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Solar reflection of dark matter with dark-photon mediators

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We consider the scattering of low-mass halo dark-matter particles in the hot plasma of the Sun, focusing on dark matter that interact with ordinary matter through a dark-photon mediator. The resulting "solar-reflected" dark matter (SRDM) component contains high-velocity particles, which significantly extend the sensitivity of terrestrial direct-detection experiments to sub-MeV dark-matter masses. We use a detailed Monte-Carlo simulation to model the propagation and scattering of dark-matter particles in the Sun, including thermal effects, with special emphasis on ultralight dark-photon mediators. We study the properties of the SRDM flux, obtain exclusion limits from various direct-detection experiments, and provide projections for future experiments, focusing especially on those with silicon and xenon targets. We find that proposed future experiments with xenon and silicon targets can probe the entire "freeze-in benchmark", in which dark matter is coupled to an ultralight dark photon, including dark-matter masses as low as O(keV). Our simulations and SRDM fluxes are publicly available.

Title of the Poster/Talk

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Related Papers/Preprints

https://arxiv.org/abs/2404.10066

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