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Low temperature measurement on directional dependence of phonon-scintillation signals from a zinc tungstate crystal

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In dark matter direct-detection experiments, the detection limits of most detectors are confined with the backgrounds originating from coherent neutrino-nucleus scattering. One of the possible methods to break the neutrino background floor is a use of the directional dependence of detector response. We employed ZnWO_4 crystals as an anisotropic target material for the simultaneous detection of phonon and scintillation signals based on MMC readouts. The crystal is known to have birefringence properties depending on its crystal axes. Its low-temperature properties are well suited for phonon-scintillation detection. Here we report on the recent progress in low-temperature measurement using a ZnWO_4 crystal that demonstrated clear dependence of scintillation signals on different incident directions of alpha particles relative to the crystal axes. We found the signal amplitudes were differed by 13.2 % in the light channels. However, the high energy resolution in the heat channels showed no measureable difference within 0.07 %. We will discuss the crystal properties and features for the directional WIMP detection.

Less than 5 years of experience since completion of Ph.D

Y

Student (Ph.D., M.Sc. or B.Sc.)

N

Primary authors: Dr JEON, JA (Center for Underground Physics, Institute for Basic Science); Ms KIM, HL (Center for Underground Physics, Institute for Basic Science); Ms KIM, SR (Center for Underground Physics, Institute for Basic Science); Ms LEE, HJ (Center for Underground Physics, Institute for Basic Science); Prof. SEKIYA, H (Kamioka Observatory, ICRR, The University of Tokyo); Prof. KIM, YH (Center for Underground Physics, Institute for Basic Science)

Presenter: Dr JEON, JA (Center for Underground Physics, Institute for Basic Science)

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