The Compton Spectrometer and Imager (COSI): The Next Era of MeV Gamma-Ray Astronomy and the Legacy of INTEGRAL

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Abstract

The Compton Spectrometer and Imager (COSI) is a Small Explorer satellite mission selected by NASA and scheduled to launch in August 2027. COSI employs a novel Compton telescope consisting of a compact array of cross-strip germanium detectors. Utilizing its wide field of view and excellent energy resolution, COSI will perform an all-sky survey in the 0.2–5 MeV band and achieve uniform exposure over the sky. In this talk, I will give an overview of the COSI project and its current status, and describe the MeV gamma-ray astrophysics it will enable, including imaging, spectroscopy, and polarimetry. Advancing MeV gamma-ray astronomy requires not only new instruments but also accessible analysis software, given the complex instrumental response of coded-mask and Compton telescopes. COSI therefore provides an open-source data analysis framework, cosipy, which is general enough for application beyond COSI itself. As one such application, I will also present 511 keV all-sky imaging from 20 years of INTEGRAL/SPI data using cosipy's image deconvolution module. Besides the established central, bulge, and disk components, the reconstructed image shows hints of new features, including a bulge asymmetry and emission possibly associated with massive stars in Scorpius–Centaurus and other OB associations. I will discuss how these can be tested by COSI, and how the INTEGRAL archive can remain a highly useful dataset in the era of future MeV missions.

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