Black hole entropy, the black hole information paradox, and time travel paradoxes from a new perspective

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Relatively simple but apparently novel ways are proposed for viewing three related subjects: black hole entropy [1,2], the black hole information paradox [3,4], and time travel paradoxes. (1) Gibbons and Hawking [5] have completely explained the origin of the entropy of all black holes, including physical black holes – nonextremal and in 3-dimensional space – if one can identify their Euclidean path integral with a true thermodynamic partition function (ultimately based on microstates). An example is provided of a theory containing this feature. (2) There is unitary quantum evolution with no loss of information if the detection of Hawking radiation is regarded as a measurement process within the Everett interpretation of quantum mechanics. (3) The paradoxes of time travel evaporate when exposed to the light of quantum physics (again within the Everett interpretation), with quantum fields properly described by a path integral over a topologically nontrivial but smooth manifold. This presentation extends a previous article [6].

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