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Solar reflection of light dark matter with light mediators

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We consider halo dark matter particles whose energy is boosted by colliding with the hot solar plasma. This "solar-reflected"dark matter (SRDM) halo component extends the sensitivity of terrestrial direct detection experiments to lower dark matter masses. In this study, we use a Monte-Carlo simulation to model the propagation and scattering of dark matter particles. We study the properties of the SRDM flux, obtain exclusion limits for various direct-detection experiments, and provide projections for future experiments. We extend previous work on SRDM by focusing on dark matter that interacts with light mediators and implementing a new simulation method that includes the thermal effects in the Sun. Using our updated modeling of the SRDM flux and of the interaction of dark matter particles in terrestrial detectors, we show how SRDM can probe the freeze-in benchmark for sub-MeV dark matter masses.

Authors: XU, Hailin; ESSIG, Rouven; Dr EMKEN, Timon

Presenter: XU, Hailin

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