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Adiabatic quantum computation with neutral atoms via the Rydberg blockade[1] KRITTIKA GOYAL, IVAN DEUTSCH, Department of Physics and Astronomy, University of New Mexico — We study a trapped-neutral-atom implementation of the adiabatic model of quantum computation whereby the Hamiltonian of a set of interacting qubits is changed adiabatically so that its ground state evolves to the desired output of the algorithm. We employ the "Rydberg blockade interaction," which previously has been used to implement two-qubit entangling gates in the quantum circuit model. Here it is employed via off-resonant virtual dressing of the excited levels, so that atoms always remain in the ground state. The resulting dressed-Rydberg interaction is insensitive to the distance between the atoms within a certain blockade radius, making this process robust to temperature and vibrational fluctuations. Single qubit interactions are implemented with global microwaves and atoms are locally addressed with light shifts. With these ingredients, we study a protocol to implement the two-qubit Quadratic Unconstrained Binary Optimization (QUBO) problem. We model atom trapping, addressing, coherent evolution, and decoherence. We also explore collective control of the many-atom system and generalize the QUBO problem to multiple qubits.

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