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A Direct Detection View of the Neutrino NSI Landscape

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Neutrino non-standard interactions (NSI) have been extensively explored in the context of dedicated neutrino experiments. However, the next generation of direct detection experiments is on course to observe a significant number of solar neutrino events, and the sensitivities of these experiments within the NSI landscape are yet to be determined. Due to their sensitivity to neutrino-nucleus and neutrino-electron scattering, as well as to tau neutrinos, direct detection provides a complementary view of the NSI parameter space to that of spallation source and neutrino oscillation experiments. To study their potential in the NSI landscape, we develop a re-parametrisation or the NSI framework that explicitly includes a variable electron contribution and allows for a clear visualisation of the complementarity of the different experimental sources. For the first time, we compute the NSI sensitivity limits from the first results of the XENONnT and LZ experiments, and we obtain future xenon-based projections. Our results demonstrate indicate that next-generation direct detection experiments will form powerful probes of neutrino NSI.

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