Max-Planck-Institut für Kernphysik

Max Planck Institute for Nuclear Physics

The Max Planck Institute for Nuclear Physics (www.mpi-hd.mpg.de) is one of 86 research institutes of the Max Planck Society for the Advancement of Science e.V. (MPG). The MPG is an independent, non-profit research organization, which seeks to promote basic research in the service of the general public.

The Division of Quantum Dynamics and Control Division (Director: Prof. Dr. Thomas Pfeifer) at the Max Planck Institute for Nuclear Physics in Heidelberg (Germany) offers

PhD and Postdoc positions (m/f/d)

in ultrafast nonlinear light-matter interaction of small atoms and molecules

Working field / your tasks

We offer opportunities for postdoc and PhD projects in the area of experimental strong-field physics and ultrafast light-matter interaction, working with state-of-the-art laser light sources. We are interested in understanding and steering/controlling the fundamental laser-driven (nonlinear) quantum dynamics of electron motion within small atoms and molecules, primarily at the femtosecond to attosecond time scale. Hereby we pursue a bottom-up approach with the goal to obtain a complete understanding of the correlated interaction of charged particles in small quantum systems. We conduct these experiments to test fundamental quantum-dynamics theories, e.g., of two active electrons in a helium atom or the correlated electron and nuclear dynamics in a hydrogen molecule. We also routinely apply our findings to understand increasingly larger systems, such as multi-electron atoms, small diatomic and polyatomic molecules. Last but not least we transfer our findings in small quantum systems to study the coherence properties of large molecular complexes in solution in the liquid phase. Selected recent publications include [1 – 8], where we offer projects both with in-house few-cycle femtosecond laser systems, as well as at external-facility free electron lasers.

In our research we employ time-resolved strong-field absorption spectroscopy, developing a time-domain physics picture of the nonlinear dipole response at the heart of light-matter interaction [7, 8]. With in-house attosecond pulses from high-order harmonic generation or external-facility free-electron laser pulses we typically focus on the XUV and x-ray spectroscopic fingerprint region of element-specific transitions.

Requirements:

Hands-on experience with ultrafast laser systems, handling of XUV/x-ray radiation in ultra-high vacuum systems and general experience in optics and laser laboratories is beneficial but not required.

The salary will be paid according to the collective agreement for civil service employees in Germany (TVöD).

The Max Planck Society is an equal opportunity employer actively seeking to increase diversity and to create an inclusive environment within its research activities. We celebrate diversity and do not discriminate based on race, religion, national origin, gender, sexual orientation, age, disability status, or any other applicable characteristics protected by law. The Max Planck Institute for Nuclear Physics is a family-friendly employer.

Further information can be obtained from Dr. Christian Ott: christian.ott@mpi-hd.mpg.de and Prof. Dr. Thomas Pfeifer: thomas.pfeifer@mpi-hd.mpg.de

https://www.mpi-hd.mpg.de/mpi/en/research/scientific-divisions-and-groups/quantum-dynamicscontrol/research/excited-atomsmolecules-in-strong-fields-ag-ott

Applicants are encouraged to send a curriculum vitae and a motivation letter, reflecting their motivation and interest for the research opportunities outlined above.

Applications should be uploaded **ONLINE** with reference #11-2022.

[1] Rupprecht et al., PRL 128, 153001 (2022); see also Phys. Unserer Zeit 4/2022 (53), 164-165.
[2] Rebholz et al., PRX 11, 031001 (2021).
[3] Ding et al., Faraday Discuss. 228, 519-536 (2021).
[4] Hartmann et al., Optics Letters 44, 4749-4752 (2019).
[5] Ott et al., PRL 123, 163201 (2019).
[6] da Costa Castanheira et al., Front. Phys. 9:627826 (2021).
[7] Ott et al., Science 340, 716-720 (2013).
[8] Stooß et al., PRL 121, 173005 (2018).

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Saupfercheckweg 1
D-69117 Heidelberg
Germany
www.mpi-hd.mpg.de

