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Blockade and antiblockade of Rydberg excitations in ultracold gases CENAP ATES, Max Planck Institute for the Physics of Complex Systems, Nöthnitzer Str. 38, D-01187 Dresden, Germany, THOMAS POHL, ITAMP, Harvard-Smithsonian Center for Astrophysics, 60 Garden Street, Cambridge, MA 02138, USA, THOMAS PATTARD, JAN MICHAEL ROST, Max Planck Institute for the Physics of Complex Systems, Nöthnitzer Str. 38, D-01187 Dresden, Germany
— Experimental studies of the impact of strong interatomic interactions on the Rydberg excitation dynamics in ultracold gases have recently led to a verification of the interaction-induced suppression of excitation compared to a non-interacting reference system. This blockade effect has been demonstrated directly via the fraction of atoms that are excited by a laser pulse, and indirectly via the sub-Poissonian counting statistics of the number of excited atoms. For a theoretical treatment, we have developed a microscopic approach based on a description of the single-atom dynamics within a rate equation approximation and a Monte Carlo treatment of the many-particle system. This method is particularly well suited for a study of the statistical properties of the excitation process. Moreover, we show that under certain circumstances a reversal of the blockade effect is possible, leading to an enhancement of excitation rather than a suppression.

Thomas Pattard
Max Planck Institute for the Physics of Complex Systems,
Nöthnitzer Str. 38, D-01187 Dresden, Germany

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