

Towards experimentally testing the paradox of black hole information loss

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Abstract:

In 1976, Hawking pointed out that information about the collapsed matter in a black hole will be lost since there is no correlation among the thermal Hawking radiations. In 2000, Parikh and Wilczek discovered that Hawking radiations are slightly derived from exact thermality when back reaction is considered. With the nonthermal spectrum of Parikh and Wilczek, we recently showed that Hawking radiations can carry off all information about the collapsed matter in a black hole [1,2]. In this talk, I will discuss the spectroscopic features of Hawking radiation from a Schwarzschild black hole, contrasting the differences between the nonthermal and thermal spectra. We found that the energy covariances of Hawking radiations for the thermal spectrum are exactly zero, but the energy covariances are nontrivial for the nonthermal spectrum. Thus, the nonthermal spectrum can be distinguished from the thermal one by counting the energy covariances of Hawking radiations, which presents an avenue towards experimentally resolving the paradox [3]. Finally, I will discuss the possibility of testing the paradox by counting Hawking radiations from small manmade black holes such as predicted to appear in LHC experiments or discussed with optical, acoustic, and cold-atomic systems.

References:

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2. B. Zhang, Q.-y. Cai, M.-s. Zhan, and L. You, Ann. Phys. 326, 350 (2011).
3. B. Zhang, Q.-y. Cai, M.-s. Zhan, and L. You, Phys. Rev. D 87 044006 (2013).