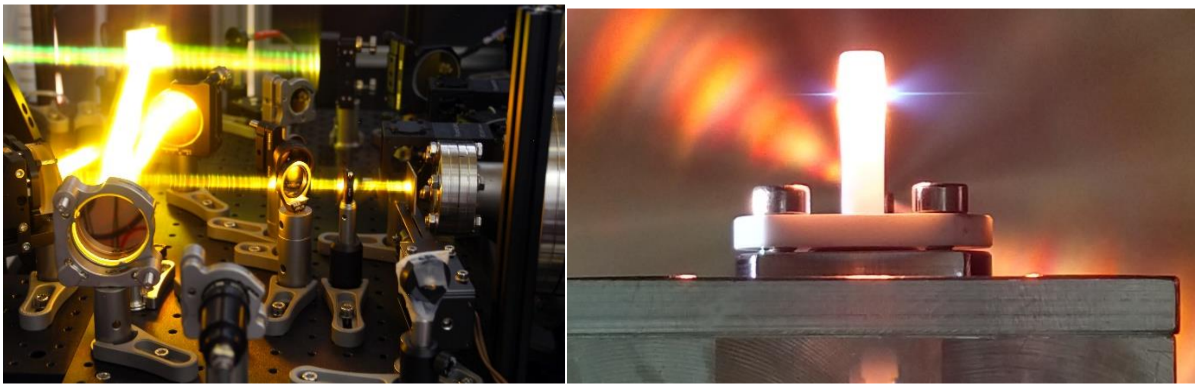

Fig. 1: Optical beam path of femtosecond infrared few-cycle pulses (left) entering one of our vacuum apparatus for the generation of attosecond pulses through high-order harmonic generation (right).

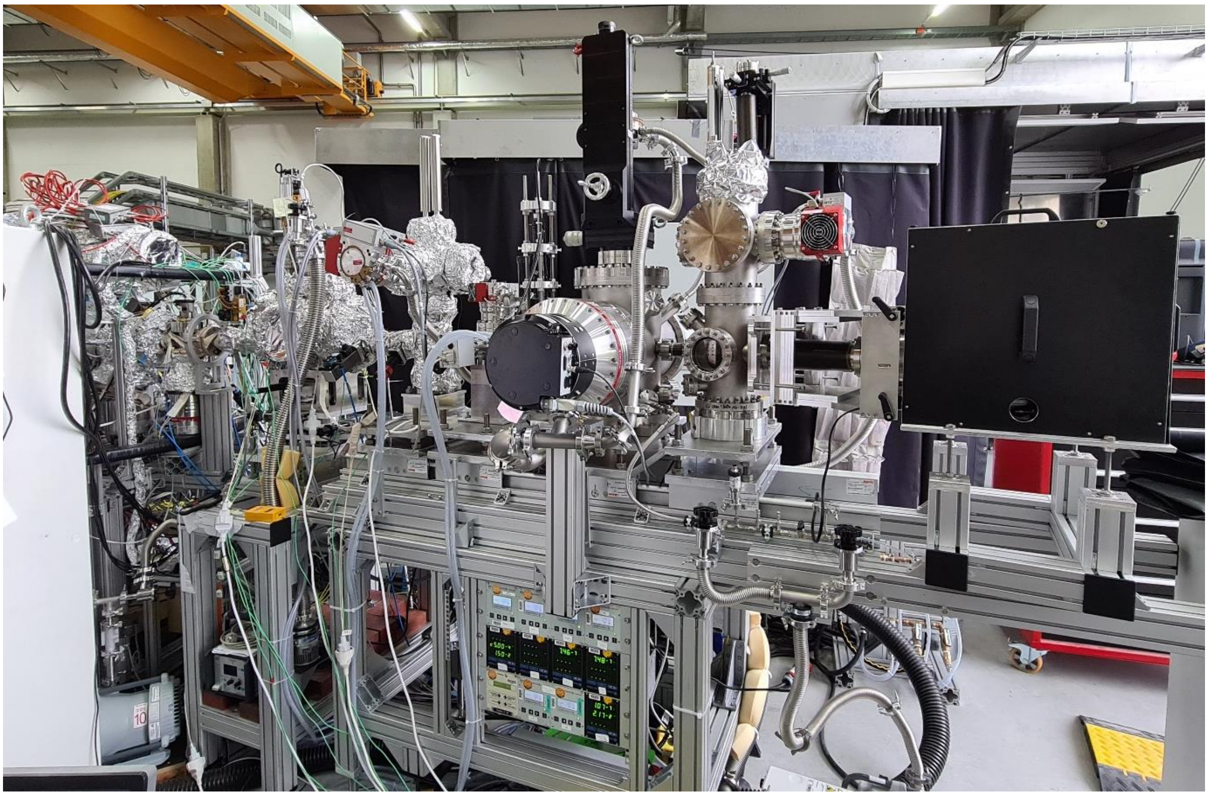

Fig. 2: Our experimental apparatus at Beamline FL26 at FLASH2, DESY, in Hamburg, Germany, where we combine a Reaction Microscope (in collaboration with PD Dr. Robert Moshammer, MPIK) with time-resolved nonlinear XUV absorption spectroscopy.