A 22: Poster Session - Atomic Physics III

Time: Wednesday 16:00–18:00 Location: Empore Lichthof

A 22.1 Wed 16:00 Empore Lichthof

Single-photon double ionization in two-center atomic systems — •Alexandra Eckey, Alexander B. Voitkiv, and Carsten Müller — Institut für Theoretische Physik I, Heinrich-Heine-Universität Düsseldorf

We study double ionization of an atom (atom A) via single-photon absorption in the presence of a neighbouring atom of different atomic species (atom B) [1]. The process is driven by the combined effects of inter- and intraatomic electron correlations. In this process atom B is first resonantly photoexcited , then this excitation energy is transferred radiationlessly to atom A leading to its double ionization. We show that the total rate for this two-center process can exceed the direct double photoionization of atom A by several orders of magnitude at interatomic distances in the range up to a few nanometers. Moreover, we explain the characteristic influence of the neighbouring atom onto the angular distribution of the emitted electron by introducing an effective polarization vector which depends on the relative position between the atoms.

[1] A. Eckey, A.B. Voitkiv and C. Müller, J. Phys. B, accepted (arXiv:1906.08123)

A 22.2 Wed 16:00 Empore Lichthof

An ion microscope to study Rydberg physics and ultracold ions — •Nicolas Zuber, Christian Veit, Phatthamon Kongkhambut, Florian Meinert, Robert Löw, and Tilman Pfau — 5. Physikalisches Institut and Center for Integrated Quantum Science and Technology IQST, Universität Stuttgart, Germany

In addition to spectroscopic tools developed to study Rydberg atoms, spatially resolved detection enables the possibility to directly observe spatial correlations or transport phenomena. Information can be extracted on a single particle level, as it is done in quantum gas microscopes for ground state atoms or with several detection techniques for Rydberg atoms. Along the same lines we integrated an ion microscope, consisting of three electrostatic lenses combined with a spatially resolving delay line detector, to observe Rydberg atoms and ions in our ultracold rubidium gas. The ion microscope provides a high resolution below one micrometer and a tunable magnification between 200 and 1500 with single particle sensitivity. The field of view for the largest magnification 25 micrometer only limited by the detector size. Additionally the setup features an electric field control, which permits a well controlled suppression of electric stray fields. On the poster we present details of our experimental setup and first measurement results of the ion microscope.

A 22.3 Wed 16:00 Empore Lichthof

On-demand single-photon source based on thermal rubidium — •Florian Christaller[1], Max Mäusezahl[1], Felix Moumtsilis[1], Annika Belz[1], Hao Zhang[1], Oliver de Vries[2], Marco Plötner[2], Thomas Schreiber[2], Hadiseh Alaeian[1], Harald Kübler[1], Robert Löw[1], and Tilman Pfau[1] — [1]5. Physikalisches Institut and Center for Integrated Quantum Science and Technology IQST, Universität Stuttgart, Germany — [2]Fraunhofer-Institut für Angewandte Optik und Feinmechanik IOF, Jena, Germany

Photonic quantum devices based on atomic vapors at room temperature are intrinsically reproducible as well as scalable and integrable. Besides a quantum memory for single photons one key device in the field of quantum information processing is an on-demand single-photon source. A promising candidate for realization relies on the combination of four-wave mixing and the Rydberg blockade effect, as demonstrated for ultracold atoms [1] and recently for room-temperature atoms in a micro-cell [2]. For the next generation single-photon source at high repetition rates, we can exploit the latest developments in laser technology by using a 1010 nm fiber amplifier to reach the Rydberg state. At a repetition rate of 1 MHz we reach a peak pulse-power of 100 W for Fourier-limited nanosecond pulses. Here we report on the characterization of two fiber amplifiers and on the latest status towards the high repetition rate single-photon generation at room-temperature.

