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Hawking radiation from primordial black holes

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Low-mass primordial black holes (PBHs) have re-emerged as a promising dark matter candidate. At the lowest allowed masses (of order 10^{17} g), the leading tool for constraining PBHs is Hawking radiation, either in gamma rays or in electrons and positrons (since the peak of the Hawking graybody spectrum is at an energy of order the electron mass). Our group is carrying out a systematic computation of the photon, electron, and positron spectra from Hawking radiation to order $O(\alpha)$ (where $\alpha \approx 1/137$ is the fine structure constant), using the full machinery of quantum electrodynamics (QED), with both the electromagnetic field and the fermions quantized on the Schwarzschild spacetime background. We present results on two previously discussed processes —final state radiation and stochastic charge —that modify the particle spectra, as well as the roadmap for our ongoing calculations. We discuss the implications both for PBH searches, and what we are learning about interacting theories in the Schwarzschild spacetime.

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