Background and Motivation

Astrophysical observation suggests that the Universe contains an abundant amount of dark matter. A simple and predictive model to explain this is thermal relic dark matter, which spans a mass range of ~10 keV up to 100 TeV. WIMPs have been a popular candidate in this range, but much of the accessible parameter space has already been ruled out. In recent years, there has been increasing interest in expanding these searches to "light" dark matter in the sub-GeV mass range. The simplest prediction includes a dark photon ($A'$) that couples to dark matter and mixes with the Standard Model photon [1]. The mechanism for production is shown in the figure below.

The Light Dark Matter eXperiment (LDMX) is a fixed target, missing momentum search for light dark matter which will be run at SLAC National Accelerator Laboratory. The primary search mechanism used for LDMX will be missing energy/momentum in the detector (shown in the figure below), but other detection channels can be implemented, such as the sudden appearance of $e^+e^-$ pairs downstream in the detector due to the decay of an $A'$ (a "visible" signal). A proof of concept of a high-efficiency, low-rate visibles trigger will be demonstrated in this poster. Our trigger will be looking for a minimum energy deposition $E_{\text{min}}$ downstream of some distance $z_{\text{min}}$. Reach estimates for both the invisible and visible detection channels are demonstrated, and vetoed backgrounds for our required sensitivity are discussed.

Reach Estimates

LDMX’s projected sensitivity assumes backgrounds are at a level of < 1 event, so these events must be properly vetoed. Veto handles show which detector subsystems will detect and veto background events [2].

Acknowledgements

We thank the vital contributions of our many colleagues on LDMX. This work is partially supported by the U.S. Department of Energy Contract DE-SC0007838.

Background Processes

LDMX's projected sensitivity assumes backgrounds are at a level of < 1 event, so these events must be properly vetoed. Veto handles show which detector subsystems will detect and veto background events [2].

References