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Maximizing Direct Detection with HYPER Dark Matter

Wednesday 15 December 2021 13:00 (1 hour)

Faced with null results in the direct search of WIMP dark matter, there is growing motivation to explore dark matter candidates too light to be directly detected at current experiments. Indeed, there exists a vast array of proposals for direct detection experiments sensitive to sub-GeV dark matter coupled to nucleons. But can dark matter with a consistent cosmological history populate the regions of parameter space these proposals would be sensitive to? Furthermore, is there a maximum cross section for sub-GeV dark matter scattering off nucleons in light of present day constraints? In this talk, I will first estimate this maximum cross section. I will then introduce a novel dark matter candidate which realizes this cross section: HighlY interactive ParticlE Relics (HYPERs). The HYPER relic abundance is set by UV freeze-in, afterwhich a dark sector phase transition decreases the mass of the mediator which connects HYPERs to the visible sector. This increases the HYPER's direct detection cross section, but in such a way as to leave the HYPER's abundance unaffected. HYPERs present a benchmark for direct detection experiments that probe light dark matter.

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