[1] Dudin et al., Science 336, 6083 (2012)
[2] Ripka et al., Science 362, 6413 (2018)

A 22.4 Wed 16:00 Empore Lichthof

Light-induced atomic desorption in thermal μ-cells — •Felix Moumtsilis, Florian Christaller, Max Mäusezahl, Fabian Ripka, Hadiseh Alaeian, Harald Kübler, Robert Löw, and Tilman Pfau — 5. Physikalisches Institut and Center for Integrated Quantum Science and Technology IQST, Universität Stuttgart, Germany

Micrometer-sized cells for atomic vapors are powerful devices in the realm of fundamental research and applied quantum technology. To reach significant optical densities along the short optical paths in such cells, temperatures exceeding 300°C have to be applied. This however is accompanied by stronger collisional effects, the excitation of surface-polaritons and technical difficulties in the experimental setups due to large temperature gradients. We present an experimental approach exploiting the effect of light-induced atomic desorption (LIAD) [1, 2]. In this configuration, atoms are desorbed from the cell's glass surface by intense nanosecond-pulses at 532 nm and provide a temporarily dense cloud of atoms. These atoms eventually reach the opposing glass surface, where they are adsorbed again. Using this technique, we locally increase the density to several hundreds of atoms per μm^3 on a nanosecond timescale. Here we report on the latest systematic time-resolved LIAD measurements in a thermal rubidium cell.

[1] Meucci et al., EPL 25, 639 (1993)
[2] Atunov et al., Phys. Rev. A 67, 053401 (2003)

A 22.5 Wed 16:00 Empore Lichthof

Circular Rydberg states for quantum many-body physics — Christian Hölzl, Muamera Basic, and •Florian Meinert — 5. Physikalisches Institut and Center for Integrated Quantum Science and Technology, Universität Stuttgart, Stuttgart, Germany

Highly excited low-L Rydberg atoms in configurable mircotrap arrays have recently proven highly versatile for studying quantum many-body spin systems with single particle control. I will report on the status of a new project pursuing to harness high-L circular Rydberg atoms for quantum simulation. When stabilized in a suitable cavity structure, circular Rydberg states promise orders of magnitude longer lifetimes compared to their low-L counterparts and thus provide an appealing potential to strongly boost coherence times in Rydberg-based interacting atom arrays. We propose a novel approach to stabilize circular Rydberg states against black-body decay in a room temperature setup combined with excellent optical access for generating flexible trap arrays.

A 22.6 Wed 16:00 Empore Lichthof

Rydberg molecules under a reaction microscope — •Daniel Fichtner, Max Althön, Philipp Geppert, and Herwig Ott — Department of Physics and Research Center OPTIMAS, TU Kaiserslautern

We report on the first results of our MOTRIMS-type reaction microscope experiment. We prepare a sample of ^{87}Rb atoms in a 3D-MOT, which is loaded from a 2D-MOT. The atoms are then transferred to a crossed optical dipole trap. Using a 3-photon excitation scheme, atoms are excited to atomic or molecular Rydberg states and photoionized by a short laser pulse from a high power CO_2 laser after a variable evolution time. Following small homogeneous electric fields generated by Wiley-McLaren-type ion optics, the produced ions are subsequently detected by a time and position sensitive micro channel plate detector. This tool allows both momentum- and position-resolved measurements of few-body Rydberg dynamics. In this context, we are especially interested in measuring momentum distributions of Rydberg molecule vibrational states as well as momenta resulting from internal decay processes such as l-changing collisions. Special focus lies on butterfly and trilobite molecules, which can be addressed efficiently due to the opportunity of exciting Rydberg p- and f-states. As an outlook we present a scheme to address heavy Rydberg systems via Rydberg molecules.

A 22.7 Wed 16:00 Empore Lichthof

Ultracold ytterbium Rydberg states in electric fields — Christian Halter, •Alexander Miethke, and Axel Görlitz — Heinrich-Heine-Universität, Düsseldorf, Deutschland

In recent years Rydberg atoms with their special features, like dipole-dipole interaction or van-der-Waals blockade, have become more and more important for quantum optics. Particularly ultra cold Rydberg

atoms are of great interest for the investigation of long range interaction.

A special feature of ytterbium is that due to its two valance electrons atoms in Rydberg state can be easily manipulated and imaged using optical fields. A first step towards studies of ultra cold ytterbium is to gain precise knowledge on the Rydberg states.

Here we present the study of ultra cold ytterbium Rydberg states using traploss spectroscopy as well as direct ion detection. For the ion detection we are exciting atoms in a MOT to states of high principal quantum numbers n (n=30-90), followed by a short high voltage pulse. Making use of the variable delay between the excitation and ionization, information about the lifetimes of Rydberg states can be found. Additionally, by changing the high-voltage pulse the ionization threshold can be investigated. Various dependencies can be compared to theoretical quantum models.

