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The CONNIE experiment with Skipper CCDs

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The Coherent Neutrino-Nucleus Interaction Experiment (CONNIE) aims to detect the coherent elastic neutrino-nucleus scattering (CEvNS) of reactor antineutrinos off silicon nuclei using fully depleted high-resistivity charge-coupled devices (CCDs). The experiment, located at a distance of 30 m from the core of the 3.8 GW Angra 2 nuclear reactor in Rio de Janeiro, was able to set upper limits on the coherent scattering rate and place stringent constraints on simplified extensions of the Standard Model with light mediators. The detector was upgraded in 2021 to host 2 Skipper CCDs with the purpose of further reducing the detection energy threshold. Since then, CONNIE has achieved stable operation of the new sensors with a readout noise of 0.15 electrons and a single-electron rate of about 0.05 e-/pix/day. In addition, new methods of event extraction and selection are being developed, based on the sharper images that allow the effects of instrumental backgrounds to be identified and masked, thus permitting to lower the threshold to 15 eV. The performance of the Skipper CCDs is presented, together with the improved selection and the resulting low-energy background spectrum, measured by CONNIE in the 2022 reactor-off period. The prospects for detecting CEvNS with the Skipper-CCD technology are also discussed.

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