Bolometric Interferometer for Cosmology) is a novel instrument concept dedicated to the search for B-modes by measuring the Q and U polarization modes. It brings together the advantages of bolometers with high sensitivity and those of interferometers that have exquisite control of instrument systematic effects. The interferometric nature of QUBIC also allows spectro-imaging and improved spectral resolution with respect to imagers, providing a significant advantage concerning foreground removal. The Technological Demonstrator was inaugurated in Nov. 2022 at the QUBIC site at 5000m a.s.l. in the province of Salta in Argentina and is currently undergoing commissioning. Observations are expected to start early in 2024.

The poster will present the current state of our knowledge on Inflation and CMB, the technical features implemented in QUBIC to respond to the constraints associated with the observation of B modes of polarization as well as part of my work on the algorithms for reconstructing sky maps and their analysis to obtain the cosmological parameters that interest us.

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