

Dark matter direct detection and constraints on non-relativistic effective operators

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The initiative to detect dark matter directly has been prominent for decades after the WIMP miracle was proposed. Following this, many institutions have come forward with a variety of dark matter direct detection experiments, each trying to find the possible missing particle of the universe. Most prominently, the DAMA collaboration published their results during the end of the last century, giving rise to a possible yearly modulation of dark matter. On the other hand, most of the other experiments report null results, such as COSINE and ANAIS which both feature a Sodium Iodine scintillator. Apart from that, experiments that feature Xenon such as XENONnT, LUX-ZEPLIN or PandaX obtain the lowest limits for the DM-SM cross sections, with yet no dark matter event observations. The aim of this work is to determine the compatibility of DAMA with other null experiments such as LUX-ZEPLIN, PICO-60 and CDMSlite. The analysis in this work uses the non-relativistic effective field theory. We classify the effective operators using an expansion scheme based on the dark matter velocity and momentum transfer. Furthermore, we investigate the posterior of the dark matter mass and the respective couplings and analyse key features. Ultimately, we are able to determine the compatibility of DAMA and other experiments and compare these results to previous literature.

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