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Axion misalignment with memory-burdened PBH

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We study the possibility of producing axion dark matter (DM) via misalignment mechanisms in a non-standard cosmological era dominated by ultra-light primordial black holes (PBH). While the effect of PBH domination on the production of axion via vacuum misalignment is known assuming the PBH evaporation to proceed according to Hawking's semi-classical (SC) approximation, we go beyond these simplest possibilities to include kinetic misalignment of axion and backreaction effect of emitted particles on the PBH themselves, referred to as the memory-burden (MB) effect. We show that, depending upon the type of misalignment mechanism and PBH evaporation regime, the axion as well as PBH parameter space consistent with the observed DM relic changes significantly having interesting implications for axion detection experiments. PBH also offer complementary detection prospects via gravitational wave due to PBH density fluctuations and excess radiation due to emission of hot axions within reach of future cosmic microwave background experiments.

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