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Extracting Dark-Matter Mass from Directional Observables

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We propose a novel method to determine the mass scale of ambient dark matter that can be generally applied to the (at least effectively) two-dimensional direct detection experiments allowing for directional observables. Due to the motions of the solar system and the Earth relative to the galactic center and the Sun, the dark-matter flux carries a directional preference. We first formulate that dark-matter event rates have a non-trivial dependence on the angle between the associated detection plane and the overall dark-matter flow and that the curvature of this angular spectrum encrypts the mass information. For proof of principle, we take the recently-proposed Graphene-Josephson-Junction-based superlight dark-matter detector (named as GLIMPSE) as a concrete example and demonstrate these theoretical expectations through numerical analyses.

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