

## MO 13: Poster II

Time: Wednesday 16:30–19:00

Location: Empore Lichthof

MO 13.1 Wed 16:30 Empore Lichthof

**Towards the production of groundstate RbYb** — ●CHRISTIAN SILLUS, BASTIAN POLLKLESENER, ARNE KALLWEIT, CÉLINE CASTOR, and AXEL GÖRLITZ — Heinrich-Heine Universität

Ultracold dipolar molecules constitute a promising system for the investigation of topics like ultracold chemistry, novel interactions in quantum gases, precision measurements and quantum information. Here we report on first experiments in our apparatus for the production of ultracold RbYb molecules. This setup constitutes an improvement of our old apparatus, where the interactions in RbYb and possible routes to molecule production have already been studied extensively [1,2]. In the new setup a major goal is the efficient production of ground state RbYb molecules. We employ optical tweezers to transport individually cooled samples of Rb and Yb from their separate production chambers to a dedicated science chamber. Here we start to study interspecies interactions of different isotopes by overlapping crossed optical dipole traps. To explore the pathways towards ground state molecules we start with photoassociation spectroscopy near the intercombination line of Yb.

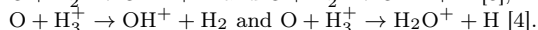
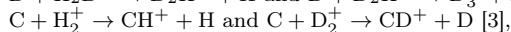
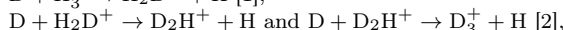
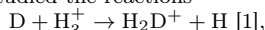
[1] M. Borkowski et al., PRA 88, 052708 (2013)

[2] C. Bruni et al., PRA 94, 022503 (2016)

MO 13.2 Wed 16:30 Empore Lichthof

**Merged-beams experiments on molecular ion-neutral reactions for astrochemistry** — ●PIERRE-MICHEL HILLENBRAND<sup>1</sup>, XAVIER URBAIN<sup>2</sup>, and DANIEL WOLF SAVIN<sup>3</sup> — <sup>1</sup>Justus-Liebig Universität, Giessen, Germany — <sup>2</sup>Université catholique de Louvain, Louvain-la-Neuve, Belgium — <sup>3</sup>Columbia University, New York, USA

The gas-phase formation of complex molecules in the interstellar medium proceeds dominantly through barrierless ion-neutral reactions at typical temperatures of 10–100 K. Our merged-beams apparatus at Columbia University in New York City enables us to measure energy-dependent absolute cross sections of molecular formation processes for reactions of singly-charged molecules with neutral atoms and derive temperature-dependent thermal rate coefficients for individual product channels. Focusing on key reactions implemented in astrochemical models as well as on systems of fundamental interest, we have recently studied the reactions



For example, the branching ratio for the two product channels of the  $O + H_3^+$  reaction is relevant for accurately modeling the gas-phase formation of water in the diffuse and dense molecular clouds.

[1] *Astrophys. J.* **877**, 38 (2019). [2] *J. Chem. Phys.* **154**, 084307 (2021). [3] *Phys. Chem. Chem. Phys.* **22**, 27364 (2020). [4] *Astrophys. J.*, **927**, 47 (2022).

MO 13.3 Wed 16:30 Empore Lichthof

**UV Photoexcitation-Photoemission Map of the Hydrogen Molecule** — ●GABRIEL KLASSEN<sup>1</sup>, ANDREAS HANS<sup>1</sup>, PHILIPP SCHMIDT<sup>2</sup>, CATMARNA KÜSTER-WETEKAM<sup>1</sup>, JOHANNES VIEHMANN<sup>1</sup>, and ARNO EHRESMANN<sup>1</sup> — <sup>1</sup>Institut für Physik und CINSA-T, Universität Kassel, Heinrich-Plett-Str. 40, 34132 Kassel, Germany — <sup>2</sup>European XFEL, Holzkoppel 4, 22869 Schenefeld, Germany

The hydrogen molecule, the simplest molecule we know, has been studied extensively in the past. Although most of the details of its electronic potentials are well understood, there is no complete set of experimentally determined absolute data with quantitative absorption and dispersed emission cross sections. These cross sections, however, are necessary to interpret spectra of gaseous clouds in space, where H<sub>2</sub> may be used as a probe molecule, once its cross sections are known.

