Abstract Submitted
for the MAR09 Meeting of
The American Physical Society

Closed timelike curves enable perfect state distinguishability TODD A. BRUN, University of Southern California, JIM HARRINGTON, Los Alamos National Laboratory, MARK M. WILDE, SAIC — The causal self-consistency condition for closed timelike curves can give rise to nonlinear interactions on chronology-respecting qubits. We demonstrate that particular unitary interactions between closed timelike curve qubits and chronology-respecting qubits allow perfect distinguishability of nonorthogonal states, and provide a constructive proof for an arbitrary number of nonorthogonal states. This has a number of highly significant consequences. For example, an adversary with access to closed timelike curves can break the B92, BB84, and SARG04 quantum key distribution protocols, or any prepare-and-measure quantum key distribution scheme. Our result also implies that a party with access to closed timelike curves can violate the Holevo bound by accessing more than $\log(N)$ bits of information from an N-dimensional quantum state. In principle, he can transmit an arbitrarily large amount of classical information with a quantum system of fixed size. We discuss the implications of this for quantum cloning.

Todd A. Brun
University of Southern California

Date submitted: 21 Nov 2008 Electronic form version 1.4