

Mass or Model! New ways to quantify the Signal Diversity in (Direct) Dark Matter Searches

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Abstract content

Direct detection experiments are one of a few primary avenues for the potential detection of particle Dark Matter (DM). We introduce general new statistical methods to systematically study the model-discrimination power of these (and many other) instruments. In a nutshell, our approach allows one to study all possible benchmark models at once making general conclusions possible. As an application, we derive the exact boundary where near-future Xenon and Argon detectors will be (un-)able to dissect the DM-nucleon interaction and DM mass. We show that a simultaneous mass and coupling reconstruction only works in a small region of the parameter space (DM masses around 20-100 GeV) just below current detection limits. Furthermore, we show that inelastic contributions to the DM signal may further break the mass/DM-nucleon interaction degeneracy, motivating a more in depth analysis of additional signal contributions from a wider variety of models. Finally, we propose a new way to visualize the degeneracy breaking abilities of combinations of experiments, which we call Infometric Venn diagrams.

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