Report on the STSM of N. Stolterfoht at the Queens University Belfast in June 2005 within COST P9 Action

The laboratories in Berlin and Belfast have an ongoing collaboration since about 2 years concerning the fragmentation of molecules by impact of slow highly charged ions. Within the Cost P9 Action we started experiments studying the fragmentation of water molecules because of its relevance to biological matter. In Berlin experiments were performed where the energy and angular distribution of fragment ions from collisions of 1 – 5 keV He^{2+} impact with H_2O molecules were measured. This work of fragment ion spectroscopy (FIS) has been combined with complementary data produced with corresponding results from Belfast using the methods translational energy spectroscopy (TES). The results have been described in a recent Paper which has been published in Phys. Rev. A **71**, 022705 (2005).

In this STSM we have further developed models for charge exchange between multicharged ions and molecular targets such as CO_2, NH_3, and O_2. For the analysis, models introduced by Landau and Zener have been used. In specific cases also the model by Demkov has been applied. The models are based on potential curves that can be generated using molecular orbitals influenced by the Coulomb forces of the two collision partners. Then analytic matrix elements coupling the potential curves have been explored with respect to their model parameters. Single and double electron capture are generally involving non-dissociative and dissociative channels, respectively. The non-dissociative channel was modelled considering single-electron transitions governed by nuclear-electron interaction. The dissociative channels, which involve two electron transitions, were evaluated by means of the electron-electron interaction. The model calculations provided a useful tool to understand the details of the charge exchange mechanisms underling the experimental observations.

HMI Berlin, August 10, 2005

(N. Stolterfoht)

I agree with this Report of the STSM by Nico Stolterfoht at Queens University at Belfast

Belfast, August 12, 2005

(R. McCullough)