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Enhancing Performance for AMoRE-II Detectors Using Lithium Molybdate Crystal Absorber

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The AMoRE collaboration is engaged in experiments aimed at detecting neutrinoless double beta decay of 100Mo. The experiments utilize large molybdenum-based scintillating crystals with cryogenic sensors. The forthcoming AMoRE-II phase will use large cylindrical Li_2MoO_4 (LMO) crystals with diffusive surfaces, which helps to reduce the crystal preparation time significantly. Despite the increased mass of these crystals, 6 cm (D) x 6 cm (H) in dimensions, they have performed similarly to the previous 5 cm (D) x 5 cm (H) LMO crystals in various tests. The diffusive surfaces of the LMO crystals have improved the discrimination between alpha and beta/gamma particles through pulse shape discrimination (PSD) analysis, despite the slower signal compared to polished crystals. We also investigated muon events, which showed two bands in the PSD parameter (rise time) of the 6 cm LMO crystal with polished surfaces. Developing detectors with LMO crystals required optimizing crystal and environmental setup conditions and utilizing pulse shape analysis due to the lower scintillation light yield compared to $CaMoO_4$ (CMO) crystals used in previous phases. We will present detailed information on the preparation and results of the AMoRE-II R&D experiment.

Submitted on behalf of a Collaboration?

Yes

Author: KIM, Wootae (Center for Underground Physics, Institute for Basic Science (IBS))

Co-author: Dr SO, Jungho (Institute for Basic Science)

Presenter: Dr SO, Jungho (Institute for Basic Science)

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