Evaporating Kerr black holes as probes of new physics

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Abstract

In the string axiverse scenario, primordial black holes (PBHs) can sustain non-negligible spin parameters as they evaporate. We show that tracking the mass and spin evolution of a PBH in its final hour can yield a purely gravitational probe of new physics beyond the TeV scale, allowing one to determine the number of new scalars, fermions, vector bosons and spin-3/2 particles. Furthermore, we propose a multi-messenger approach to accurately measure the mass and spin of a PBH from its Hawking photon and neutrino primary emission spectra, which is independent of putative interactions between the new degrees of freedom and the Standard Model particles, as well as from the Earth-PBH distance.

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