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A New Method for Detecting Charged-Current Neutrino Interactions on 136Xe in KamLAND-Zen: Implications for Solar Neutrino Measurements and Fermionic Dark Matter Searches

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136Xe nuclei capture electron neutrinos through charged-current (CC) interactions, leading to the excited states of 136Cs: (ν_e + 136Xe ⟶ e^- + 136Cs*). This process can be used for solar neutrino measurements and fermionic dark matter searches.

The recent observation of low-lying isomeric states in 136Cs* with lifetimes on the order of 100 ns [1] implies that the CC interaction can be identified by a delayed coincidence measurement. This technique involves detecting a prompt signal consisting of the electron and most of the de-excitation gamma rays, followed by a delayed signal consisting of the remaining de-excitation gamma rays with energies below 140 keV.

KamLAND-Zen is an experiment designed to search for the neutrinoless double beta decay of 136Xe, using an organic liquid scintillator that dissolves 750 kg of xenon gas (91% enriched in 136Xe). This presentation will discuss the feasibility of identifying the CC interaction in KamLAND-Zen.

References
[1] S.J. Haselschwardt et. al, arXiv:2301.11893 (2023).

Submitted on behalf of a Collaboration?

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