On the road towards such a full data set for the hydrogen molecule we are performing experiments where H<sub>2</sub> is excited by small-bandwidth monochromatized synchrotron radiation and its emission is recorded dispersedly with high resolution. By scanning synchrotron radiation over parts of the UV spectrum and measuring the consecutive fluorescence we are able to construct a 2d-map with distinct features being representative for the H<sub>2</sub> rovibronic structure.

MO 13.4 Wed 16:30 Empore Lichthof

**Ultrafast spectroscopy of intramolecular dynamics and photodissociation of a single trapped molecular ion** — ●ZHENLIN WU, BRANDON FUREY, STEFAN WALSER, GUANQUN MU, RENÉ NARDI, and PHILIPP SCHINDLER — Institut für Experimentalphysik, Universität Innsbruck, Innsbruck, Austria

Trapped atomic ions are one of the most promising platforms for quantum simulation and quantum computation. By co-trapping molecular ions with atomic ions, quantum logic spectroscopy can be performed to investigate the rovibrational structure of various molecular species, as demonstrated recently with diatomic molecular ions including CaH<sup>+</sup> and N<sub>2</sub><sup>+</sup>. In a similar system, we plan to explore ultrafast intramolecular dynamics in complicated polyatomic molecular ions with femtosecond laser pulses. In particular, we will measure the net momentum transfer of the pump and the delayed probe pulse. Such momentum change can be detected by preparing the common motion of the ion crystal in a non-classical state. With this scheme, we aim to study the evolution of vibrational excitations inside a single polyatomic molecule of chemical or biological importance.

We are currently investigating the interaction between ultrafast laser pulses and molecular ions by measuring the photodissociation threshold of CaOH<sup>+</sup>. The molecules are generated by chemical interactions between trapped Ca<sup>+</sup> ions and water molecules that can be introduced with a gate valve into the main experimental chamber. After the reaction, a Ca<sup>+</sup> ion turns “dark” and femtosecond laser pulses with variable wavelength are applied to dissociate it back to a “bright” Ca<sup>+</sup> ion.

MO 13.5 Wed 16:30 Empore Lichthof

**Spectroscopic and collision studies of the laser-cooling candidate C<sub>2</sub><sup>-</sup>** — ●CHRISTINE MARIA LOCHMANN, MARKUS NÖTZOLD, SRUTHI PURUSHU MELATH, ROBERT WILD, and ROLAND WESTER — Institut für Ionenphysik und Angewandte Physik, Universität Innsbruck, Austria

The precise control of the external and internal motion of negative ions has been of increasing interest in the past decades. One possible method to reach this control is through laser cooling, which has never been achieved for a negatively charged particle, as only a few anions provide the strongly bound electronic excited and adequate internal energy states suitable for laser cooling schemes. One such candidate is the molecular carbon anion C<sub>2</sub><sup>-</sup>. Here, we present our studies on the spectroscopy of C<sub>2</sub><sup>-</sup> carried out in a cryogenic 16-pole RF wire trap at 6 K to determine precise laser cooling transition frequencies. We are able to resolve the spin-rotation splitting in C<sub>2</sub><sup>-</sup> with an accuracy of 20 MHz and determine the rotational and translational temperature of the ions [1]. A useful method to repopulate the ground state of the molecule could be through vibrational quenching. We studied the quenching rate into the vibrational ground state of C<sub>2</sub><sup>-</sup> in cold collisions with H<sub>2</sub>. At high H<sub>2</sub> densities the collision also leads to a three-body reaction which forms C<sub>2</sub>H<sup>-</sup>. We measured the temperature dependent three-body rate between 10 K and 28 K to benchmark quantum calculations.

