corinf12

Participant	Title	Abstract
Abraham Camacho Garibay	Electron spectra from C$_$ under XFEL pulses	Many body dynamics can be triggered and investigated through instense XFEL pulses in systems like clusters and molecules. A theoretical study is performed for the C$_$ fullerene by a semi-classical microscopic model including sub-shell photo-ionization, Auger processes and Coulombic interactions. For not very strong pulses, electron emission is sequential, and interaction between electrons is negligible as can be seen by switching off the interaction. For sequential ionization, a simple analytical model is proposed which is found to be in good agreement with the full microcopic model.
Alejandro de la Calle Negro	Interaction of aligned molecules with attosecond pulses	We report the development of a library for the efficient calculation of electron spectra from the interaction of an aligned molecule with an attosecond pulse.
Johann Förster	Preparation and measurement of nuclear wave packets with ultrashort laser pulses: "Lochfraß" and the inversion motion of NH3	Time-resolved imaging of the dynamics of electrons and nuclei is a prerequisite to understand chemical processes and, therefore, a great challenge for theory and experiment. Preparing and measuring nuclear wave packets describable within the promising pump-probe sheme "Lochfraß" was so far discussed theoretically [1] and experimentally [2] for diatomic molecules. The vibration of the molecule D2 was monitored experimentally with subfemtosecond and sub-Ångstrom resolution in real time. This became possible using two identical but delayed intense ultrashort laser pulses. While so far only diatomic molecules were considered, the Lochfraß effect should be observable for larger molecules as well. The challenge for theory consists in describing this higher dimensional coupled vibrational problem and suggesting pulse parameters for the experiment. For NH3, we expect a significant Lochfraß effect which can be understood within a simple one-dimensional double-well picture describing the inversion motion of the molecule. In addition to Lochfraß itself, also the tunneling problem in the double-well potential is of interest since a coordinate-dependent ionization rate allows the study of the wave packet traversing the inversion barrier, and thus to investigate quantum-mechanical tunneling. [1] Goll et al., Phys. Rev. Lett. 97, 103003 (2006). [2] Ergler et al., Phys. Rev. Lett. 97, 103004 (2006).
Felipe Morales Moreno	Shaping of attosecond pulses via laser control of electron and hole dynamics	We present [1] a way to control the polarization of attosecond pulses generated by HHG by using the combination of the fundamental radiation and its second harmonic, both linearly polarized, in perpendicular geometry. Extending the multi-electron analysis done in the CO2 molecule in previous works [2] to treat the two-color laser fields, we explore the rich possibilities that this control mechanism offers. The second color component of the field allows to control the recombination angle which, in turns, controls the relative magnitudes of different recombination channels as they have preferred recombination angles. This second field also induces dynamics in the molecular ion upon ionization, that leads to population transfer between the ionic states. Therefore the magnitude of additional recombination channels can be controlled by the relative intensity and the phase delay between the two driving fields. This manipulation of amplitude and phases of several interfering HHG channels results in fine control of polarization properties of the XUV emission, which is ready for experimental tests as the setup has already been implemented in experiments [3-4]. [1] Shaping of attosecond pulses via laser control of electron and hole dynamics. F. Morales, I. Barth, V. Serbinenko, S. Patchkovskii and O. Smirnova. J. Mod. Optics, in press (2012) [2] High Harmonic Spectroscopy of Multichannel Dynamics in Strong-Field Ionization. Y. Mairesse, J. Higuet, N. Dudovich, D. Shafir, B. Fabre, E. Mével, E. Constant, S. Patchkovskii, Z. Walters, M. Yu. Ivanov, and O. Smirnova. Phys. Rev. Lett. 104, 213601 (2010) [3] Trajectory Selection in High Harmonic Generation by Controlling the Phase between Orthogonal Two-Color Fields. Leonardo Brugnera, David J. Hoffmann, Thomas Siegel, Felix Frank, Amelle Zaïr, John W. G. Tisch, and Jonathan P. Marangos. Phys. Rev. Lett. 107, 153902 (2011) [4] O. Raz, O. Pedatzur, B. D. Bruner and N. Dudovich, Spectracl Caustics in Attosecond Science. Nature Photonics, accepted (2012)
