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Impact of operators interferences in dark matter direct detection

The non-relativistic effective theory of WIMP-nucleon interactions depends on 28 coupling strengths. Due to the vast parameter space of the effective theory, most direct detection experiments interpret the results of their searches assuming that only one of the coupling strengths is non-zero. On the other hand, dark matter models generically lead in the non-relativistic limit to several interactions which interfere with one another, therefore, the published limits cannot be straightforwardly applied to model predictions. We present a method to determine a rigorous upper limit on the WIMP-nucleon interaction strength including all possible interferences among operators. We illustrate the method using the null search results from the XENON1T and the PICO collaborations; for some interactions, the limits on the coupling strengths are relaxed up to one order of magnitude. We also present a method that allows to combine the results from different experiments, thus exploiting the synergy between different targets in exploring the parameter space of WIMP-nucleon interactions.

Collaboration / Activity

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