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**Control of dipolar collisions of polar molecules in the quantum regime<sup>1</sup>**

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Ultracold polar molecular quantum gases promise to open new research directions ranging from the study of ultra-cold chemistry, precision measurements to novel quantum phase transitions. Based on the preparation of high-phase space density gases of polar KRb molecules, I will discuss the control of dipolar collisions and chemical reactions of polar molecules in a regime where quantum statistics, single scattering partial waves, and quantum threshold laws play a dominant role. In particular, I will discuss the crucial role of electric dipole-dipole interactions and external confinement in determining the chemical reaction rate. Finally, I will discuss prospects of reaching quantum degeneracy in bi-alkali samples of polar molecules and prospects for these systems as novel dipolar quantum many-body systems.

<sup>1</sup>Experimental work done in collaboration with Silke Opselkaus, M. H. G. de Miranda, B. Neyenhuis, K.-K. Ni, D. Wang, D. S. Jin, and J. Ye