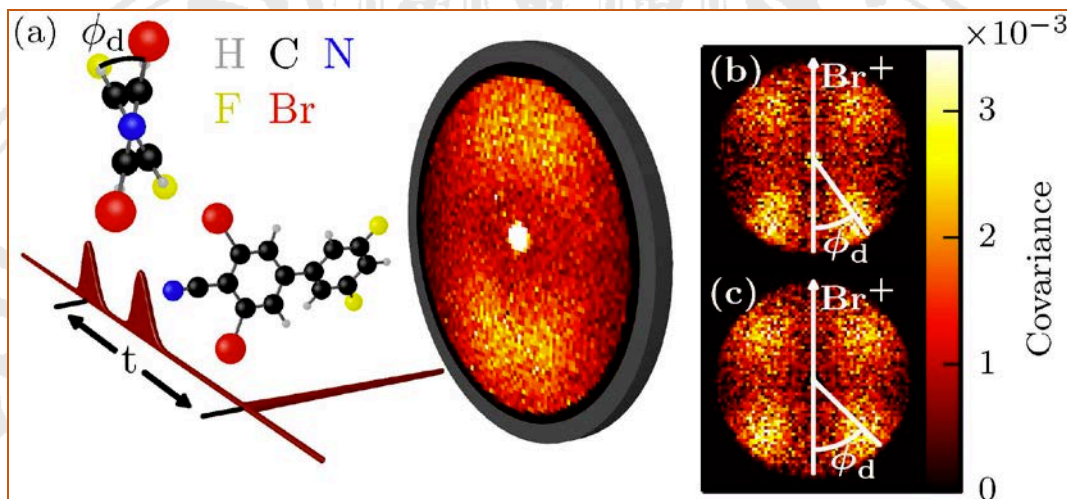


# PHYSIKALISCHES KOLLOQUIUM

AM 10. NOVEMBER 2014 UM 17 UHR C.T.

IM GROßEN HÖRSAAL



## FEMTOSECOND TIME-RESOLVED IMAGING OF TORSION IN A CHIRAL MOLECULE

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I will discuss how it is possible to directly image torsion of a chiral molecules, consisting of two benzene rings linked by a carbon-carbon single bond, on their natural femtosecond time-scale. The torsional motion is of special importance because it is the fundamental reaction coordinate linking the left-handed and the right-handed mirror forms of the chiral molecule. Experimentally, the molecules are initially fixed-in-space by laser-induced 3-dimensional adiabatic alignment with a 10 nanosecond (ns) long laser pulse. Next, torsion is induced by a femtosecond pump pulse, synchronized to the peak of the ns pulse. The torsion is monitored in real time by Coulomb exploding the molecules with a delayed, intense femtosecond probe pulse and detecting the emission direction of the ionic fragments [1]. In particular, ion species labelling each of the two benzene rings, here F<sup>+</sup> and Br<sup>+</sup> ions, are detected simultaneously by a Pixel Imaging Mass Spectrometry (PI-MMS) camera [2]. Covariance analysis of the emission distribution of the two ion species yields the dihedral angle between the two benzene rings directly and reveals torsional motion with an amplitude of 3 degrees and a period of 1.3 ps. The torsional amplitude can be doubled by applying two appropriately synchronized pump pulses in excellent agreement with calculations. The torsional motion persists for more than 150 ps corresponding to approximately 120 torsional oscillations.

[1] J. L. Hansen et al., J. Chem. Phys. 136, 204310, 2012.

[2] J.J. John et al. JINST 7, C08001, 2012.

[3] L. Christensen et al. Phys. Rev. Lett. 113, 073005 (2014)