Molecular Engineering with Light Fields

Quantum control of atomic and molecular processes, in particular at ultralow temperatures, has reached an amazing degree of sophistication. Using light fields, pairs of atoms may be joined together to form molecules. Their internal quantum states may be controlled via coherent population transfer. This provides the starting conditions for quantum controlled interactions and many-body physics. I will show how we form and manipulate ultracold molecules using continuous and ultrafast laser fields and how we study ultracold molecular collisions. Ultraintense light fields provide an additional control knob for orientational degrees of freedom. I will present imaging results of a molecular reaction that is a model system for an orientation-dependent process and give an outlook on intense field control of molecular collisions.