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Simulation of Noble Element Detectors with NEST

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Noble element detectors are currently one of the most attractive technologies for rare-event search experiments, such as searches for WIMP dark matter. NEST (Noble Element Simulation Technique) is a software toolkit used to model the microphysics of xenon and argon in both gases and liquids. NEST can be used across a large range of applications, from table-top setups to multi-tonne experiments, such as LZ, XENONnT, and PandaX. NEST models light and charge production along with final pulse areas with high accuracy across different particle types, energies, and electric fields, all based on experimental data and simple, empirical formulae. This enables efficient computational scaling, with millions of simulated events able to be processed in only tens of seconds with off-the-shelf computers. I present here an overview of NEST and its applications, along with recent updates that have continued to improve the accuracy of NEST.

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