

Extending MeV Dark Matter Bounds with COSI

Tuesday 25 March 2025 09:15 (15 minutes)

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.

Author: ANTHONY-PETERSEN, Robin Ma'ila

Co-authors: Dr TOMSICK, John (Space Sciences Laboratory, 7 Gauss Way, University of California, Berkeley CA 94720-7450, USA); Dr ZOGLAUER, Andreas (Space Sciences Laboratory, 7 Gauss Way, University of California, Berkeley CA 94720-7450, USA); Dr KIERANS, Carolyn (NASA Goddard Space Flight Center, 8800 Greenbelt Road, Greenbelt, MD 20771, USA); Prof. HARTMANN, Dieter (Clemson University, South Carolina, USA); Dr SIEGERT, Thomas (Institut für Theoretische Physik und Astrophysik, Universität Würzburg, Campus Hubland Nord, Emil-Fischer-Str. 31, 97074, Würzburg, Germany); Prof. SAFDI, Benjamin (Berkeley Center for Theoretical Physics, University of California, Berkeley, CA 94720, U.S.A.); Dr DUTRA, Maira (Astroparticle Physics Laboratory, NASA Goddard Space Flight Center, Greenbelt, MD 20771, United States of America); THE COSI SCIENCE TEAM

Presenter: ANTHONY-PETERSEN, Robin Ma'ila

Session Classification: SESSION 5: Astrophysics and Cosmology-1