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Opening the Window for Ultra-Light Primordial Black Holes

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We study the scalar-induced gravitational wave (SIGW) signal from the evaporation of primordial black holes (PBHs). In the idealised monochromatic case, a pronounced SIGW signal is produced via the *Poltergeist* mechanism, driven by a sudden transition from matter to radiation dominance. However, realistic extended mass distributions - such as those predicted by the Press-Schechter formalism from the collapse of superhorizon-scale over-densities - smoothen this transition, leading to a substantial suppression of the resulting GW signal. We show that this suppression not only renders much of the ultra-light PBH parameter space inaccessible to future GW experiments, but also allows these scenarios to evade stringent Big Bang nucleosynthesis constraints, thereby opening up new viable regions of parameter space.

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