Abstract Submitted
for the MAR15 Meeting of
The American Physical Society

Device-Level Models Using Multi-Valley Effective Mass ANDREW D. BACZEWSKI, Sandia National Laboratories, ADAM FREES, University of Wisconsin-Madison, JOHN KING GAMBLE, XUJIAO GAO, N. TOBIAS JACOBSON, JOHN A. MITCHELL, INÈS MONTAÑO, RICHARD P. MULLER, ERIK NIELSEN, Sandia National Laboratories — Continued progress in quantum electronics depends critically on the availability of robust device-level modeling tools that capture a wide range of physics and effective mass theory (EMT) is one means of building such models. Recent developments in multi-valley EMT show quantitative agreement with more detailed atomistic tight-binding calculations of phosphorus donors in silicon (Gamble, et. al., arXiv:1408.3159). Leveraging existing PDE solvers, we are developing a framework in which this multi-valley EMT is coupled to an integrated device-level description of several experimentally active qubit technologies. Device-level simulations of quantum operations will be discussed, as well as the extraction of process matrices at this level of theory. The authors gratefully acknowledge support from the Sandia National Laboratories Truman Fellowship Program, which is funded by the Laboratory Directed Research and Development (LDRD) Program. 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 Security Administration under contract DE-AC04-94AL85000.

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Date submitted: 10 Nov 2014 Electronic form version 1.4