

MO 22: Posters 3: Cluster, Strong Field Physics, and Experimental Techniques

Time: Thursday 16:15–18:15

Location: S Foyer LLM

MO 22.1 Thu 16:15 S Foyer LLM

Angle resolved photoelectron spectra of small copper clusters — ●LUKAS WEISE and BERND V. ISSENDORFF — Physikalisches Institut der Albert-Ludwigs-Universität Freiburg

Angle resolved spectra are important tests for the theoretical description of clusters since they carry more information than the energy spectra alone. The anisotropy of photoelectron spectra for example depends on the angular momentum state.

The cluster anions are produced in a magnetron sputter source and enter a time-of-flight spectrometer for mass measurement and selection. Afterwards electrons are detached by linear polarized laser light and projected onto a MCP detector in a velocity map imaging setup.

Here the results for small copper cluster are presented. Although copper clusters have been studied intensively, there are still undiscovered features of their photoelectron spectra. For example Cu_5^- shows a strong vibrational structure.

MO 22.2 Thu 16:15 S Foyer LLM

Optical spectroscopy of small cluster cations — ●MARKO FÖRSTEL, WOLFGANG SCHEWE, and OTTO DOPFER — TU Berlin, IOAP, Hardenbergstr. 36, 10623 Berlin

Optical spectra of small cationic species are needed to understand the absorption properties of the interstellar medium. They also allow to understand the electronic structure of species relevant for catalysis and material science. Unfortunately, those spectra are not easy to obtain due to intrinsically low target densities.

In this poster presentation we introduce our new tandem quadrupole - reflectron time-of-flight spectrometer coupled to a laser vaporization source for the measurement of optical spectra of cluster cations.^[1] Several improvements allow us to measure optical spectra detailed enough to enable structure determinations via comparisons to TD-DFT based Franck-Condon simulations.^[2]

[1] M. Förstel, B. K. A. Jaeger, W. Schewe, P. H. A. Sporkhorst, O. Dopfer, Improved tandem mass spectrometer coupled to a laser vaporization cluster ion source, *Rev. Sci. Instr.* 2017, 88, 123110.

[2] M. Förstel, W. Schewe, O. Dopfer, Optical spectroscopy of the Au_4^+ cluster: Resolved vibronic structure indicates an unexpected isomer, submitted.

MO 22.3 Thu 16:15 S Foyer LLM

Small silver clusters on porphyrin templates — ●CARL FREDERIC USSLING¹, TOBIAS BISCHOFF¹, ANDRE KNECHT¹, ANDREA MERLI¹, MERLE I. S. RÖHR², POLINA G. LISINetskAYA², JENS PETERSEN², ROLAND MITRIĆ², and THOMAS MÖLLER¹ — ¹Institut für Optik und Atomare Physik, Technische Universität Berlin — ²Institut für Physikalische und Theoretische Chemie, Universität Würzburg

Due to promising applications in nanotechnology, the size- and structure-dependent optical properties of noble metal clusters have been studied for many years. In the smallest size regime, both the cluster geometry and optical properties are strongly influenced by size [1]. Recently, first studies on the collective optical characteristics and interactions between silver clusters arranged in an ordered 2D lattice were published [2]. Furthermore, it has been predicted that porphyrin templates may be used to produce such well defined arrangements, e.g. of cationic Ag_3 clusters [3]. As a first step into the direction of cluster arrays we investigated the possibility to combine cationic Ag_3 clusters with single porphyrins in a collision cell in the gasphase and explored first the optical properties of the produced silver-porphyrin-hybrids in the UV/VIS range.

[1] K. L. Kelly *et. al.*, *J. Phys. Chem. B* **107**, 668 (2003)

[2] P. G. Lisinetskaya *et. al.*, *Phys. Rev. B* **89**, 035433 (2014)

[3] M. Röhr *et. al.*, *J. Phys. Chem. A* **120**, (2016)

MO 22.4 Thu 16:15 S Foyer LLM

Dispersion-controlled docking preference: analyzing isolated dibenzofuran–solvent complexes with IR/UV spectroscopy — DOMINIC BERNHARD¹, ●DOMINIQUE MAUÉ¹, MARIYAM FATIMA^{2,3}, ANJA POBLOTZKI⁵, MARTIN A. SUHM⁵, MELANIE SCHNELL^{2,3,4}, and MARKUS GERHARDS¹ — ¹Physical Chemistry, TU Kaiser-

lautern, Germany — ²Max Planck Institute for the Structure and Dynamics of Matter, Hamburg — ³DESY, Hamburg — ⁴Physical Chemistry, CAU Kiel — ⁵Physical Chemistry, Georg-August Universität Göttingen

The structural preferences within a series of dibenzofuran–solvent complexes has been investigated by electronic, vibrational and rotational spectroscopic methods within supersonic jet experiments. The experimental study is accompanied with a detailed theoretical analysis including dispersion corrected density functional theory, symmetry adapted perturbation theory as well as coupled cluster approaches. The complementary, multi-spectroscopic results of microwave, FTIR and – as presented here – by combined IR/UV spectroscopy reveal a preferred $\text{OH}\cdots\text{O}$ structure for dibenzofuran–water as the smallest complex, whereas for the methanol complex two coexisting $\text{OH}\cdots\text{O}$ and $\text{OH}\cdots\pi$ isomers are revealed. Furthermore, for dibenzofuran–*tert*-butanol as the largest complex within this study, only a π -bound structure is observed. A general trend regarding the binding preference is deduced, which is driven by London dispersion interactions.

