SFB/TRR 21 - Colloquium

24. Mai 2013, Ulm

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Manipulating Rydberg atoms and molecules in the gas phase and near chip surfaces

New experimental results on the manipulation of the translational motion of Rydberg atoms and molecules in the gas phase using inhomogeneous electric will be presented. In the experiments, cold atoms or molecules moving at high speed (about 700 m/s) in the laboratory reference frame in supersonic beams are photoexcited to Rydberg-Stark states with large electric dipole moments, deflected, slowed down to low velocity, and loaded in electric traps at translational temperature of about 100 mK. The talk will begin with an introduction on the properties of Rydberg states upon which these experiments rely. Then, results on the deceleration and trapping of hydrogen atoms and molecules will be presented to illustrate the general principles of these experiments Blackbody-radiation-induced transitions and collisional processes limit the trapping times, but their effects can be reduced by maintaining the surfaces surrounding the Rydberg atom or molecule samples at 4 K after adiabatic 90o deflection of the Rydberg atoms/molecules out of the supersonic beam. Finally, experiments will be discussed in which (1) hydrogen Rydberg atoms have been decelerated and trapped above the surface of a chip, and (2) interactions between Rydberg atoms and on-chip transmission lines have been investigated spectroscopically.

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