DECELERATING MOLECULES WITH MICROWAVE FIELDS

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An important remaining issue in the field of cold molecules is a general technique to manipulate the motion of polar molecules in high-field-seeking states, which is crucial for the investigation of molecules in their ground states and of all large and more complex molecules. Complementary to the already demonstrated and experimentally rather challenging alternating gradient methods, we exploit the interaction of polar molecules with electromagnetic radiation in a microwave cavity.
Based on the concept of our microwave lens [a] we have developed a decelerator for polar molecules that allows motion control in three dimensions. It consists of a cylindrically symmetric microwave resonator, which is cooled to liquid nitrogen temperature. For our deceleration experiments, we are using the $TE_{1,1,12}$ mode, i.e., the decelerator consists of 12 stages. We will present a detailed characterization of the microwave deceleration process and discuss prospects for future experiments, which are opening the door for novel control experiments of larger molecules.

[a] H. Odashima et al., Microwave Lens for Polar Molecules, *Phys. Rev. Lett.*, 104, 253001, 2010