Abstract Submitted
for the DAMOP09 Meeting of
The American Physical Society

Constructing General Unitary Maps from State Preparations[1]
SETH MERKEL, University of New Mexico, GAVIN BRENNEN, Macquarie University, POUL JESSEN, University of Arizona, IVAN DEUTSCH, University of New Mexico — We present an open-loop protocol for constructing arbitrary unitary maps on d-dimensional quantum systems. This protocol utilizes both geometric and stochastic construction techniques, and as such is reasonably efficient and places only minor restrictions on the form of the dynamics necessary to drive the system. We extend this construction to maps that are defined only on a subspace of the Hilbert space, and show that the fundamental scaling depends on the subspace dimension. Additionally, we show how these techniques can be used in atomic spin systems to create general qudit operators as well to perform a simple form of error correction on an embedded qubit.

[1]This research was supported by IARPA Grant No. DAAD19-13-R-0011 and NSF Grant No. 0653599.

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Date submitted: 23 Jan 2009 Electronic form version 1.4