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Observation of low-lying isomeric states in 136Cs: a new avenue for dark matter and solar neutrino detection in xenon detectors

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Xenon-based detectors are powerful tools in the search for low energy signatures of new physics. Here we report experimental results that open up a new channel for rare event searches in these detectors: MeV-scale charged-current interactions on 136Xe nuclei. These interactions will populate low-lying 1+ excited states in 136Cs, which then relax to the ground state through the emission of characteristic gamma rays. We have performed measurements of γ rays produced by 136Xe(p,n)136Cs reactions, providing the first data on the gamma ray emission from the relevant excited states. We also identify two isomeric states with O(100)~ns lifetimes, which will create delayed-coincidence signatures in charged-current interactions that can be used to dramatically suppress backgrounds. These results could enable xenon-based detectors to perform background-free measurements of solar 7Be and CNO neutrinos, as well as achieve world-leading sensitivity to dark matter particles interacting with nuclei through new charged-current-like interactions.

Poster prize

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