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TeV mini black hole decay at future colliders. (English) Zbl 1087.83517

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Summary: It is generally believed that mini black holes decay by emitting elementary particles with a black body energy spectrum. The original calculation leads to the conclusion that about the 90% of the black hole mass is radiated away in the form of photons, neutrinos and light leptons, mainly electrons and muons. With the advent of string theory, such a scenario must be updated by including new effects coming from the stringy nature of particles and interactions. The main modifications with respect to the original picture of black hole evaporation come from recent developments in non-perturbative string theory globally referred to as TeV-scale gravity. By taking for granted that black holes can be produced in hadronic collisions, then their decay must take into account that: (i) we live in a D3 brane embedded into a higher dimensional bulk spacetime; (ii) fundamental interactions, including gravity, are unified at the TeV energy scale. Thus, the formal description of the Hawking radiation mechanism has to be extended to the case of more than four spacetime dimensions and includes the presence of D-branes. This kind of topological defect in the bulk spacetime fabric acts as a sort of 'cosmic fly-paper' trapping electro-weak standard model elementary particles in our $(3 + 1)$-dimensional universe. Furthermore, unification of fundamental interactions at an energy scale many orders of magnitude lower than the Planck energy implies that any kind of fundamental particle, not only leptons, is expected to be emitted. A detailed understanding of the new scenario is instrumental for optimal tuning of detectors at future colliders, where, hopefully, this exciting new physics will be tested. In this review, we study higher dimensional black hole decay, considering not only the emission of particles according to the Hawking mechanism, but also their near-horizon QED/QCD interactions. The ultimate motivation is to build up a phenomenologically reliable scenario, allowing a clear experimental signature of the event.

MSC:

83C57 Black holes
83C47 Methods of quantum field theory in general relativity and gravitational theory
83E15 Kaluza-Klein and other higher-dimensional theories
83E30 String and superstring theories in gravitational theory

Software:

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