A 17: Interaction with Strong or Short Laser Pulses II (joint session A/MO)

Time: Wednesday 14:30–16:15 Location: F107

Invited Talk A 17.1 Wed 14:30 F107

Adiabatic properties of the bicircular attoclock — •Paul Winter and Manfred Lein — Leibniz University Hannover

If the right field-strength ratio between a circularly polarized laser pulse and its counter-rotating second harmonic is chosen, one can create a quasilinear electric field in the temporal vicinity of the maximal field. In contrast to conventional linear polarization, rescattering is avoided and a detailed study of direct ionization in strong fields is possible.

The well-defined direction of the field at the ionization time enables us to investigate orientation dependencies in the ionization of molecules in a controlled manner. As our main observables, the ionization yield and the orientation-dependent attoclock shift (i.e. the potential-induced shift of the peak of the electron momentum distribution) are obtained by solving the two-dimensional time-dependent Schrödinger equation for HeH^+ and H_2.

In the regime of small Keldysh parameter $\gamma = \sqrt{2I_p}\frac{\omega}{E} \ll 1$, ionization can be described by two-step models, in which the electron travels classically after tunneling out. A crucial factor in these adiabatic models (and hence for the predicted attoshift) is the location of the exit point, which is sensitive to molecular properties such as the dipole moment and the polarizability of the ionized orbital.

A 17.2 Wed 15:00 F107

Towards strong-field XUV coherent control — •F. Richter[1], C. Manzoni[2], A. Ngai[1], M. Michelbach[1], D. Uhl[1], F. Landmesser[1], N. Rendler[1], S. D. Ganeshamandiram[1], C. Callegari[3], M. Di Fraia[3], N. Pal[3], O. Plekan[3], G. Sansone[1], K. Prince[3], T. Laarmann[4], M. Mudrich[5], P. Rebernik[3], R. Feifel[6], R. Squibb[6], M. Wollenhaupt[7], S. Hartweg[1], G. Cerullo[2], F. Stienkemeier[1], and L. Bruder[1] — [1]Institute of Physics, University of Freiburg — [2]Dipartimento di Fisica, Politecnico di Milano — [3]Elettra - Sincrotrone Trieste S.C.p.A. — [4]Department of Physics, University of Hamburg — [5]Department of Physics and Astronomy, Aarhus University — [6]Department of Physics, University of Gothenburg — [7]Institute of Physics, University of Oldenburg

Within the NIR and VIS wavelength regime there are various coherent control schemes. However, for coherent control in the XUV regime two major challenges arise: (i) The technical challenge to manipulate the pulses. (ii) XUV radiation induces typically extremely fast relaxation dynamics, which compete with the coherent control scheme. Ultrafast control schemes are, hence, paramount which can be achieved by using intense pulses beyond the weak field regime. Intense optical fields are known to induce Rabi oscillations leading to Autler-Townes level splittings. We investigate the population control of the respective sublevels as shown in the NIR [1]. We will present simulations of the expected Autler-Townes splitting as well as preliminary results from our beamtime at the free electron laser FERMI.

[1] M. Wollenhaupt et al., Phys. Rev. A 68, 015401 (2003).

A 17.3 Wed 15:15 F107

The N-shaped partition method: A novel parallel implementation of the Crank Nicolson algorithm — •Francisco Navarrete and Dieter Bauer — Institute of Physics, University of Rostock

We develop an algorithm to solve tridiagonal systems of linear equations, which appear in implicit finite-difference schemes of partial differential equations (PDEs), being the time-dependent Schrödinger equation (TDSE) an ideal candidate to benefit from it. Our N-shaped partition method optimizes the implementation of the numerical calculation on parallel architectures, without memory size constraints. Specifically, we discuss the realization of our method on graphics processing units (GPUs) and the Message Passing Interface (MPI). In GPU implementations, our scheme is particularly advantageous for systems whose size exceeds the global memory of a single processor. Moreover, because of its lack of memory constraints and the generality of the algorithm, it is well-suited for mixed architectures, typically available in large high performance computing (HPC) centres. We also provide an analytical estimation of the optimal parameters to implement our algorithm, and test numerically the suitability of our formula in a GPU implementation. Our method will be helpful to tackle problems which require large spatial grids for which ab-initio studies might be otherwise prohibitive both because of large shared-memory requirements and computation times.

