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Searching for Light Dark Matter with Fixed Target Neutrino Experiments

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We consider a model of light (sub-GeV) dark matter that escapes many of the bounds placed by current dark matter searches. Such low mass dark matter candidates, if produced as a thermal relic in the early universe, must be accompanied by light mediators in order to reproduce the dark matter abundance observed in the present-day universe. These light mediators provide new channels for the production and detection of dark matter at fixed-target neutrino experiments, and proton beam dumps. Detectors sensitive to neutrinos could detect the resulting relativistic dark matter beam through neutral-current-like interactions. Coherent neutrino-nucleus scattering experiments such as COHERENT and Coherent Captain-Mills could produce these dark matter candidates through neutral pion decay at a rate similar to that of neutrinos. Low energy, coherent scattering channels can significantly enhance the expected dark matter signal beyond that expected at higher energy fixed-target experiments and provide unique sensitivity to light dark matter candidates.

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