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The capacity to transmit classical information via black holes CHRISTOPH ADAMI, Michigan State University, GREG VER STEEG, University of Southern California — One of the most vexing problems in theoretical physics is the relationship between quantum mechanics and gravity. According to an argument originally by Hawking, a black hole must destroy any information that is incident on it because the only radiation that a black hole releases during its evaporation (the Hawking radiation) is precisely thermal. Surprisingly, this claim has never been investigated within a quantum information-theoretic framework, where the black hole is treated as a quantum channel to transmit classical information. We calculate the capacity of the quantum black hole channel to transmit classical information (the Holevo capacity) within curved-space quantum field theory, and show that the information carried by late-time particles sent into a black hole can be recovered with arbitrary accuracy, from the signature left behind by the stimulated emission of radiation that must accompany any absorption event. We also show that this stimulated emission turns the black hole into an almost-optimal quantum cloning machine, where the violation of the no-cloning theorem is ensured by the noise provided by the Hawking radiation. Thus, rather than threatening the consistency of theoretical physics, Hawking radiation manages to save it instead.

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