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Dark matter annual modulation analysis with combined nuclear and electron recoil channels

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The DAMA/LIBRA (DL) experiment remains the only direct detection effort reporting a positive annual modulation (AM) signal attributed to WIMP-nucleus (χN) interactions, despite several decades of intensive searches in the dark matter sector [1, 2]. In recent years, several analyses employing both time-integrated and AM approaches have placed significant constraints on, and in many cases excluded, the DL positive signal claim. Our current analysis [3] broadens the AM investigation by simultaneously considering dark matter-electron (χe) interactions − addressed in both long-range and short-range frameworks [4] alongside the standard χN interaction channel. To enhance the credibility of the study, we investigated single- and two-component χ's interaction scenarios for both χN and χe recoil channels. Despite achieving better statistical fits, these scenarios do not reconcile with the DL signal and are ruled out by null results from other contemporary experiments. The CDEX experiment, with its low detection threshold, is particularly sensitive to long-range interactions, thereby placing tight constraints, whereas XMASS offers more stringent bounds on short-range interactions due to its high exposure and large target mass. In addition to the current analysis, we also discuss the future sensitivity to both long-range and short-range χe interactions, as well as χN interactions, in light of the recently achieved 150~eV ionization threshold using a p-type point-contact germanium detector at the TEXONO experiment [5].

References:
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Collaboration you are representing

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