

Abstract Submitted  
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**A controlled-phase gate for matterwave interferometry** AARON HANKIN, Univ of New Mexico, YUAN-YU JAU, GRANT BIEDERMANN, Sandia National Laboratories — We are implementing a controlled-phase gate based on singly trapped neutral atoms whose coupling is mediated by the dipole-dipole interaction of Rydberg states. An off-resonant laser field dresses ground state cesium atoms in a manner conditional on the Rydberg blockade mechanism [1,2], providing the required entangling interaction. We will present our progress [3] and its connection to single-atom matterwave interferometry [4] with entangled atoms. Sandia National Laboratories is a multi-program laboratory managed and operated by Sandia Corporation, a wholly owned subsidiary of Lockheed Martin Corporation, for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000.

- [1] S. Rolston, et al. Phys. Rev. A, 82, 033412 (2010)
- [2] T. Keating, et al. Phys. Rev. A, 87, 052314 (2013)
- [3] A. Hankin, et al. arXiv:1401.2191
- [4] L. P. Parazzoli, et al. Phys. Rev. Lett., 109, 230401 (2012)

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