

茨城大学素粒子論研究室セミナー

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Title: Searching for Dark Photon Tridents Through Primordial Black Hole Signatures

概要

The detection of gamma-ray signals from primordial black holes (PBHs) could provide compelling evidence for their role as dark matter candidates, particularly through the observation of their Hawking radiation. Future gamma-ray observatories, such as e-ASTROGAM and next-generation telescopes, are poised to explore this possibility by measuring both Standard Model (SM) and beyond-the-SM particle emissions. A particularly promising avenue involves the production of dark photons, hypothetical particles that decay into photons, by PBHs. In this work, we investigate the trident decay of dark photons into three photons, focusing on their emission from PBHs. We assume that dark photons produced via Hawking radiation decay into photons well before reaching Earth, thereby enhancing the detectable gamma-ray flux. The energy spectrum of these dark photons is distinct from that of directly Hawking-radiated photons due to higher degree of freedom, leading to observable modifications in the gamma-ray signal. Using asteroid-mass PBHs as a case study, we demonstrate that future gamma-ray missions could detect dark photon signatures and distinguish them from conventional Hawking radiation. This approach enables the exploration of previously inaccessible parameter spaces in dark photon mass m_γ and their coupling to photons, offering a novel pathway to uncover the properties of dark sectors and the nature of PBHs.