Hector Rey Pereira	Application of the RMT approach to anisotropy parameters for sidebands in two-colour two-photon ionization of Helium	We investigate ionization of He irradiated by a combination of two laser pulses: an XUV pulse corresponding to the 17th - 21st harmonic of the fundamental laser field and an overlapping fundamental dressing field. The wavelength of the fundamental field ranges from 790 – 810 nm. We use the R-matrix with time-dependence (RMT) approach [1] to determine anisotropy parameters of the sidebands generated by the dressing field. We investigate how these parameters vary with the amount of atomic structure included. We compare the theoretical anisotropy parameters with those obtained experimentally [2]. [1] L. R. Moore et al, Phys. Rev. A 84, 061404 (2011) [2] Louis H. Haber, Benjamin Doughty, and Stephen R. Leone, Phys. Rev. A 84, 013416 (2011)
Maria Richter	Imaging the Kramers-Henneberger atom	Even moderate laser fields with intensities of about 10^13 W/cm^2, standard in many ultrafast experiments, suppress the potential barrier for ionization for all excited states in most atoms and molecules. The response of such “almost-free” states plays a key role in a number of recent experimental surprises, as diverse as (i) the observation of the unprecedented acceleration of neutral atoms [1], at the rate of 10^15 m/sec^2 in intense infrared (IR) laser pulses and (ii) the paradigm-shifting results on the filamentation of ultrashort IR femtosecond laser pulses in the air without substantial plasma formation [2]. Both experiments, albeit indirectly, demonstrate the existence of stable atoms and molecules in intense IR fields. Our numerical experiment demonstrates [3] that these stable "laser-dressed" atoms, the so-called Kramers-Henneberger (KH) atoms [4], can be unambiguously identified and imaged in the angle resolved photoelectron spectra obtained with standard femtosecond laser pulses and velocity map imaging techniques. We also show that the KH atom is formed and can be detected even before the onset of stabilization [5,6]. Our study was done for an alkaline atom (potassium), with conditions very similar to those in recent experiments [7,8]. Our findings open the way to visualizing and controlling bound electron dynamics in strong laser fields and reexamining its role in various strong field processes, including microscopic description of high-order Kerr non linearities and their role in laser filamentation. [1] Eichmann, U., Nubbemeyer, T., Rottke, H. & Sandner, W. Acceleration of neutral atoms in strong short-pulse laser fields. Nature 461, 1261-1264 (2009). [2] Béjot, P., Kasparian, J., Henin, S., Loriot, V., Vieillard, T., Hertz, E., Faucher, O., Lavorel, B., & Wolf, J.-P. Higher-Order Kerr Terms Allow Ionization-Free Filamentation in Gases. Phys. Rev. Lett. 104, 103903 (2010). [3] Morales, F., Richter, M., Patchkovskii, S. & Smirnova, O. Imaging the Kramers-Henneberger atom. P. Natl. Acad. Sci. USA 108, 16906-16911 (2011). [4] Henneberger, W. Perturbation method for atoms in intense laser fields. Phys. Rev. Lett. 21, 838 (1968). [5] Fedorov, M.V. & Movsesyan, A.M. Field-induced effects of narrowing of photoelectron spectra and stabilisation of Rydberg atoms. J. Phys. B 21, L155 (1988). [6] Pont, M. & Gavrila, M. Stabilization of atomic hydrogen in superintense, high-frequency laser fields of circular polarization. Phys. Rev. Lett. 65, 2362 (1990). [7] Wollenhaupt, M., Krug, M., Köhler, J., Bayer, T., Sarpe-Tudoran, C. & Baumert, T. Photoelectron angular distributions from strong-field coherent electronic excitation. Applied Physics B 95, 245 (2009). [8] Schuricke, M., Zhu, G., Steinmann, J., Simeonidis, K., Ivanov, I., Kheifets, A., Grum-Grzhimailo, A. N., Bartschat, K., Dorn, A. & Ullrich, J. Strong-field ionization of lithium. Phys. Rev. A 83, 023413 (2011).
