AstroParticule et Cosmologie
CNRS IN2P3 – Université Paris Cité

10, rue Alice Domon et Léonie Duquet
F-75205 Paris Cedex 13 France
satorchi@apc.in2p3.fr

INTERNSHIP

SEARCHING FOR PRIMORDIAL GRAVITATIONAL WAVES WITH QUBIC: Characterization of the atmosphere at Alto Chorrillos

The quest for B-mode polarization of the Cosmic Microwave Background is the primary challenge in Observational Cosmology and is pursued by a worldwide effort. Measurement of B-mode polarization in the CMB will be clear evidence of primordial gravitational waves which are theoretically expected to be produced during inflation at about 10^{-35} seconds after the Planck epoch. Their presence would be a non-trivial result concerning quantum gravity because tensor modes would mean the metric must be quantized. 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 to separate the primordial signal from foreground emissions.

QUBIC (QU Bolometric Interferometer for Cosmology: http://qubic.org.ar) is a novel instrument that brings together the advantages of bolometers with their high sensitivity and interferometers with their exquisite control of instrument systematic effects. The interferometric nature of QUBIC also allows spectral-imaging with high spectral resolution compared to direct imagers, which is a significant advantage for foreground removal. The QUBIC Observatory was inaugurated in Nov. 2022 on its observing site at 5000m a.s.l. in the province of Salta in Argentina. The Technological Demonstrator is installed at the site and is completing commissioning. Observations will begin during 2026.

The topic of this internship is specifically the characterization of the atmosphere. The student will participate in data acquisition campaigns, including setting up and running the instrument remotely. The student will analyse the subsequent data sets, in particular sky dip measurements which will be used to measure the atmospheric load on QUBIC, and the variability of the atmosphere. The student will work within the QUBIC-APC team at APC, with the rest of the collaboration in France, Italy, Ireland, and Argentina.