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A new experimental setup for investigation of cold molecule-Rydberg-atom interactions MARTIN ZEPPENFELD, Max Planck Institute of Quantum Optics — A quantum hybrid system composed of polar molecules and Rydberg atoms has been suggested for a wide variety of applications, including cooling of internal and external molecular degrees of freedom, nondestructive molecular state readout, and quantum information processing. However, to date no experiments in any of these directions have been performed.
In my talk I will present the status and plans for a new experimental setup to investigate interactions between cold molecules and cold Rydberg atoms. Slow molecular beams produced by velocity filtering will interact with Rydberg atoms excited from cold atoms in a magnetooptical trap. This will allow us to enter a previously unexplored low energy regime for molecule-Rydberg-atom interactions. In this regime, pure dipole-dipole interactions should dominate, with substantially enhanced cross-sections and dramatically reduced resonance widths for resonant energy transfer between the two systems compared to previous measurements at room temperature [1]. Moreover, we hope to demonstrate molecule-Rydberg-atom interactions as an efficient means to nondestructively detect polar molecules, possibly including heralded nondestructive detection of single molecules.
[1] F. Jarisch *et al.* NJP **20**, 113044 (2018)

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