[1] M. Nötzold et al., *Phys. Rev. A* 106, 023111 (2022)

MO 13.6 Wed 16:30 Empore Lichthof

**State-to-state ion-molecule reaction dynamics** — ●TIM MICHAELSEN, DASARATH SWARAJ, ARNAB KHAN, ROBERT WILD, and ROLAND WESTER — Institut f. Ionenphysik und Angewandte Physik, Universität Innsbruck, Technikerstraße 25/3 A-6020 Innsbruck, Austria

The study of reaction dynamics aims to gain a mechanistic understanding how chemical reactions occur on an atomistic level. The combination of crossed beam experiments with velocity map imaging [VMI], especially in comparison with trajectory calculations, are a powerful tool to observe these dynamics [1]. Product state detection for ion-molecule reactions were limited by energy resolution, at least for non di-atomic products [2].

Here we present a new setup, that aims push the required resolution towards product vibrational state detection in larger systems, which combined with prepared ground state reactants prior to the reactive collision, will let us obtain state-to-state differential cross sections. This is achieved by a newly designed laser-ionization source for H<sub>2</sub><sup>+</sup> and implementation of a Rydberg-tagging scheme to detect neutral hydrogen atom products in coincidence [3]. First reactions of interest

are  $H_2^+ + Ne$  and  $H_2$ , where little is known experimentally about the energy partitioning and dynamics.

- [1] J. Meyer, E. Carrascosa, et al. *Nat. Chem.* 13, 977-981 (2021)
- [2] T. Michaelsen, et al., *J. Chem. Phys.* 147, 013940 (2017)
- [3] M. Qiu, et al., *Science* 311 5766, 1440-1443 (2006)

MO 13.7 Wed 16:30 Empore Lichthof

**Towards state-to-state ion-molecule reaction dynamics** — ●TIM MICHAELSEN, DASARATH SWARAJ, FLORIAN TRUMMER, ARNAB KHAN, ROBERT WILD, and ROLAND WESTER — Institut für Ionenphysik und Angewandte Physik, Universität Innsbruck, Technikerstraße 25/3, A-6020 Innsbruck, Austria

The study of reaction dynamics aims to gain an understanding how chemical reactions occur on an atomistic level. Experiments combining crossed beams with velocity map imaging [VMI] are a powerful tool to observe these dynamics [1]. In the past product state detection for ion-molecule reactions was limited by energy resolution, at least for non-diatomic products [2].

Here we present a new setup, that aims to push the required resolution towards product vibrational state detection in larger systems, which combined with prepared ground state reactants prior to the reactive collision, will let us obtain state-to-state differential cross sections. This is achieved by a newly designed laser-ionization source for  $H_2^+$  and implementation of a Rydberg-tagging scheme to detect neutral hydrogen atom products in coincidence [3]. First reactions of interest are  $H_2^+ + Ne$  and  $H_2$ , where interesting quantum dynamics have been predicted and little is known experimentally about the energy partitioning.

- [1] J. Meyer, E. Carrascosa, et al. *Nat. Chem.* 13, 977-981 (2021)
- [2] T. Michaelsen, et al., *J. Chem. Phys.* 147, 013940 (2017)
- [3] M. Qiu, et al., *Science* 311 5766, 1440-1443 (2006)

MO 13.8 Wed 16:30 Empore Lichthof

**Development of a Cryogenic Beam Source for Cold Calcium Monofluoride Molecules** — ●PHILLIP GROSS, OLE PROCHNOW, ALEXANDRA KÖPF, and TIM LANGEN — 5. Physikalisches Institut, Universität Stuttgart

The production of ultracold molecular quantum gases promises to add long-range dipolar interactions to the quantum simulation toolbox. Here we first show theoretically that such dipolar interactions can lead to the formation of new phases of matter in bulk molecular Bose-Einstein condensates, such as droplet states and supersolids. Second, we present a new setup to realize these phases of matter in an experiment. In this setup we work with calcium monofluoride molecules, which are characterized by large electric dipole moments and well-established laser cooling strategies. In a first step to create a gas of these molecules with high phase space density, we present the design of a cryogenic buffer gas beam source, as well as extensive simulations of transversal and longitudinal laser cooling of the resulting molecular beam.

