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The Power of the Dark Sink

We describe a simple dark sector structure which, if present, has implications for the direct detection of dark matter (DM): *the Dark Sink*. A Dark Sink transports energy density from the DM into light dark-sector states that do not appreciably contribute to the DM density. As an example, we consider a light, neutral fermion ψ which interacts solely with DM χ via the exchange of a heavy scalar Φ. We illustrate the impact of a Dark Sink by adding one to a DM freeze-in model in which χ couples to a light dark photon γ' which kinetically mixes with the Standard Model (SM) photon. This freeze-in model (absent the sink) is itself a benchmark for ongoing experiments. In some cases, the literature for this benchmark has contained errors; we correct the predictions and provide them as a public code. We then analyze how the Dark Sink modifies this benchmark, solving coupled Boltzmann equations for the dark-sector energy density and DM yield. We check the contribution of the Dark Sink ψ's to dark radiation; consistency with existing data limits the maximum attainable cross section. For DM with a mass between MeV $-$ $\mathcal{O}(10\ \text{GeV})$, adding the Dark Sink can increase predictions for the direct detection cross section all the way up to the current limits.

Mini Symposia (Invited Talks Only)

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