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CEvNS and BSM physics with the CONNIE experiment.

The CONNIE experiment is dedicated to detecting Coherent Elastic Neutrino-Nucleus Scattering (CEvNS) of reactor antineutrinos using high-resistivity silicon CCDs at the Angra-2 reactor, and underwent significant advancements in 2021. Introducing two Skipper-CCD sensors with sub-electron readout noise, CONNIE became the pioneering project to employ Skipper-CCDs for reactor neutrino detection and achieved a record detection threshold of 15 eV. This work presents an overview of the sensors performance and the latest findings derived from 300 days of data collected during 2021-2022, totaling an exposure of 18.4 g-days. A comparison of event rates during reactor-on and off periods reveals no excess, resulting in upper limits on the neutrino interaction rates at 95% confidence level, consistent with earlier findings. Additionally, searches for Physics Beyond the Standard Model yield constraints on simplified models with light vector mediators. New studies include a dark matter search employing diurnal modulation techniques and a quest for relativistic millicharged particles produced in the reactor. The promising outcomes achieved with a minimal sensor mass underscore the potential of Skipper-CCDs in probing rare neutrino interactions, motivating the future plans to expand the detector mass with a Multi-Chip-Module of Skipper-CCDs.

Primary author: VENTURA, Pedro (IF-USP)

Co-authors: BONIFAZI, Carla; NASTEVA, Irina (IF-UFRJ)

Presenter: VENTURA, Pedro (IF-USP)

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