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Extending MeV Dark Matter Bounds with COSI

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Indirect dark matter detection in the MeV energy range is notably constrained by our limited observing sensitivity in this regime. The Compton Spectrometer and Imager (COSI), selected as a NASA Small Explorer satellite with an expected launch in 2027, will offer new potential to push these boundaries. COSI is a gamma-ray telescope that will survey the sky from 0.2-5 MeV with excellent energy resolution. The instrument comprises 16 cross-strip germanium detectors that provide imaging, polarimetry, and spectroscopy. Its instantaneous field of view is >25% of the sky with all-sky coverage every day. COSI's primary science goals are to reveal galactic element formation, study extreme environments with polarization, detect gamma-ray bursts, and image the Galactic positron annihilation line. The same instrument features that enable COSI's science goals – wide field of view, all-sky coverage, and exceptional energy resolution –make COSI excellent for exploring the MeV dark matter parameter space. COSI will search for spectral line signatures from the decay and annihilation of MeV scale dark matter candidates, potentially extending existing bounds by an order of magnitude or more. COSI also has the potential to explore continuum signals from primordial black hole evaporation and annihilation and decay of sub-GeV dark matter into leptons or photons. This talk will review the COSI mission, the instrument characteristics that make COSI excellent for dark matter searches, and the efforts being pursued to study COSI's dark matter sensitivity. By extending our current observing capabilities in the 0.2-5 MeV energy range, COSI will enable the exploration of a previously-unprobed dark matter parameter space.

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