A 22.8 Wed 16:00 Empore Lichthof

Construction of a Rydberg atom register — •Suthep Pomjaksilp, Sven Schmidt, Thomas Niederprüm, and Herwig Ott — Department of Physics and research center OPTIMAS, Technische Universität Kaiserslautern, Germany

Over the last years, arrays of assembled single atoms emerged as a ground-breaking platform in quantum physics. These setups do not only feature single-atom control, additionally exciting addressable atoms to Rydberg states introduces further possibilities to investigate interaction in arbitrary geometric configurations.

We plan to realize a two-dimensional array of up to 100 single ^{87}Rb atoms trapped with holographically created optical tweezers at 1064 nm. Cold atoms are provided by a magneto optical trap via a single laser serving as both, cooler and repumper. While stabilized at the repumper transition, an electro-optical modulator generates the necessary cooling light. This enables us to further cool and compress the atom cloud with a grey molasses scheme by sweeping the laser. In addition, exploiting light-induced atomic desorption prolongs the lifetime of the trapped atoms by allowing us to reduce the background pressure.

Finally, cooling of ^{85}Rb can be implemented all electronically by driving the modulator with additional frequencies. Combined with the single atom control and excitation to Rydberg states, a highly versatile, yet compact, experimental setup is obtained.

A 22.9 Wed 16:00 Empore Lichthof

Cold Rydberg Atoms as Ultrasensitive Quantum Sensors for Chiral Molecules — •Stefan Aull[1], Miriam Mendoza-Delgado[1], Steffen Giesen[3], Robert Berger[3], Peter Zahariev[1,2], and Kilian Singer[1] — [1]Institut für Physik, Universität Kassel, Heinrich-Plett-Str. 40, 34132 Kassel — [2]ISSP - Bulgarian Academy of Sciences — [3]Fb. 15 - Chemie, Hans-Meerwein-Straße 4, 35032 Marburg

Rydberg atoms show a variety of extreme properties, including a high sensitivity to external peturbations. We present an experimental setup for measuring molecular chirality with Rydberg atoms as a quantum probe. The goal of the project is to perform chiral discrimination based on far field interaction between chiral molecules and Rydberg dressed cold atoms. Chiral molecules in a supersonic beam will interact with a cloud of ultracold atoms in a MOT while Rydberg dressing will be applied to the atoms. A quantum measurement scheme allows for ultra-sensitive detection of chirality dependent interaction energy shifts.

A 22.10 Wed 16:00 Empore Lichthof

Dissipative dynamics of strongly interacting driven Rydberg gases — •Jana Bender, Patrick Mischke, Carsten Lippe, Tanita Klas, Erik Bernhart, Thomas Niederprüm, and Herwig Ott — Department of Physics and research center OPTIMAS, Technische Universität Kaiserslautern, Germany

By continuously driving open Rydberg many-body systems, we investigate the interplay between Rydberg blockade and facilitation. We discuss the dynamics and steady states of a system of mesoscopic Rydberg blockaded clouds loaded into a one-dimensional optical lattice with a lattice constant tailored to match the facilitation distance of the 70S Rydberg state. Each cloud acts as an effective two-level system with an asymmetric excitation and deexcitation rate, a so-called superatom. The chain of superatoms created in the lattice allows to study dissipative Ising-like spin models.

Experimentally, we examine the correlations of excitations within these superatoms. The analysis of temporal correlations gives evidence of sub-poissonian behaviour in the resonantly driven system due to the Rydberg blockade.

A 22.11 Wed 16:00 Empore Lichthof

Continuous-wave absorption spectroscopy on the γ_{00} band of nitric oxide — •Yannick Schellander[1,2], Fabian Munkes[1,2], Patrick Kaspar[1,2], Johannes Schmidt[1,2,3], Robert Löw[1,2], Tilman Pfau[1,2], Edward Grant[4], and Harald Kübler[1,2] — [1]5. Physikalisches Institut — [2]Center for Integrated Quantum Science and Technology — [3]Institut für Großflächige Mikroelektronik — [4]Department of Chemistry University of British Columbia

We present first results on the continuous-wave absorption spectroscopy on the $A\,^2\Sigma^+ \leftarrow X\,^2\Pi_{1/2}$ transition of the γ_{00}-band in nitric oxide. The measurement is done at room temperature. The production of the necessary glass cells as well as technical challenges of the employed laser system are explained. To prove the validity of the results the needed theory is analyzed. For putting the results into perspective pulsed absorption spectroscopy was performed on the same transition at much lower temperature allowing for comparison and yielding important insights on the advantages of continuous- wave spectroscopy. The results are classed with the overall goal of building a trace-gas sensor for nitric oxide.

