

DIESE WOCHE

PHYSIKALISCHES KOLLOQUIUM

des Fachbereichs Physik
der Johann Wolfgang Goethe-Universität Frankfurt

Mittwoch, den 01.07.2015, 16 Uhr c.t.
Großer Hörsaal, Raum _0.111,
Max-von-Laue-Str. 1

Dr. Olga Smirnova
Max-Born Institut, Berlin

"New effects in optical tunnelling"

Tunnelling is a ubiquitous quantum process playing fundamental role in many areas of physics, chemistry, and biology. It can occur naturally or be induced by an external field, whether static or a low-frequency oscillating. In this talk I will discuss several effects associated with tunnel ionization induced by an intense low-frequency laser field, starting with atoms and moving on to chiral molecules. First, I will discuss opportunities to use precisely controlled, circularly polarized few-cycle laser pulses to measure the so-called tunnelling delay times – the time an electron can spend while moving in the classically forbidden region under the barrier. I will show that delays during tunnel ionization of one-electron systems are equal to zero (at least within non-relativistic quantum mechanics), but that electron-electron correlation may be modifying this picture [1]. Next, I will discuss unexpected consequences of tunnelling from states with non-zero angular momentum in circularly polarized laser fields. I will show that states co-rotating and counter-rotating with the laser field tunnel differently, leading not only to the different electronic spectra but also to the generation of few-femtosecond long, spin-polarized electron bunches [2]. Finally, I will show that tunnel ionization of molecules can create holes that move, that the motion of these holes can be sensitive to the topology of the molecule, and that it can be used to follow the dynamics of the chiral response with both high sensitivity and sub-femtosecond time resolution [3].

[1] L. Torlina, F. Morales, J. Kaushal, I. Ivanov, A. Kheifets, A. Zielinski, A. Scrinzi, H. G. Muller, S. Sukiasyan, M. Ivanov and O. Smirnova, Interpreting attoclock measurements of tunnelling times, Nature physics, 11, 503, (2015) [2] R. Cireasa, A. E. Boguslavskiy, B. Pons, M. C. H. Wong, D. Descamps, S. Petit, H. Ruf, N. Thire, A. Ferre, J. Suarez, J. Higuete, B. E. Schmidt, A. F. Alharbi, F. Legare, V. Blanchet, B. Fabre, S. Patchkovskii, O. Smirnova, Y. Mairesse, V. R. Bhardwaj, Probing molecular chirality on sub-femtosecond time-scale, Nature physics, (2015) [3] I. Barth and O. Smirnova, Spin-polarized electrons produced by strong-field ionization, Phys. Rev. A, 88, 013401 (2013)

Die Dozenten der Physik

Kolloquium