CFEL SCIENCE

SEMINAR

7th July 2015 - 10:00 h

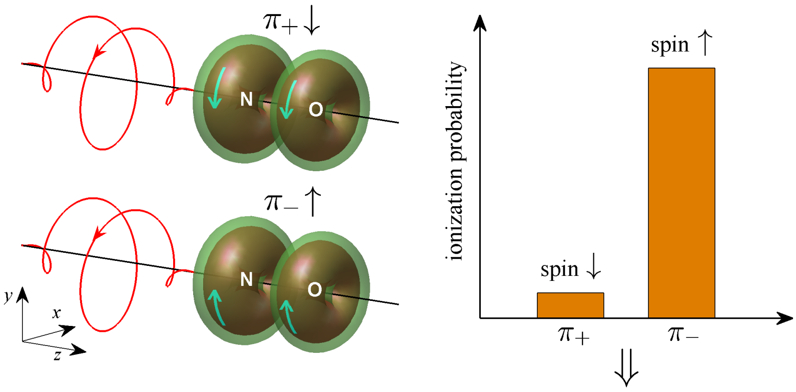
CFEL – Building 99, seminar room I+II (ground floor)

Ingo Barth

Max Planck Institute of Microstructure Physics, Halle, Germany

Tunnel ionization of degenerate orbitals in strong circularly polarized laser fields

The theory of nonadiabatic tunnel ionization of atomic degenerate valence orbitals in strong circularly polarized laser fields has been developed, based on the theory for short-range potentials, known as PPT theory. In contrast to the adiabatic-based theories, in which the electric field is assumed to be static, the nonadiabatic theory predicts that the ionization rates for co- and counter-rotating electrons in atomic degenerate p+ and p- orbitals are different and that, in general, for right circularly polarized laser fields the ionization of p- orbitals (i.e. orbitals with a counter-rotating electron) is preferred. This counter-intuitive predication has been confirmed by the sequential double ionization experiment and verified by numerical calculations. However, numerical calculations and improved theoretical results in terms of laser-dressed orbitals and three-level Floquet models show that in the regime of strong fields and low frequencies the ionization behaviors can change and the ionization of p+ orbitals becomes preferred. In this talk, I also present the extended theory to describe tunnel ionization of molecular degenerate p + and p- orbitals as well as corresponding numerical calculations for the pre-oriented nitric oxide molecule. Furthermore, numerical calculations show that the emission angles of photoelectrons from degenerate orbitals are different and should be observable in attoclock experiments. Tunnel ionization by strong circularly polarized laser fields can produce highly spin-polarized photoelectrons and ions, rotating hole dynamics, and spin currents in the ion.



NO in the degenerate ground state $\Pi_{1/2}$ $\Rightarrow$ spin polarization 81%

Host: Terry Mullins / CFEL Molecular Physics Seminar