A 22.12 Wed 16:00 Empore Lichthof

Laser linewidth and phase noise measurements for EIT — •Carlos Brandl[1], Annika Tebben[1], Clément Hainaut[1], André Salzinger[1], David Grimshandl[1], Sebastian Geier[1], Titus Franz[1], Nithiwadee Thaicharoen[1], Gerhard Zürn[1], and Matthias Weidemüller[1,2] — [1]Physikalisches Institut, Ruprecht-Karls Universität Heidelberg, Im Neuenheimer Feld 226, 69120 Heidelberg, Germany — [2]National Laboratory for Physical Sciences at Microscale and Department of Modern Physics, and CAS Center for Excellence and Synergetic Innovation Center in Quantum Information and Quantum Physics, Shanghai Branch, University of Science and Technology of China, Shanghai 201315, China

For experiments on electromagnetically induced transparency (EIT) with Rydberg atoms a narrow laser linewidth is desirable to achieve a full EIT transmission on two photon resonance and a wider EIT linewidth, which scales inversely with the laser linewidth. Moreover, the knowledge of the laser linewidth allows for a direct comparison between EIT measurements and theoretical models. Therefore, using a self-heterodyne setup, we can measure the linewidth and the phase noise components - white noise, flicker noise and random walk noise - of a 780nm laser, which is used as one of the two lasers in our Rydberg EIT scheme with 87Rb. Furthermore, the setup is mounted on a mobile panel to easily extend the measurement to other lasers.

A 22.13 Wed 16:00 Empore Lichthof

Towards Arrays of Cryogenic Traps for Improved Quantum Simulation — •Kai-Niklas Schymik, Florence Nogrette, Daniel Barredo, Thierry Lahaye, and Antoine Browaeys — Laboratoire Charles Fabry, Institut d'Optique Graduate School, Palaiseau, France

Large arrays of individually controlled atoms in optical tweezers are a promising platform for quantum engineering applications. In our group, we have realized several quantum simulations of spin models in 2D arrays of Rydberg atoms with up to 50 spins.

Here we report on the development of a novel cryogenic platform for performing quantum simulations with several 100s of spins with increased coherence times. Combining the techniques of the current setup and a closed-cycle, optical-access cryostat at 4 K, we will tackle two main limitations of scalability: the vacuum lifetime of the ground-state atom in the tweezers due to collisions with residual gas and the decoherence arising from black-body radiation induced transitions between neighboring Rydberg states.

A 22.14 Wed 16:00 Empore Lichthof

Reconstructing the optical transfer function by absorption imaging of disordered atom distributions. — •David Grimshandl[1], Carlos Brandl[1], Titus Franz[1], Sebastian Geier[1], Clément Hainaut[1], André Salzinger[1], Annika Tebben[1], Gerhard Zürn[1], and Matthias Weidemüller[1,2] — [1]Physikalisches Institut, Universität Heidelberg, Im Neuenheimer Feld 226, 69120 Heidelberg, Germany — [2]Shanghai Branch, University of Science and Technology of China, Shanghai 201315, China

Many cold atom experiments rely on absorption imaging as primary

observation method. Here it is crucial to discriminate between the optical response of the imaged medium and the effects of the imaging apparatus. Common methods to retrieve the transfer function of an optical system require additional optics and instrumentation in the object plane which cannot be accessed in situ in most cold atom experiments. In our experiment with cold Rydberg atoms we employed a method to retrieve the wavefront error across the exit pupil and the coherent point spread function of the imaging apparatus from the spatial noise correlations in absorption images. This allows to evaluate the performance of the imaging system in situ and thus can be used to improve the optical system on-the-fly, e.g. by selectively cancelling aberrations from misalignment, defocus and tilts.

