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Numerical First Order QED calculations of Hawking Radiation from Asteroid Mass PBHs

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Asteroid mass primordial black holes (mass $10^{16} - 10^{21}$ grams) are viable candidates to describe the total dark matter content of the universe. One of the interesting features of these primordial black holes (PBHs) being a source of dark matter is their Hawking temperature is greater than 100 keV, meaning that charged particle pairs can easily be created for nontrivial hawking radiation signatures. Because of this generation of particles on Quantum Electrodymanic (QED) energy scales, it is necessary to rigorously investigate the Hawking radiation spectra not just at zeroth order, but also at first order in the coupling constant where electrons and positrons could also interact with emitted photons. Previously, our group has created an analytic expression for the first order Hawking radiation spectra from dissipative effects for a Schwarzschild PBH. This talk will demonstrate the numerical implementation of that result for a range of black hole masses, as well as demonstrate which processes are most impactful at different energy scales. This work is critical in understanding upcoming keV -MeV surveys that will be able to directly search for asteroid mass PBHs, and is part of the first steps towards a complete treatment of QED interactions on black hole spacetimes.

Primary author: KOIVU, Emily (The Ohio State University)

Co-authors: KUSHAN, John (The Ohio State University); VASQUEZ, Gabriel (The Ohio State University); SILVA, Makana (Los Alamos National Lab); HIRATA, Christopher (The Ohio State University)

Presenter: KOIVU, Emily (The Ohio State University)

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