MO 13.9 Wed 16:30 Empore Lichthof

**Imaging Photoelectron Circular Dichroism in Mass-Selected Chiral Anions** — ●VIKTORIA KATHARINA BRANDT, JENNY TRIP-TOW, ANDRÉ FIELICKE, GERARD MEIJER, and MALLORY GREEN — Molecular Physics Department of the Fritz Haber Institute of the Max Planck Society

Photoelectron Circular Dichroism (PECD) is a chiral effect that manifests in the angle-dependent photoemission of an electron upon irradiation of a chiral molecule by circularly polarized light. The use of anions in this technique allows for mass-selectivity and eliminates the need for X-ray based ionization sources, thus leading to a potentially robust analytical tool for chiral discrimination of multicomponent gas-phase samples. PECD spectroscopy of neutral chiral species has flourished over the past decades. A PECD effect in anions, however, has only been observed recently. By coupling pre-photodetachment mass selection, tuneable detachment, and velocity-map imaging anion photoelectron spectroscopy, we provide an energy-resolved PECD signal for mass-selected anions. We have recently demonstrated this successfully in the study of the deprotonated 1-indanol anion, where we observed a PECD effect for several detachment channels and a maximum PECD effect of 11%. Current aims of the project are focused on improving the resolution for spectroscopic PECD measurements. Such improvements will pave a way to an understanding of the underlying cause in the difference in electron scattering dynamics of neutral and charged molecules, as well as work towards a robust analytical method for the chiral analysis of dilute, but complex, chemical samples.

MO 13.10 Wed 16:30 Empore Lichthof

**Implementation of time-correlated single photon counting for studying photo-activated processes in aggregates of organic molecules attached to rare gas clusters** — ●ALEKSANDR DEMIANENKO, MORITZ MICHELBACH, SEBASTIAN HARTWEG, and FRANK STIENKEMEIER — Institute of Physics, University of Freiburg, Germany

Collective effects in organic semiconductors affect excited state lifetimes, important for organic optoelectronic and photovoltaic applications. Previous studies addressed radiative and non-radiative decay mechanisms of the processes connected to the collective effects in aggregates of polyacenes attached to the surface of solid Ne and Ar clusters. Fluorescence quantum yield and excited singlet state's lifetime decreased upon increasing sample molecules surface density [1,2]. The limited temporal resolution of a few ns, due to the ns-laser excitation and PMT detection, made disambiguation of different contributions to the lifetime reduction challenging.

This project is aimed at enhancing the temporal resolution of fluorescence measurements by implementing time correlated single photon counting. This technique allows us to cover the sub-ns lifetime region currently not achievable in our cluster doping apparatus. We present the current status of the ongoing upgrade of our setup and discuss advantages and implementation challenges.

- [1] M. Bohlen et al. *J. Chem. Phys.* 156, 034305 (2022).
- [2] S. Izadnia et al. *J. Phys. Chem. Lett.* 8, 2068 (2017).

MO 13.11 Wed 16:30 Empore Lichthof

**Learning potential energy surfaces for collisions of H<sub>2</sub>+ molecules and rare gas atoms** — ●KARL P. HORN<sup>1</sup>, LUIS ITZA VAZQUEZ-SALAZAR<sup>2</sup>, CHRISTIANE P. KOCH<sup>1</sup>, and MARKUS MEUWLY<sup>2</sup> — <sup>1</sup>Theoretische Physik, Freie Universität Berlin, Germany — <sup>2</sup>Department of Chemistry, Universität Basel, Switzerland

The latest developments in experimental techniques and coupled channel calculations have led to measurements and theoretical simulations of ever increasing accuracy, such as in the case of Helium/Neon and H<sub>2</sub> cold collisions. The utilisation of methods such as multi-reference configuration interaction (MRCI) and full configuration interaction (FCI) ab-initio calculations has already resulted in potential energy surfaces (PESs) of very high quality [1]. Whilst experiment and theory already show good agreement using these existing potentials, high resolution measurements unlock the enticing possibility of exploiting experimental data for the purpose of improving existing PESs. In this work, we employ a closed loop parameter optimisation in order to morph [2] He-H<sub>2</sub><sup>+</sup> PESs determined at several levels of theory, including second order Moller Plesset, MRCI and FCI by minimising the difference between collision cross sections from quantum wavepacket simulations and experiment. This yields a collection of PESs all consistent with experimental observables within certain error bounds and provides insight into which regions of the PES are sampled and which require further probing by new experiments.

