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Primordial Black Holes as Dark Matter Candidates: O(α) Corrections to Hawking Radiation

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Primordial black holes (PBHs) in the mass range $10^{17} - 10^{22}$ g are a promising candidate for the dark matter. At the lower end of this range, PBHs emit Hawking radiation with temperatures T_H $gtrsim$100 keV, allowing for electron-positron pair production and making their radiation detectable in high-energy surveys. To interpret these signals, it is crucial to account for O(α) corrections to the Hawking radiation spectrum.

This work focuses on the perturbative calculation of these O(α) corrections in a Schwarzschild geometry, starting with the quantization of photon and electron/positron fields. We compute the dissipative corrections, which arise from pair creation and annihilation in the plasma. Our numerical results for asteroid-mass PBHs (with masses $M = 1 - 8 \times 10^{21}\ m_{\text{Planck}}$) confirm that at low energies, bremsstrahlung radiation dominates the spectrum, while at high energies, pair production causes a slight suppression of the photon flux.

By comparing our results to existing approximation schemes, we find deviations that could impact the interpretation of Hawking radiation and the constraints on PBHs as dark matter candidates.

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