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Geometric Phase Gates via Adiabatic Control Using Electron Spin Resonance HUA WU, ERIK GAUGER, Department of Materials, Oxford University, Oxford OX1 3PH, UK, RICHARD GEORGE, Clarendon Laboratory, Department of Physics, Oxford University, Oxford OX1 3PU, UK, JOHN MORTON, Department of Materials, Oxford University, Oxford OX1 3PH, UK, MIKKO MÖTTÖNEN, 1)Department of Applied Physics/COMP, Aalto University, FI-00076 AALTO, Finland 2)Low Temperature Laboratory, Aalto University, FI-00076 AALTO Finland — High fidelity operations are essential elements of quantum information processing. In contrast with the dynamic pulses that are routinely used in electron spin resonance for spin qubit manipulation, geometric phase gates achieved via adiabatic control are less sensitive to certain kinds of noise and field inhomogeneities. Here, we employ theoretical and numerical tools to show that these geometric operations can be realized in electron spin systems with greater fidelities than composite dynamic pulses for large inhomogeneities in the microwave field. We further show that the adiabatic geometric phase is robust against fast fluctuations in the static magnetic field. Finally, we investigate adiabatic geometric phase operations experimentally, showing that we are able to apply such robust phase gates to the electron spin on the microseconds timescale.

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