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Adiabatic passage for quantum gates in mesoscopic atomic ensembles[1] I.I. BETEROV, A.V.Rzhanov Institute of Semiconductor Physics SB RAS, 630090 Novosibirsk, Russia, M. SAFFMAN, University of Wisconsin, E.A. YAKSHINA, A.V.Rzhanov Institute of Semiconductor Physics SB RAS, 630090 Novosibirsk, Russia, V.P. ZHUKOV, Institute of Computational Technologies SB RAS, 630090 Novosibirsk, Russia, D.B. TRETYAKOV, V.M. ENTIN, I.I. RYABTSEV, A.V.Rzhanov Institute of Semiconductor Physics SB RAS, 630090 Novosibirsk, Russia, C.W. MANSELL, C. MACCORMICK, S. BERGAMINI, The Open University, Walton Hall, MK7 6AA, Milton Keynes, UK, M.P. FEDORUK, Institute of Computational Technologies SB RAS, 630090 Novosibirsk, Russia — We present schemes for geometric phase compensation in adiabatic passage which can be used for implementation of quantum logic gates with atomic ensembles consisting of an arbitrary number of strongly interacting atoms. Protocols using double sequences of stimulated Raman adiabatic passage (STIRAP) or adiabatic rapid passage (ARP) pulses are analyzed. Switching the sign of the detuning between two STIRAP sequences, or inverting the phase between two ARP pulses, provides state transfer with well defined amplitude and phase independent of atom number in the Rydberg blockade regime. Using these pulse sequences we present protocols for universal single-qubit and two-qubit operations in atomic ensembles containing an unknown number of atoms.

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Mark Saffman
University of Wisconsin

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