- [1] *Phys. Chem. Chem. Phys.*, 21, 24976-24983, 2019
- [2] *J. Chem. Phys.*, 110, 8338, 1999

MO 13.12 Wed 16:30 Empore Lichthof

**Reactive Scattering of the oxygen atom transpher reaction between Carbondioxide and group V cations** — ●MAXIMILIAN HUBER<sup>1</sup>, MARCEL META<sup>1</sup>, ATILAY AYASLI<sup>2</sup>, TIM MICHAELSEN<sup>2</sup>, ROLAND WESTER<sup>2</sup>, and JENNIFER MEYER<sup>1</sup> — <sup>1</sup>RPTU Kaiserslautern-Landau Fachbereich Chemie, Kaiserslautern, Germany — <sup>2</sup>Universität Innsbruck Institut für Ionenphysik und angewandte Physik, Innsbruck, Austria

With our method we investigate the atomistic dynamics of elementary reactions like the oxygen atom transfer of CO<sub>2</sub> with transition metal cations under single collision conditions. We achieve this by recording energy and angle differential cross sections by means of product ion velocity distributions after a reactive collision. [1]

Here, we present our first results for the oxygen atom transfer reaction  $Nb^+ + CO_2 \rightarrow NbO^+ + CO$  measured with our 3D crossed beam velocity map imaging experiment. The reaction is exothermic by 1.68 eV and is spin forbidden in its electronic ground state. Nevertheless the reaction was found to have relatively high reaction efficiencies at room temperature. [2,3] We recorded energy dependent velocity map images of the Niobium reaction at different energies. Also, we compared these results to the reaction of the heavier homologue tantalum  $Ta^+ + CO_2 \rightarrow TaO^+ + CO$ .

- [1] J. Meyer, R. Wester, *Annu. Rev. Phys. Chem.* 2017, 68, 333. [2]

M.R. Sievers, P.B. Armentrout, *Int. J. Mass. Spec.*, 1998, 179/180, 103. [3] G. K. Koyanagi, D. K. Bohme, *J. Phys. Chem. A* 2006, 110, 1232.

MO 13.13 Wed 16:30 Empore Lichthof

**Absorption spectroscopy and modeling laser cooling of barium monofluoride** — ●FELIX KOGEL, MARIAN ROCKENHÄUSER, EINIUS PULTINEVICIUS, and TIM LANGEN — 5. Physikalisches Institut, Universität Stuttgart

Cold molecular gases are the starting point for studies of cold chemistry, quantum simulation and precision measurements of fundamental physics. Here, we report on our effort towards direct laser cooling of BaF molecules. We perform high-resolution absorption spectroscopy to derive an improved set of molecular constants for the bosonic isotopologues  $^{138}\text{BaF}$  and  $^{136}\text{BaF}$  and use these constants to model laser cooling using simulations based on the optical Bloch equations. We find effective Doppler, sub-Doppler, and coherent cooling strategies for the bosonic, as well as for the fermionic BaF isotopologues. This provides important guidance for the corresponding experiments ongoing in our group, and paves the way for tests of fundamental symmetries using these molecules.

