Tuesday, Sep 30, **4:15pm** I PAB 4-708 I Zoom: 517 486 4983

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Dark Matter and MeV γ-ray Detection with COSI

Detecting MeV gamma rays has long been difficult, a limitation known as the “MeV gap.” Recent advances have led to new missions aimed at closing this gap, most notably NASA’s Compton Spectrometer and Imager (COSI), scheduled for launch in 2027. In this talk, I will discuss the implications of COSI for dark matter (DM) phenomenology.

A well-motivated DM candidate is thermal DM, once in equilibrium with Standard Model particles in the early universe. While electroweak-scale thermal DM has been extensively studied, the lack of signals has shifted attention to alternative mass regimes, particularly in the MeV range. We have built general models of MeV-scale thermal DM based on minimality and renormalizability, subject to cosmological, experimental, and theoretical constraints. This analysis reveals viable parameter regions, a significant fraction of which can be probed by COSI.

DM-rich environments such as the supermassive black hole (SMBH) at the Galactic Center (Sgr A*) provide especially promising targets. The SMBH modifies the spectrum of DM-induced photons through gravitational redshift, Doppler broadening, and kinetic enhancements from high DM velocities. These effects encode intrinsic DM properties, and we find that COSI, with its unprecedented sub-percent energy resolution, can detect them—enabling both source discrimination and extraction of DM characteristics.