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Search for gamma-ray signatures from dark matter spikes around an intermediate-mass black hole in Omega Centauri

Dark matter (DM) constitutes 27% of the universe, but its precise nature remains unknown. Several DM particle candidates were suggested, such as the Weakly Interacting Massive Particles (WIMPs), which can annihilate and create gamma rays. Our research focuses on detecting these gamma rays, specifically around Intermediate Mass Black Holes (IMBHs). The strong gravitational potential of IMBHs is thought to attract and accumulate DM in their surroundings, leading to large overdensities known as DM "spikes," potentially enhancing the resulting gamma-ray signal.

Omega Centauri (NGC 5139), the most massive globular cluster in the Milky Way, with a recently identified IMBH of 8200 solar masses at its core, represents a unique opportunity to study DM.
In this work, we estimate the expected gamma-ray flux from DM annihilation in Omega Centauri, assuming a DM spike around the IMBH. Our analysis considers the benchmark thermal relic velocity averaged cross-section and a WIMP dark matter mass ranging from 10 GeV to 1.5 TeV. Our calculations indicate that the expected gamma-ray flux from WIMP annihilation in the b-b channel surpasses the HESS sensitivity threshold, making Omega Centauri a promising target for investigating potential dark matter spikes around this source.

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