MO 13.14 Wed 16:30 Empore Lichthof

**Readout techniques for the implementation of a trace-gas sensor for nitric oxide** — ●MAURICE SCHAMBER<sup>1,4</sup>, YANNICK SCHELLANDER<sup>2,4</sup>, FABIAN MUNKES<sup>1,4</sup>, PATRICK KASPAR<sup>1,4</sup>, PHILIPP NEUFELD<sup>1,4</sup>, ALEXANDER TRACHTMANN<sup>1,4</sup>, MARIUS WINTER<sup>2,4</sup>, PATRICK SCHALBERGER<sup>2,4</sup>, NORBERT FRÜHAUF<sup>2,4</sup>, HASSAN HAYERI<sup>3,4</sup>, PHILIPP HENGEL<sup>3,4</sup>, LARS BAUMGÄRTNER<sup>3,4</sup>, JENS ANDERS<sup>3,4</sup>, ROBERT LÖW<sup>1,4</sup>, TILMAN PFAU<sup>1,4</sup>, and HARALD KÜBLER<sup>1,4</sup> — <sup>1</sup>5. Physikalisches Institut, Universität Stuttgart, Pfaffenwaldring 57, 70569 Stuttgart — <sup>2</sup>Institut für Großflächige Mikroelektronik, Universität Stuttgart, Allmandring 3b, 70569 Stuttgart — <sup>3</sup>Institut für Intelligente Sensorik und Theoretische Elektrotechnik, Universität Stuttgart, Pfaffenwaldring 47, 70569 Stuttgart — <sup>4</sup>Center for Integrated Quantum Science and Technology (IQST), Universität Stuttgart

Two different readout techniques for nitric oxide spectroscopy are presented. The first approach is based on the detection of charged particles created by collisional ionization of Rydberg molecules in a low-pressure through-flow gas cell setup, whereas the second enables the detection of photons in the deep UV based on a-IGZO semiconductor technology. Both methods are presented within the scope of the development of a trace-gas sensor for nitric oxide.

MO 13.15 Wed 16:30 Empore Lichthof

**Collisions in a quantum gas of bosonic  $^{23}\text{Na}^{39}\text{K}$  molecules** — ●MARA MEYER ZUM ALTEN BORGLOH<sup>1</sup>, PHILIPP GERSEMA<sup>1</sup>, LEON KARPA<sup>1</sup>, KAI KONRAD VOGES<sup>1</sup>, JULE CAROLINE HEIER<sup>1</sup>, SILKE OSPELKAUS-SCHWARZER<sup>1</sup>, CHARBEL KARAM<sup>2</sup>, and OLIVIER DULIEU<sup>2</sup> — <sup>1</sup>Institut für Quantenoptik, Leibniz Universität Hannover — <sup>2</sup>Université Paris-Saclay, CNRS, Laboratoire Aimé Cotton

We report about our experiments with quantum gases of polar  $^{23}\text{Na}^{39}\text{K}$  molecules. We discuss both atom-molecule and molecule-molecule collisions including the origin of loss processes in a cloud of chemically stable  $^{23}\text{Na}^{39}\text{K}$  molecules.

Furthermore, we discuss a method for suppressing molecular loss using two optical photons at Raman resonance, leading to a potential barrier that protects the colliding molecules from reaching the short range.

MO 13.16 Wed 16:30 Empore Lichthof

**Surface charge removal by UV illumination in a microstructured electrostatic trap for cold molecule research** — ●JINDARATSAMEE PHROMPAO, MICHAEL ZIEMBA, YVAN BRIARD, FLORIAN JUNG, MARTIN ZEPPENFELD, ISABEL RABEY, and GERHARD REMPE — Max-Planck-Institut für Quantenoptik, Hans-Kopfermann-Straße 1, 85748 Garching, Germany

Polar molecules are an excellent platform to conduct fascinating research ranging from cold chemistry to tests of fundamental physics. Precise determination of molecular constants is essential for these applications. Toward this end, long observation time [1] is beneficial, which can be achieved by trapping the cold molecules. In our experiment, we employ a microstructured electrostatic trap [2] to confine the molecules for several seconds. The trap potential is created by applying high voltages to the trap electrodes. This, however, induces surface charges that can broaden the electric-field distribution, which renders

precise addressing and controlling of the trapped molecules difficult. Thus, surface charge removal is crucial to overcome these problems.

Here, we will highlight the working principles of the electrostatic trap. The characteristics of high-voltage-induced surface charge build up will be described. Furthermore, surface charge removal by UV illumination will be presented. We found that the surface charge removal efficiency depends on the applied UV intensity and wavelength in a nontrivial way.

[1] A. Prehn et al., *Phys. Rev. Lett.* 127, 173602 (2021).

