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Detrimental effects of molecular resonances on Rydberg blockade
ANDREI DEREVIANKO, University of Nevada, Reno, PETER KOMAR, Harvard University, TURKER TOPCU, University of Nevada, Reno, RONEN KROEZE, Eindhoven University of Technology, M LUKIN, Harvard University — We study the effect of resonances associated with complex molecular interaction of Rydberg atoms on Rydberg blockade. We show that densely-spaced molecular potentials between doubly-excited atomic pairs become unavoidably resonant with the optical excitation at short interatomic separations. Such molecular resonances limit the coherent control of individual excitations in Rydberg blockade. As an illustration, we compute the molecular interaction potentials of Rb atoms near the $100s$ states asymptote to characterize such detrimental molecular resonances, determine the resonant loss rate to molecules and inhomogeneous light shifts. Techniques to avoid the undesired effect of molecular resonances are discussed.

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