A 17.4 Wed 15:30 F107

Dephasing effects in high-order harmonic generation from finite Su-Schrieffer-Heeger chains — •Christoph Jürss and Dieter Bauer — Insitute of Physics, University of Rostock, Germany

The Su-Schrieffer-Heeger (SSH) model describes a linear, one-dimensional chain that displays topological effects. Due to its simplicity, the SSH-model has been used to study numerous effects in topological insulators. The most interesting feature of topologically non-trivial insulators are their topologically protected edge states. It was shown in previous studies that the generation of high-order harmonics can be influenced by the topological nature of the solid and even by just the edge states themselves. In order to obtain more realistic simulated harmonic spectra, relaxation and dephasing effects should be taken into account. This is usually done for the bulk, i.e., with no edge states present. In this work, we implement dephasing for the finite SSH-model and compare the results to those from the respective bulk.

A 17.5 Wed 15:45 F107

Delay time and Non-Adiabatic Calibration of the Attoclock. *Multiphoton process versus tunneling in strong field interaction* — •Ossama Kullie[1] and Igor Ivanov[2] — [1]Institute for Physics, University of Kassel — [2]nstitute for Basic Science (IBS), Gwangju 61005, Republic of Korea

Recent measurement of the tunneling time in attosecond experiments (termed attoclock), triggered a hot debate about the tunneling time, the role of time in quantum mechanics and the separation of the interaction with the laser pulse into two regimes of a different character, the multiphoton and the tunneling (field-) ionization. In the adiabatic field calibration, we showed in earlier works (see e.g. [1]) that our real tunneling time model fits well to the experimental data. In the present work [2], we investigate the nonadiabatic case (see [3]) and combine it with a new result of a numerical integration of the TDSE (see [4]). Our model explains the experimental of Hofmann et al [3] with an excellent agreement. Our model is appealing because it offers a clear picture of the multiphoton and tunneling. In the nonadiabatic case, the barrier itself is mainly driven by multiphoton absorption and the number of the absorbed photons depends on the δ-value of the barrier height. Surprisingly, for a filed strength $F < F_a$ (the atomic field strength) the model always indicates a time delay with respect to the lower quantum limit at $F = F_a$. Its saturation at the adiabatic limit explains the well-known Hartman effect or Hartman paradox. [1] O. kulllie. PRA **92** 052118 (2015). [2] O. kulllie and I. Ivanov arxiv.2005.09938v4. [3] J. of Mod. Opt. **66**, 1052, 2019. [4] Phys. Rev. A **89**, 021402, 2014.

A 17.6 Wed 16:00 F107

Writing waveguides in polymers with femtosecond laser. — •Dmitrii Perevoznik[1,2] and Uwe Morgner[1,2,3] — [1]Institut für Quantenoptik, Welfengarten 1, 30167, Hannover — [2]Cluster of Excellence PhoenixD (Photonics, Optics, and Engineering -Innovation AcrossDisciplines), Hannover, Germany — [3]Laser Zentrum Hannover e.V ., Hollerithalle 8, D-30419 Hannover, Germany

Writing waveguides with femtosecond laser is a very promising technique and has already proven its performance in glasses and crystals. Nevertheless, writing waveguides in polymers is a just developing field and polymer material can offer the potential to create low-cost and complex structures inside the volume of the material. Singlemode waveguides with propagation losses of 0.6 *m were achieved by putting modifications, done by femtosecond laser, around waveguide core forming different geometries. Also shown are various optical elements embedded in waveguides, such as waveguide splitters or Bragg gratings.