Abstract Submitted
for the MAR14 Meeting of
The American Physical Society

Quantum capacity of quantum black holes CHRIS ADAMI, Michigan State Univ, KAMIL BRADLER, St. Mary's University — The fate of quantum entanglement interacting with a black hole has been an enduring mystery, not the least because standard curved space field theory does not address the interaction of black holes with matter. We discuss an effective Hamiltonian of matter interacting with a black hole that has a precise analogue in quantum optics and correctly reproduces both spontaneous and stimulated Hawking radiation with grey-body factors. We calculate the quantum capacity of this channel in the limit of perfect absorption, as well as in the limit of a perfectly reflecting black hole (a white hole). We find that the white hole is an optimal quantum cloner, and is isomorphic to the Unruh channel with positive quantum capacity. The complementary channel (across the horizon) is entanglement-breaking with zero capacity, avoiding a violation of the quantum no-cloning theorem. The black hole channel on the contrary has vanishing capacity, while its complement has positive capacity instead. Thus, quantum states can be reconstructed faithfully behind the black hole horizon, but not outside. This work sheds new light on black hole complementarity because it shows that black holes can both reflect and absorb quantum states without violating the no-cloning theorem, and makes quantum firewalls obsolete.

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Date submitted: 13 Nov 2013 Electronic form version 1.4