

Abstract Submitted  
for the MAR15 Meeting of  
The American Physical Society

**Universal  $SU(d)$  holonomic quantum computing with cat-qudits**

VICTOR V. ALBERT, Yale Univ, STEFAN I. KRASTANOV, CHAO SHEN, ZAKI LEGHTAS, Yale University, REN-BAO LIU, The Chinese University of Hong Kong, MAZYAR MIRRAHIMI, Yale University, INRIA Paris-Rocquencourt, ROBERT J. SCHOELKOPF, LIANG JIANG, Yale University — We present a holonomic computation scheme with engineered dissipation of a multi-photon process, a generalization of the driven dissipative 2-photon process studied in [1]. The engineered  $d$ -photon process can stabilize a  $d$ -dimensional steady state manifold spanned by  $d$  coherent states. Universal control is achieved with two types of non-Abelian holonomic gates [2]. The first type consists of adiabatically moving a coherent state around a closed path in phase space, resulting in a relative Berry phase between that state and the other states. The second type consists of adiabatically colliding two coherent states, resulting in a unitary evolution with coherent population transfer between those two components. We outline a way to realize the  $d = 2$  case using circuit QED.

[1] M. Mirrahimi, Z. Leghtas, V. V. Albert, S. Touzard, R. J. Schoelkopf, L. Jiang, and M. H. Devoret, *New J. Phys.* **16**, 045014 (2014).

[2] A. Carollo, M. Santos, and V. Vedral, *Phys. Rev. Lett.* **96**, 020403 (2006).

Victor V. Albert  
Yale Univ

Date submitted: 14 Nov 2014

Electronic form version 1.4