A 22.15 Wed 16:00 Empore Lichthof

Long-Range Interacting Quantum Systems via Rydberg Dressing in Microtraps — •Lea-Marina Steinert[1], Nikolaus Lorenz[1], Lorenzo Festa[1], Philip Osterholz[1], Joop Adema[1], Robin Eberhard[1], and Christian Gross[1,2] — [1]Max-Planck-Institut für Quantenoptik, Hans-Kopfermann-Str. 1, 85748 Garching — [2]Physikalisches Institut, Eberhard Karls Universität Tübingen, Auf der Morgenstelle 14, 72076 Tübingen

Individual neutral atoms trapped in optical tweezers offer a fast and flexible platform for the deterministic creation of atomic arrays. Off-resonant laser coupling to Rydberg states (Rydberg dressing) allow for the study of quantum many-body systems with engineered long-range interactions. By carefully choosing the laser parameters the strong dipolar interactions can be precisely controlled. We aim to realize synthetic quantum magnets based on this engineered inter-spin interaction. Here we report on the status of the project including a high power laser system for Rydberg coupling in the ultraviolett. We show coherent ground - Rydberg state Rabi oscillations for single and Rydberg superatoms and discuss the limits to their coherence. Finally, we discuss experiments aiming at the deterministic loading of a single potassium atom into each of the optical tweezers.

A 22.16 Wed 16:00 Empore Lichthof

Characterizing molecular symmetries with quantum gas microscopy — •Simon Hollerith[1], Jun Rui[1], Antonio Rubio-Abadal[1], David Wei[1], Kritsana Srakaew[1], Simon Evered[1], Christian Gross[1,2], and Immanuel Bloch[1,3] — [1]Max-Planck-Institut für Quantenoptik, 85748 Garching — [2]Physikalisches Institut, Eberhard Karls Universität Tübingen, Auf der Morgenstelle 14, 72076 Tübingen — [3]Fakultät für Physik, Ludwig-Maximilians-Universität München, 80799 München

Rydberg macrodimers - molecules consisting of two bound highly excited Rydberg atoms - provide enormous bond lengths even resolvable with optical wavelengths. Here we report on a microscopic study of macrodimers with different molecular symmetries in a gas of ultracold atoms in an optical lattice. The bond length of about 0.7 micrometers matches the diagonal distance of two atoms in the lattice. The geometry of the two-dimensional lattice initially unity filled with ground state atoms allows to control the relative orientation of the molecular axis to an ambient magnetic field and the polarization of the photoassociation light. Using our spatially resolved detection, we detect the associated molecules by correlated atom loss and find the excitation rates to be in agreement with theoretical predictions. Furthermore, we present how the molecular excitation rate can be significantly increased by the use of two color photoassociation. Our results highlight the potential of quantum gas microscopy for molecular physics and show how macrodimers might be used to study many body physics.

A 22.17 Wed 16:00 Empore Lichthof

Mixed dimension Rydberg Composites — •Andrew Hunter, Matt Eiles, Alex Eisfeld, and Jan M Rost — Max Planck Institute for the Physics of Complex Systems

Rydberg Composites are a Rydberg atom in a dense environment of neutral atoms [1]. Here we explore the properties of quasi one- and two-dimensional Rydberg composites, mapping out the transition from a lower dimensional lattice to a higher one as a function of its width. The dependence of the Rydberg Composite's properties on temperature-dependent disorder and random arrangements is also investigated, elucidating paths to experimental realizations.

Hunter A L, Eiles M T, Eisfeld A and Rost J M 2019 arXiv:1909.01097

A 22.18 Wed 16:00 Empore Lichthof

Inner-Shell Multiple Photodetachment of Carbon Anions — •Alexander Perry-Sassmannshausen[1], Alexander Borovik Jr.[1], Ticia Buhr[1], Michael Martins[2], Alfred Müller[1], Simon Reinwardt[2], Sandor Ricz[3], Florian Trinter[4,5], and Stefan Schippers[1] — [1]Justus-Liebig-Universität Gießen, Germany — [2]Universität Hamburg, Germany — [3]Atomki, Debrecen, Hungary — [4]FS-PE, DESY, Hamburg, Germany — [5]Molecular Physics, Fritz-Haber-Institut, Berlin, Germany

Negative atomic ions play an important role in low temperature plasmas such as Earth's upper atmosphere or the interstellar medium [1,2]. A sensitive tool for studying the interactions between the valence and the core electrons is inner-shell ionization of negative ions [3].

