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Dissociative electron attachment dynamics in polyatomic gases[1]

DANIEL SLAUGHTER, Lawrence Berkeley Natl Lab

The resonant process of dissociative electron attachment can be described by a transient molecular anion intermediate, exhibiting highly non-Born-Oppenheimer behavior in the coupling of electronic motion into internuclear motion within the molecule, followed by dissociation. The transient molecular anion is initially in the electronic continuum, therefore the resonance autodetachment lifetime must be included explicitly in an accurate theoretical description of this process. Detailed examination of the dynamics of the transient molecular anion requires multidimensional experimental techniques to analyze the outgoing fragments in detail. Anion fragment momentum imaging[1,2] captures the final-state momentum of the dissociated anion fragment and allows both the kinetic energy release and the angular distribution to be determined in the laboratory frame, which is defined by the incident electron momentum. Transforming this information into the molecular frame can be achieved with the support of ab initio electron scattering calculations to determine the electron attachment amplitude. This potent combination of experiment and theory allows the dynamics of dissociative electron attachment to be interrogated in detail. The results of recent investigations on polyatomic molecules will be presented, along with our latest results on the simplest organic acid, formic acid, performed in collaboration with C. S. Trevisan (Cal Maritime Academy), and A. Belkacem, C. W. McCurdy, T. N. Rescigno, and R. R. Lucchese (LBNL). References cited: [1] H. Adaniya, D. S. Slaughter, T. Osipov, Th. Weber, A. Belkacem (2012), A momentum imaging microscope for dissociative electron attachment, Rev. of Sci. Inst. 83 (2), 023106; [2] D. S. Slaughter, A. Belkacem, C. W. McCurdy, T. N. Rescigno, D. J. Haxton (2016), Ion-momentum imaging of dissociative attachment of electrons to molecules, J. Phys. B: Atomic, Molecular and Optical Physics 49 (22), 222001

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