

Atomic Rydberg Reservoirs for Polar Molecules

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We discuss laser-dressed dipolar and van der Waals interactions between atoms and polar molecules, so that a cold atomic gas with laser admixed Rydberg levels acts as a designed reservoir for both elastic and inelastic collisional processes. The elastic scattering channel is characterized by large elastic scattering cross sections and repulsive shields to protect from close encounter collisions. In addition, we discuss a dissipative (inelastic) collision where a spontaneously emitted photon carries away (kinetic) energy of the collision partners, thus providing a significant energy loss in a single collision. This leads to the scenario of rapid thermalization and cooling of a molecule in the mK down to the μ K regime by cold atoms.

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