



SFB/TRR 21 - Colloquium

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Rydberg-dressed atoms under control

The ability to control and modify inter-particle interactions using external electric, magnetic or electromagnetic fields has proven an outstanding tool to improve the stability of atomic and molecular quantum gases and to harness novel quantum many-body phases in these systems. In this talk we discuss recent ideas concerning groundstate alkali atoms weakly dressed by a highly-excited Rydberg state using off-resonant laser light. We demonstrate theoretically that laser-dressing can induce novel exotic many-body phenomena in an atomic quantum gas, such as a quantum phase transition from a Bose-Einstein condensate to a strongly-interacting free-space supersolid crystal. At the few-body level, engineered interactions between cold Rydberg-dressed atoms and polar molecules may be used to cool the latter down from mK to μ K temperatures, an exciting prospect in cold molecular physics and chemistry.

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