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SWGO Sensitivity to Dark Matter Spikes Around Intermediate-Mass Black Holes

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The microscopic nature of dark matter (DM) remains one of the major open questions in particle physics and astrophysics. Weakly interacting massive particles (WIMPs) are among the most extensively studied candidates and may produce high-energy gamma rays through annihilation. Intermediate-mass black holes (IMBHs) are promising targets for indirect searches because black hole growth within a dark matter halo can generate steep density spikes, enhancing the annihilation signal.

We develop a framework to estimate the sensitivity of the Southern Wide-field Gamma-ray Observatory (SWGO) to gamma rays from dark matter annihilation in spikes around IMBHs. The population and spatial distribution of IMBHs will be characterized using cosmological simulations, including the EAGLE catalog. For each scenario, we model the dark matter density profile and compute the differential gamma-ray flux as a function of the dark matter mass, annihilation cross section, and final state.

The predicted flux is folded with SWGO instrumental response functions to obtain reconstructed event distributions. We present preliminary results from the implementation and validation of the density profiles and flux calculations, providing the basis for future sensitivity limits in the $(m_\chi, \langle\sigma v\rangle)$ parameter space and comparison with existing gamma-ray searches.

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