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Possibility of "magic" trapping of three-level system for Rydberg blockade implementation[1] MUIR J. MORRISON, ANDREI DEREVIANKO, University of Nevada, Reno — The Rydberg blockade mechanism has shown noteworthy promise for scalable quantum computation with neutral atoms. Both qubit states and gate-mediating Rydberg state belong to the same optically-trapped atom. The trapping fields, while being essential, induce detrimental decoherence. Here we theoretically demonstrate that this Stark-induced decoherence may be completely removed using powerful concepts of "magic" optical traps. We analyze "magic" trapping of a prototype three-level system: a Rydberg state along with two qubit states, which are hyperfine states attached to a $J = 1/2$ ground state. Our numerical results show that the group IIIB metals such as Al are suitable candidates. Such trapping may or may not be possible for the alkalis, as "magic" conditions depend sensitively on the the trap-Rydberg interaction. Calculations of these effects are ongoing, and the results will be presented.

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