Here we report on preliminary results from a recent beam time at the Photon-Ion-Spectrometer at P04 at PETRA III (PIPE) [4]. We investigated multiple photodetachment of carbon anions which led to final charge states up to C^{4+}. Absolute cross sections for all measurable product ion channels will be presented and discussed.

[1] T. Andersen, Phys. Rep. **394**, 157 (2004)
[2] T. Millar et al., Chem. Rev. **117**, 1765 (2017)
[3] S. Schippers et al., Phys. Rev. A **94** 041401(R) (2016)
[4] S. Schippers et al., J. Phys. B **47**, 115602 (2014)

A 22.19 Wed 16:00 Empore Lichthof

A community platform for just atomic computations (JAC) — •Stephan Fritzsche — Helmholtz Institute, Jena, Germany — Friedrich-Schiller University Jena

Electronic structure calculations of atoms and ions have a long tradition in physics with applications in basic research and spectroscopy. With the Jena Atomic Calculator (JAC), I here present a fresh implementation of a (relativistic) electronic structure code for the computation of atomic amplitudes, properties as well as a large number of excitation and decay processes for open-shell atoms and ions across the periodic table. JAC is based on Julia, a new programming language for scientific computing, and provides an easy-to-use but powerful platform to extent atomic theory towards new applications.

A 22.20 Wed 16:00 Empore Lichthof

Phase-sensitive spectroscopy of Mössbauer nuclei using oscillating reference absorbers — •Benedikt Herkommer and Jörg Evers — Max-Planck-Institut für Kernphysik, Heidelberg, Germany

Mössbauer nuclei feature exceptionally narrow resonances at hard x-ray energies, which form the basis for a multitude of applications across the natural sciences. However, a direct spectroscopy at modern x-ray sources such as synchrotrons or XFELs is challenging, because of the broad spectral bandwidth of the delivered x-ray pulses, and because of a limited spectral resolution offered by x-ray detectors.

Here, we present a novel spectroscopy technique based on a moving reference absorber mounted on a piezo transducer. The motion induces sidebands to the spectrum of the absorber, which we scan across the spectrum of an unknown sample to be measured. As compared to previous methods, the phase offset of the piezo motion at the x-ray time-of-arrival offers an additional controllable degree of freedom. We show that this phase not only allows us to accurately determine the spectrum of the unknown sample, but also to measure the spectral phase of the light scattered by the nuclei.

A 22.21 Wed 16:00 Empore Lichthof

X-ray quantum optics with Mössbauer nuclei — •Lukas Wolff, Dominik Lentrodt, Christoph H. Keitel, and Jörg Evers — Max-Planck-Institut für Kernphysik, Heidelberg, Germany

Ideas from quantum optics play an important role in studying, controlling, and utilizing light matter interactions in many regions of the electromagnetic spectrum. This raises the question, whether such concepts could also be exploited at hard x-ray energies. Particularly interesting candidates for this are Mössbauer nuclei. These nuclei feature resonances with exceptionally narrow line width, which form the basis for a broad range of applications in the natural sciences.

In recent years, Mössbauer nuclei have become a promising platform for quantum optics with x-rays, and various effects known from the optical domain have already been experimentally demonstrated with nuclei. This poster will review our recent progress in nuclear quantum optics, and will highlight new developments.

A 22.22 Wed 16:00 Empore Lichthof

Controlling excitation dynamics of Mössbauer nuclei with zeptosecond phase-stability — •Pim van den Heuvel[1], Kilian P. Heeg[1], Andreas Kaldun[1], Cornelius Strohm[2], Christian

Ott[1], Rajagopalan Subramanian[1], Dominik Lentrodt[1], Johann Haber[2], Hans-Christian Wille[2], Stephan Goerttler[1], Rudolf Rüffer[3], Christoph H. Keitel[1], Ralf Röhlsberger[2], Thomas Pfeifer[1], and Jörg Evers[1] — [1]Max-Planck-Institut für Kernphysik, Heidelberg, Germany — [2]Deutsches Elektronen-Synchrotron DESY, Hamburg, Germany — [3]ESRF - The European Synchrotron, Grenoble, France

In recent years Mössbauer nuclei have become a platform for quantum optics with x-rays and various effects from the optical domain have already been demonstrated. However, they are usually probed with single pulses, preventing straightforward realization of advanced optical schemes, such as those involving control fields. Here, an x-ray pulse shaping technique, which was previously employed for spectral narrowing, is presented. It produces a sequence of two pulses with controlled relative phase, allowing for controlling and steering the nuclear dynamics. The phase-stability of this set-up holds the promise to reach a sub-zeptosecond level, which is hitherto unachieved. New regimes of nuclear dynamics could be investigated with this technique.

