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Current Status of the CONNIE Experiment using Skipper-CCDs

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The CONNIE experiment aims to detect CEvNS of reactor antineutrinos off silicon nuclei using thick fully-depleted high-resistivity silicon CCDs. In 2021, two Skipper-CCD sensors with sub-electron readout noise capability were installed at the experiment next to the Angra-2 reactor, marking CONNIE as the first experiment to employ Skipper-CCDs for reactor neutrino detection. Thanks to the remarkably low readout noise of these sensors and thorough data quality analysis, CONNIE achieved a record low detection threshold of 15 eV. In this contribution, we will detail the sensor performance and present the latest results obtained from data collected over 300 days in 2021-2022. The comparison between event rates during reactor-on and off periods reveals no excess, setting upper limits on neutrino interaction rates at a 95% confidence level. These limits align with previous findings from CONNIE using standard CCDs and longer exposure times. Based on these new results, we conducted searches for Physics Beyond the Standard Model, focusing on exploring limits within a simplified model featuring light vector mediators. Additionally, we initiated the first dark matter search by diurnal modulation and further explored the recent search for relativistic millicharged particles produced in reactors. These promising results, achieved with a small-mass sensor, underscore the potential of Skipper-CCDs in investigating rare neutrino interactions and motivate plans for expanding the detector mass by installing a Multi-Chip-Module of Skipper-CCDs.

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