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Anisotropic ionization threshold and directional sensitivity in solid state DM detectors

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The threshold displacement energy for nuclear recoils depends strongly on the direction of the recoiling nucleus with respect to the crystal lattice. Assuming that similar dependence holds for the ionization threshold for low energy nuclear recoils, we explore the consequences of the resulting directional dependence of the observable event rate in ionization detectors. For low mass dark matter, this effect leads to a daily modulation in the event rate. We discuss how this effect can be utilized to separate the DM signal from the solar neutrino background and how the structure of the modulation signal can be used to identify the type of the DM-nucleon coupling, or to extract information about the DM velocity distribution.

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