A 22.23 Wed 16:00 Empore Lichthof

Simulation of multi-particle coincidence data acquisition — •Carolin Honisch, Andreas Hans, Catmarna Küstner-Wetekam, Lutz Marder, Xaver Holzapfel, Nils Kiefer, Alexander Schrodt, Arno Ehresmann, and André Knie — Institut für Physik und CINSaT, Universität Kassel, Heinrich-Plett-Str. 40, 34132 Kassel, Germany

Coincident particle detection is a powerful experimental technique, which substantially contributed to the progress in many fields of physics in the past. In the actual coincidence experiment and during data analysis, the distinction between so-called "true" and "random" coincidences is essential. In order to support real-time data interpretation, we have developed a simulation procedure for coincidence maps, which considers information about experimental parameters and boundaries. The simulation allows reproduction of the measurement results and can also deliver information on the relevance of random coincidences. This supports the experimental process as well as its preparation and the subsequent data analysis. We also demonstrate how the simulation may be utilized to apply novel coincidence schemes, e.g. with continuous excitation sources.

A 22.24 Wed 16:00 Empore Lichthof

Reaction Microscope Endstation at FLASH2 — •Patrizia Schoch[1], Hannes Lindenblatt[1], Florian Trost[1], Severin Meister[1], Kirsten Schnorr[2], Sven Augustin[2], Georg Schmid[1], Yifan Liu[1], Markus Braune[3], Marion Kuhlmann[3], Rolf Treusch[3], Claus Dieter Schröter[1], Thomas Pfeifer[1], and Robert Moshammer[1] — [1]Max-Planck-Institut für Kernphysik, Heidelberg — [2]Paul Scherrer Institut, Villigen, Schweiz — [3]DESY, Hamburg

Our group has installed a Reaction Microscope as permanent endstation at FLASH2. During the last years, first experiments and several upgrades where performed. Most notably, a gracing incidence mirror for focussing and split-and-delay was installed. An IR Laser as well as a HHG source is now available for the beamline. These allows for a multitude of pump-probe schemes. The poster will provide an overview of the setup including beam geometry, target preparation, diagnostics and data acquisition, as well as some exemplary results.

A 22.25 Wed 16:00 Empore Lichthof

Relaxation dynamics in rare gas dimers after XUV-photoionization at FLASH2 — •Hannes Lindenblatt[1], Kirsten Schnorr[2], Sven Augustin[2], Severin Meister[1], Florian Trost[1], Patrizia Schoch[1], Georg Schmid[1], Yifan Liu[1], Markus Braune[3], Marion Kuhlmann[3], Rolf Treusch[3], Claus Dieter Schröter[1], Thomas Pfeifer[1], and Robert Moshammer[1] — [1]Max-Planck-Institut für Kernphysik, Heidelberg — [2]Paul Scherrer Institut, Villigen, Schweiz — [3]DESY, Hamburg

We investigated the relaxation dynamics of Xenon and Argon dimers employing momentum coincidence spectroscopy at the reaction-microscope beamline FL26 at FLASH2. Using the grazing incidence split, delay and focusing optics, a XUV-XUV pump-prope scheme was utilized to track dissociation dynamics. On the poster we present results for different relaxation channels, e.g. Interatomic Coulombic decay (ICD) or charge transfer.