[2] B.G.U. Englert et al., *Phys. Rev. Lett.* 107, 263003 (2011).

MO 13.17 Wed 16:30 Empore Lichthof

**Challenges and solutions in dispersed fluorescence measurements and determining their absolute cross sections** — ●ROBIN ISE<sup>1</sup>, JOHANNES VIEHMANN<sup>1</sup>, PHILIPP SCHMIDT<sup>2</sup>, ARNE SCHRÖDER<sup>1</sup>, ANDREAS HANS<sup>1</sup>, and ARNO EHRESMANN<sup>1</sup> — <sup>1</sup>University of Kassel, Kassel, Germany — <sup>2</sup>European XFEL, Hamburg, Germany

Measurements of the absorption and emission of electromagnetic radiation have always been a key contribution to the understanding of the fundamental structure of atoms and molecules. While the experimental setup used for these measurements, called PIFS (Photon Induced Fluorescence Spectroscopy) and developed by our group, has seen great success in the past, in obtaining large-scale emission maps of  $\text{H}_2$  in the near to vacuum ultraviolet spectral range, the improvement of the experimental methods may allow to determine absolute cross sections of the measured process. This ongoing optimization process of the experimental setup shall be illustrated in this work, including the reconfiguration of the setup to accommodate for measurements in the magic angle and an improved method of acquiring absolute pressure data of the medium in question.

MO 13.18 Wed 16:30 Empore Lichthof

**A Reaction Microscope for the Cryogenic Storage Ring CSR** — ●FELIX HERRMANN, DAVID V. CHICHARRO, ROBERT MOSHAMMER, CLAUS DIETER SCHRÖTER, and THOMAS PEIFER — Max-Planck-Institut für Kernphysik, Saupfercheckweg 1, 69117 Heidelberg, Germany

For studying molecular break-up reactions on slow and cold molecular ions and clusters at the cryogenic storage ring CSR, we have designed a dedicated in-ring reaction microscope (ReMi). The ReMi is a combined electron and ion spectrometer for energy and angular resolved particle detection created in an elementary collision process. This spectrometer will deliver kinematically complete data on the reaction dynamics. The implementation into the storage ring of this first cryogenic ReMi worldwide started in May 2022. Its finalization is expected for spring 2023. Subsequently, first fundamental in-ring experiments, reactions like electron transfer, molecular break-up or proton transfer at room temperature conditions, followed by measurements at cryogenic conditions ( $< 10\text{ K}$ ) in a future beamtime period are envisaged. The setup of the complex apparatus, in detail one of the MCP detectors with time and position sensitive delay-line read-out along with the design adaptation for operation at cryogenic temperatures, the supersonic gas jet and laser incouplings, as well as first test measurements will be shown.

MO 13.19 Wed 16:30 Empore Lichthof

**New apparatus for synchrotron-based photoelectron spectroscopy of cold and mass-selected ions in the gas phase** — STÖCKS PHILLIP, BÄR FABIAN, WEISE LUKAS, and ●VON ISSENDORFF BERND — Institute of Physics at the University of Freiburg, Freiburg i.Br., Germany

We present the development and construction of a new apparatus for cluster research at the BESSY II synchrotron at the Helmholtz Centre in Berlin (HZB). A magnetron sputter source provides the clusters for the apparatus. The setup allows mass selection with a Quadrupole Mass Spectrometer (QMS) before the clusters are stored. The trap is a linear Radio Frequency (RF) trap. Photoelectrons are emitted through interaction with the synchrotron beam. These are forced out of the trap with a magnetic field using the principle of the magnetic bottle on parallel trajectories in one direction. In this way, sufficient intensities can be achieved. The photoelectrons then pass through a magnetic guiding field and experience a deflection from the synchrotron axis. Subsequently, the photoelectrons are directed and focused by electric ion optics so that the photoelectrons can be guided into the Hemispherical Spectrum Analyser (HSA) as magnetic field-free as possible. At the current state of the project we will especially focus on the simulated photoelectron paths guided and focused by our newly developed photoelectron extractor. Furthermore the detailed design of the whole experiment will be introduced.