A 6: Interaction with strong or short laser pulses II

Time: Tuesday 10:30–12:00 Location: A-H1

Invited Talk A 6.1 Tue 10:30 A-H1

Synthetic chiral light for control of achiral and chiral media — •Nicola Mayer[1], David Ayuso[1,2], Misha Ivanov[1], and Olga Smirnova[1] — [1]Max-Born-Institut, Berlin, Germany — [2]Imperial College, London, United Kingdom

Light that is chiral in the dipole approximation can be synthetized by combining two or more beams with commensurate frequencies in a non-collinear or tightly-focused setup. The interaction of this particular type of light with a chiral sample leads to giant enantio-sensitive responses [1]. Moreover, the combination of chiral light with Gaussian beams carrying orbital angular momentum (OAM) gives rise to vortexes with azimuthally-varying handedness [2]. Here, we demonstrate new ways in which synthetic chiral can be used to shape the response in both achiral and chiral media. Specifically, we demonstrate the excitation of time-dependent chiral superpositions of atomic states whose handedness can be probed by standard Photoelectron Circular Dichroism methods [3]. Moreover, we demonstrate that chiral OAM beams shape the near- and far-field high-harmonic generation (HHG) signal from isotropic samples of chiral molecules in a topological manner, i.e. the spatial distribution of the HHG signal is described by an integer topological charge.

[1] D. Ayuso et al., Nat. Phot., 2019, 13 (12), 866-871

[2] N. Mayer et al., Chiral topological light, in preparation

[3] N. Mayer et al., Imprinting chirality on atoms using synthetic chiral light, arXiv:2112.02658

A 6.2 Tue 11:00 A-H1

Retrieval of the internuclear distance in a molecule from photoelectron momentum distributions using convolutional neural networks — •Nikolay Shvetsov-Shilovski and Manfred Lein — Leibniz Universität Hannover, Hannover, Germany

We train and use a convolutional neural network (CNN) to recognize the internuclear distance of a two-dimensional H_2^+ molecule from the photoelectron momentum distribution produced by a strong few-cycle laser pulse [1]. We show that the CNN trained on a dataset consisting of a few thousand images can retrieve the internuclear distance with the mean absolute error less than 0.1 a.u.

We investigate the effect of the focal averaging on the retrieval of the internuclear distance. The CNN trained on a set of focal averaged momentum distributions also shows good performance in recognizing of the internuclear distance: the corresponding mean absolute error does not exceed 0.2 a.u. Furthermore, we compare the application of the CNN with an alternative approach based on the direct comparison of the momentum distributions.

[1] N. I. Shvetsov-Shilovski and M. Lein, submitted to Phys. Rev.A, arXiv:2108.08057.

A 6.3 Tue 11:15 A-H1

Torus-knot angular momentum in attosecond pulses from high-harmonic generation — •Björn Minneker[1,2,3], Birger Böning[2,3], Anne Weber[1], and Stephan Fritzsche[1,2,3] — [1]Theoretisch Physikalisches Institut, Friedrich-Schiller-Universität, Jena, Germany — [2]GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt, Germany — [3]Helmholtz Institut, Jena, Germany

We investigated the dynamical symmetry related to the conservation of torus-knot angular momentum (TKAM) in attosecond bursts from high harmonic generation. In particular, we discuss the characterization of the TKAM for bicircular Laguerre-Gaussian driving beams. Since the orbital angular momentum of the emitted harmonics is not a good quantum number anymore, a different kind of angular momentum is required to characterize them, namely the TKAM. We developed an intuitive model which relates the characteristic parameters τ and γ of the TKAM to the geometry of a torus knot. This is done for both the driving beam and the harmonic radiation. In addition, we found a geometric relation between τ and γ. We hope that our contribution can help to get intuitively access to this form of angular momentum. Furthermore, TKAM maid help to improve the spectroscopical classification of high harmonics driven by bicircular beams.

A 6.4 Tue 11:30 A-H1

High-harmonic generation in finite Haldanite flakes — •Christoph Jürss and Dieter Bauer — Institute of Physics, University of Rostock

In topological insulators, edge states are important for the electron dynamics. The edge states allow a dissipation-less transport of electric current, whereas the bulk is an insulator. In this work, we investigate the contribution of the edge states to the high-order harmonic generation in the Haldane model. Finite "Haldanite" flakes of different sizes are considered. Compared to the spectrum for the respective bulk system, the finite flakes show several additional peaks in the energy region below the band-gap between valence and conduction band. We find that some peaks depend on the flake size. This talk focuses on the origin of this size dependency.

A 6.5 Tue 11:45 A-H1

Time Delay and Nonadiabatic Calibration of the Attoclock and TDSEQ result — •Ossama Kullie[1] and Igor Ivanov[2] — [1]Theoretical Physics, Institute of Physics, University of Kassel — [2]Centre for Relativistic Laser Science, Gwangju, Republic of Korea

The 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 ionization. In earlier works of the the adiabatic field calibration our real tunneling time showed a good agreement with the experimental data of the attoclock [1]. In the present work [1], we show that our model can explain the experimental results in the nonadiabatic field calibration, where we reach a good agreement with the experimental data of Hofmann et al [2]. Moreover, our result is confirmed by a new numerical integration of the Time-dependent Shrödinder equation, see Ivanov et al [2]. Our model is appealing because it offers a clear picture of the multiphoton and tunneling parts. Surprisingly, at a field 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. Kullie arXiv:2005.09938v3, O. Kullie PRA 92, 052118, 2015. [2] Iogr Ivanov et al, J. of Mod. Opt. **66**, 1052, 2019. [3] Phys. Rev. A **89**, 021402, 2014.