

The DarkNESS mission: searching for dark matter with a Skipper-CCD satellite observatory

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The invention of Skipper-CCDs with sub-electron noise paved the way for groundbreaking low-threshold dark matter (DM) experiments, such as DAMIC and SENSEI. Conventionally, these experiments are deployed underground to mitigate cosmogenic backgrounds; however, some DM signatures are inaccessible to underground experiments due to attenuation in the Earth's atmosphere and crust. The DarkNESS mission will deploy an array of Skipper-CCDs on a 6U CubeSat in Low Earth Orbit (LEO) to search for electron recoils from strongly-interacting sub-GeV DM as well as X-ray line signatures from sterile neutrino decay. Using a series of observations from LEO, the DarkNESS mission will set competitive upper limits on the DM-electron scattering cross section and help resolve the experimental conundrum associated with the purported observation of a 3.5 keV X-ray line, potentially produced from decaying dark matter. This work will describe the DarkNESS instrument, the technical challenges in operating Skipper-CCDs in the space environment, the scientific objectives of the DarkNESS mission, and the DM parameter space that DarkNESS will probe.

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