David Robinson	Quantitatively accuracy calculations of the harmonic spectrum for one- and two-electron atoms in one- and two-colour laser fields	We present HHG yields for helium that have been calculated using two independent methods - HELIUM and TDRM. These results show excellent agreement. The HELIUM methodology is applied to hydrogen and helium in two-colour laser fields.
Marco Ruberti	Molecular photo-ionization cross-sections by Stieltjes imaged ADC-Lanczos pseudospectra	Molecular photo-ionization cross-section describes the physical process in wich a molecule absorbs energy from radiation and as a consequence one electron is emitted leaving the molecular region. The molecule is therefore ionized and an electronic hole is created with respect to the neutral system. This type of process gives rise to a molecular ion which does not have to be in an energy eigenstate. As a consequence after photo-ionization the state of the molecular ion can undergo a non-trivial dynamical evolution, such as hole-migration, Auger decay etc... In order to follow the dynamical evolution of the system after ionization, it is essential to know the exact initial state in which the ion is left, the exact hole density of the molecular ion. Some primary insight on the possible initial state is provided by photo-ionization cross-section. In the present work this quantity is calculated appling the Stieltjes moment-theory imaging procedure to the Lanczos pseudospectra obtained from ADC calculations at various

		level of approximation in the electronic correlation, namely ADC[1], ADC[2] and ADC[2] extended.
Valeriya Serbinenko	Multidimensional high harmonic spectroscopy	We consider high harmonic generation in orthogonally polarized fundamental and weak second harmonic fields as two-dimensional pump-probe spectroscopy. The perturbative nature of the orthogonally polarized second harmonic leaves the ionization process virtually unchanged, but introduces substantial amplitude modulation of the HHG signal by altering the electron motion after ionization. Changing the delay between the fundamental and the second harmonic fields controls the modulation of the harmonic signal. Here we present analytical approach which extracts information about electron subcycle dynamics directly from the modulation of the HHG signal. We develop iterative procedure for obtaining electron ionization times, including their imaginary component- the tunneling times, recombination times and electron lateral momentum from the experiment. The delay-dependent HHG spectra can be viewed as multi-dimensional spectroscopy, with the harmonic number linked to electron recombination times and the two-color delay linked to electron ionization times.
Nader Slama	Role of the variance in the description of an excited system	The time-dependent wavefunction of the system, initially in the ground state, can be expressed as a linear combination of adiabatic states (ground and excited states of the system). However, the propagation in time of this linear combination is computationally demanding (if it is possible at all to access the dominant excited states of the system). Here, we explore the possibility of using the variance of the electronic Hamiltonian as indicator of deviation from the ground state and of excited states coming into play. We do this using an exactly solvable model, i.e., the one dimensional harmonic oscillator in the presence of an external perturbation.
Lisa Torlina	Electron-ion correlation effects in strong field ionization	In the standard picture of strong field ionization, we typically assume that only one electron is active, while the other electrons remain frozen in the ion. Under this assumption, producing an ion in an excited state is exponentially suppressed, since the active electron must depart from one of the lower lying orbitals. Here we show that allowing electron-electron correlation effects during tunnelling can remove this exponential penalty. We develop an analytical theory to calculate ionization amplitudes for this case, and demonstrate the importance of such channels for N2 and CO2 molecules.
Attila Toth	Wave function dynamics in the ionization of H by few-cycle XUV laser pulses	The interaction of few-cycle laser pulses with atoms and molecules has attracted much interest recently. In order to accurately study these interactions, we have implemented a grid based method for the "ab-initio" solution of the time-dependent Schrodinger equation (TDSE) for single active electron systems based on the time-dependent close-coupling method. We have performed calculations for the ionization of the hydrogen atom by few-cycle XUV laser pulses, where we have studied the wave function dynamics on attosecond time scale. Our attention was focused on the study of the interference between electronic wave packets emitted at different time moments, and electronic wave packets following different paths. In order to better understand the underlying physics we have performed calculations for different laser pulse parameters.