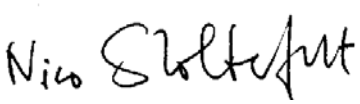
Report of the STSM to Debrecen in May 2007

The laboratories in Berlin and Debrecen have an ongoing collaboration since more than 5 years concerning the fragmentation of molecules by impact of highly charged ions. Within the Cost 09 Action we started experiments studying the fragmentation of water molecules because of its relevance to biological matter. In our recent work we found a pronounced 90° maximum in the angular distribution of the H^+ fragments ejected with relatively low energy of ~ 10 eV. The results have been published in J. Phys. B: At. Mol. Opt. Phys. **39**, 927 (2006) and Phys. Rev. A **75**, 052702 (2007). The observed maximum is important as it governs the total cross section for water fragmentation. The motivation for the present STSM was to study this 90° maximum of ejected proton in detail using faster projectiles available at the Debrecen accelerator.

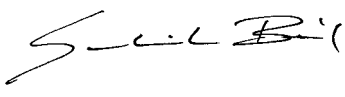
In this STSM we analyzed recent experiments using He^{2+} projectiles with relative high energies of several hundred keV. The experience of the Berlin group was implemented for the production of a clean water target. The measurements provided clear evidence for the anisotropy of the ejected protons. The projectile is fast so that these post-collision fields can be neglected. Then, the effect of the projectile can be described within a sudden approximation in which the molecular fragmentation can be treated independently of the process of charge removal from the target. Besides H_2O the 'symmetric' the target CH_4 has been used for comparison. The main work of the STSM was the development and application of models which allowed the interpretation of the anisotropy of the H^+ fragments. We verified the new prospect that the observed anisotropy is due to 90° recoils ejected in 'soft' binary collisions. The experiment agrees well with new calculations based on the binary-encounter formalism. Hence we concluded that essential parts of the 90° maximum of H^+ fragments is understood in terms of two-body collisions. However, we expect that for slower projectiles, interpreted in our previous work (Phys. Rev. A **75**, 052702 (2007)), the process of Coulomb explosion gains importance. In this case the orientation and the structure of the molecule come into play. In the future it would be useful to verify the projectile energy at which the process of Coulomb explosion loose importance and the binary collisions start to dominate.

STSM traveler



(Nikolaus Stolterfoht)

Agreements by the host



(Belá Sulik)