

Probing Neutrinoless Double Electron Capture in Calcium-40 with AMoRE

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The search for neutrinoless double electron capture ($0\nu;2EC$) is a powerful probe for lepton-number violation and the Majorana nature of neutrinos. We report on a search for the $0\nu;2EC$ decay of ^{40}Ca using the AMoRE-I cryogenic detector array, which utilizes metallic magnetic calorimeters (MMCs) and ^{48}Ca crystals. Analyzing a total exposure of $7.32 \text{ kg}\cdot\text{yr}$ ($1.39 \text{ kg}\cdot\text{yr}$ of ^{40}Ca), we find no evidence of a signal and set a lower half-life limit of $T_{1/2}^{0\nu} > 1.7 \text{ times}; 10^{22} \text{ yr}$ at 90% C.L. Furthermore, we project a sensitivity of $9.1 \text{ times}; 10^{22} \text{ yr}$ for the upcoming AMoRE-II phase. These results highlight the versatility of the AMoRE detector technology in investigating rare decay processes beyond its primary $0\nu;\beta\beta$ search program.

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