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Rydberg ensemble based CNOT^N gates using STIRAP[1] TANVI
GUJARATI, LUMING DUAN, University of Michigan, Ann Arbor — Schemes for
implementation of CNOT gates in atomic ensembles are important for realization of
quantum computing. We present here a theoretical scheme of a CNOT^N gate with
an ensemble of three-level atoms in the lambda configuration and a single two-level
control atom. We work in the regime of Rydberg blockade for the ensemble atoms
due to excitation of the Rydberg control atom. It is shown that using STIRAP,
atoms from one ground state of the ensemble can be adiabatically transferred to the
other ground state, depending on the state of the control atom. A thorough analysis
of adiabatic conditions for this scheme and the influence of the radiative decay is
provided. We show that the CNOT^N process is immune to the decay rate of the
excited level in ensemble atoms.

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