Abstract Submitted
for the APR21 Meeting of
The American Physical Society

Search for Two-Neutrino Double-Beta Decay of ^{130}Te to Excited States of ^{130}Xe with CUORE[1] ERIN V. HANSEN, UC Berkeley, DANIEL MAYER, Massachusetts Institute of Technology MIT, CUORE COLLABORATION — The CUORE experiment is a ton-scale search for neutrinoless double-beta decay ($0\nu\beta\beta$) composed of an array of 988 tellurium dioxide crystals, each instrumented as a cryogenic macrocalorimeter. While a discovery of $0\nu\beta\beta$ would herald new physics, the Standard Model process of two-neutrino double-beta decay ($2\nu\beta\beta$) in ^{130}Te is readily measured by CUORE. However, still unobserved in ^{130}Te are decays wherein the daughter ^{130}Xe nucleus is left in an excited state which subsequently decays via gamma emission, leading to events with energy deposited across multiple crystals. Understanding the branching ratio and spectral shape for such $2\nu\beta\beta$ decays to excited states can improve nuclear modelling and help constrain the matrix elements involved in searches for neutrinoless double-beta decay. This work describes progress towards an improved search for $2\nu\beta\beta$ decays to excited states with an increased exposure of CUORE. By exploiting the segmented nature of the CUORE detector, the scope of event signatures considered in the search is expanded and further accompanied by an improved efficiency of signal containment.

[1]CUORE is funded by the DOE-NP and DOE and NSF awards to individual institutions.

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Date submitted: 29 Mar 2021 Electronic form version 1.4