A 22.26 Wed 16:00 Empore Lichthof

Relaxation dynamics of CH3I and CH2I2 following FEL-induced inner-shell ionisation — •Florian Trost[1], Kirsten Schnorr[2], Sven Augustin[2], Severin Meister[1], Hannes Lindenblatt[1], Patrizia Schoch[1], Yifan Liu[1], Marc Simon[3], Renaud Guillemin[3], Maria Novella Piancastelli[4], Farzad Hosseini[3], Mustafa Zmerli[3], Markus Braune[5], Marion Kuhlmann[5], Thomas Pfeifer[1], and Robert Moshammer[1] — [1]Max-Planck-Institut für Kernphysik, Heidelberg — [2]Paul Scherrer Institut, Villigen — [3]Université Pierre-et-Marie-Curie, Paris — [4]Uppsala Universitet, Uppsala — [5]DESY, Hamburg

Using the reaction microscope endstation at the free-electron laser (FEL) in Hamburg (FLASH2), the relaxation dynamics of methyl iodide (CH3I) and diiodomethane (CH2I2) after inner-shell ionisation have been studied. FLASH2's XUV (12.7 nm) photons were used to ionise the iodine 4d inner shell electrons twice sequentially using an XUV pump - XUV probe technique with variable delay. The first XUV photon induces the dissociation of the doubly charged molecule. The absorption of the second photon, leading to higer charged ions, allows to probe the dynamics of the dissociation. The momentum-resolved data of the coincident fragments of the dissociated molecules will be presented.

A 22.27 Wed 16:00 Empore Lichthof

Phase-cycling technique for extreme ultraviolet pulses — •Andreas Wituschek[1], Lukas Bruder[1], Oleg Kornilov[2], Tobias Witting[2], Laura Maikowski[2], Marc J.J. Vrakking[2], and Frank Stienkemeier[1] — [1]Institute of Physics, University of Freiburg, Hermann-Herder-Str. 3, 79104 Freiburg, Germany — [2]Max-Born-Institut, Max-Born-Str. 2A, 12489 Berlin, Germany

The advent of intense ultrashort light sources in the extreme ultraviolet (XUV) allows for extension of coherent nonlinear spectroscopy techniques (eg. four wave mixing, multidimensional spectroscopy, CARS) to this wavelength range, providing access to unprecedented temporal resolution and site/chemical selectivity. However, these techniques require interferometric stability and high sensitivity for weak nonlinear signals, which are experimentally difficult to achieve in the XUV.

In this work we developed a laboratory-scale XUV source suitable for applications in coherent spectroscopies. We generated a collinear UV pulse pair (262 nm, 50 μJ, 30 fs) in an interferometric setup with independent control over delay and relative phase of the pulses. With this pulse pair we generated the third (14.2 eV) harmonic in krypton and found that the resulting XUV pulse pair inherits the phase information of the UV pulses, allowing us to impart a phase-cycling scheme on the XUV pulse pair. To test the scheme, we isolated the coherent oscillations of an electronic wave-packet in argon atoms, where the states participating in the wave-packet are separated by 14.2 eV. Our approach provides the necessary stability and sensitivity to extent coherent nonlinear spectroscopy to the XUV spectral range.

A 22.28 Wed 16:00 Empore Lichthof

Development of a detector to register low-energy, charge-changed ions from ionization experiments at CRYRING@ESR — •Alexander Borovik Jr.[1], Günter Weber[2,3], Vinzenz Hilbert[2,3], Haifeng Lin[2,3], Philip Pfäfflein[2,3,4], Binghui Zhu[2,3], Christoph Hahn[2,3,4], Michael Lestinsky[4], Stefan Schippers[1], Thomas Stöhlker[2,3,4], and Jan Rothhardt[2,3] — [1]Justus-Liebig-Universität Gießen, 35392 Giessen, Germany — [2]Helmholtz-Institut Jena, 07743 Jena, Germany — [3]Friedrich Schiller University, 07743 Jena, Germany — [4]GSI Helmholtzzentrum für Schwerionenforschung, 64291 Darmstadt, Germany

In the frame of the proof-of-principle experiment on photoionization of the stored C^+ ions by XUV laser pulses, a specially tailored detector setup has been developed for counting product ions. These hit the YAP:Ce scintillator plate producing light pulses which are registered by an array of silicon photomultipliers (SiPMs) placed on a custom-made interface board in a pocket tube outside of the vacuum. The detector can reliably operate in strong magnetic field and thus can be put directly inside the chamber of a dipole magnet. The developed array of mechanical actuators enables the detector's fine positioning to match the given product-ion trajectory, as well as the swift periodical retraction out of the product-ion trajectory area to avoid its unnecessary irradiation and possible primary-ion losses during the ion-beam preparation procedure. This detector enables a variety of photoionization experiments with stored highly-charged ions.