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Study of Rydberg-Rydberg interactions for quantum gates with neutral atoms BINDIYA ARORA, M.S. SAFRONOVA, University of Delaware, CHARLES W. CLARK, National Institute of Standards and Technology, Gaithersburg — The fast phase gate scheme, in which the qubits are atoms confined in sites of an optical lattice, and gate operations are mediated by excitation of Rydberg states, was proposed in [1]. The logic gate is implemented using a blockade of the simultaneous excitation of atoms into a Rydberg state. Strong coupling between atoms is required for the experimental realization of such proposal. In this work, we study Rydberg-Rydberg interactions that are resonantly enhanced by the Föster processes [2]. Such resonances may provide sufficiently strong Rydberg-Rydberg interactions in low electric fields to realize a blockade necessary for the gate operations. Comparative calculations are done for alkali atoms to determine if this entanglement scheme may be better suited for a specific system.
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