MO 22.5 Thu 16:15 S Foyer LLM

Water deprotonation on free calcium-manganese-oxide clusters: Gas Phase Model Systems for the Catalytically Active Center of Photosystem II — ●SANDRA M. LANG, IRENE FLEISCHER, SILVIA MAUTHE, NINA ZIMMERMANN, and THORSTEN M. BERNHARDT — Institute of Surface Chemistry and Catalysis, Ulm University, Albert-Einstein-Allee 47, 89069 Ulm, Germany

The catalytic oxidation of water in plants takes place at an inorganic Mn_4CaO_5 cluster located in photosystem II. To aid the design of new artificial water oxidation catalysts we embark on a novel hierarchical modeling strategy, starting with small clusters and increasing the model system's complexity in a staged, controlled manner.

In the first steps we studied the reactivity of isolated manganese oxide cluster ions, Mn_xO_y^+ , of different size and composition with D_2^{16}O and H_2^{18}O . Gas-phase ion trap experiments and infrared multiple-photon dissociation (IR-MPD) spectroscopy in conjunction with first-principles calculations, revealed the facile water deprotonation and the exchange of the oxygen atoms of the cluster with water oxygen atoms.

In a further step we investigated binary calcium manganese oxide clusters and found that the number of Ca atom is crucial to the water oxidation capabilities of the small $\text{Ca}_{4-x}\text{Mn}_x\text{O}_4^+$ and $\text{Ca}_{5-x}\text{Mn}_x\text{O}_5^+$ clusters. Finally, we started modeling the ligand environment of the manganese-clusters cluster by small acids. First experiments identified propionic acid as the most promising candidate since the smaller acids, formic and acetic acid, easily decompose in the presence of Mn_xO_y^+ .

MO 22.6 Thu 16:15 S Foyer LLM

Strong temperature and size effects in iron-nitrogen interactions — ●ANNIKA STEINER¹, MATTHIAS P. KLEIN¹, SEBASTIAN DILLINGER¹, JENNIFER MOHRBACH¹, PETER B. ARMENTROUT², and GEREON NIEDNER-SCHATTEBURG¹ — ¹Fachbereich Chemie and Forschungszentrum OPTIMAS, Technische Universität Kaiserslautern, 67663 Kaiserslautern, Germany — ²Department of Chemistry, University of Utah, Salt Lake City, Utah 84112, USA

It is a pending challenge to characterize the interaction of N_2 with transition metal surfaces and clusters in detail. For our experiments, we utilized a modified Fourier Transform Ion Cyclotron Resonance Mass Spectrometer (FT-ICR MS). With our tandem cryo trap instrument we investigate N_2 adsorption on Co, Ni, and Rh as well as N_2 and H_2 co-adsorption on Ru_3^+ .

Currently, we investigate Fe_n^+ clusters for reductive nitrogen activation and we conduct temperature dependent studies of N_2 adsorption. We found size and pressure dependent effects, such as extremely slow N_2 adsorption on Fe_{17}^+ . Also, we identified two isomers for the Fe_{18}^+ cluster one of which is unreactive.

Furthermore, we present gas phase IR spectra of N_2 adsorption on isolated cationic Fe_n^+ clusters at cryo temperatures. We find cluster size dependent and adsorbate number dependent effects in the IR spectra. All complexes show single or multiple IR active bands. These bands are significantly red shifted with respect to the IR inactive stretching mode of free N_2 (2359 cm^{-1}).

MO 22.7 Thu 16:15 S Foyer LLM

Ultra-high resolution photoelectron spectroscopy on deeply cold niobium clusters — ●FABIAN BÄR, MORITZ WEIGT, and BERND V. ISSENDORFF — Physikalisches Institut Albert-Ludwigs Universität Freiburg

The properties of deeply cold niobium clusters Nb_4^- to Nb_{35}^- at 3.9 K have been investigated. Therefore, preparatory measurements with platinum ions have been performed, showing that the used magnetic bottle time of flight photoelectron spectrometer has a current resolution of $\Delta E/E = 0.39\%$. This is at least a factor five better than a standard magnetic bottle spectrometer. Striking vibration structures in several photoelectron spectra at cluster temperatures from 3.9 K to 122 K have been found, but so far no evidence for a phase transition involving a superconducting state has been observed. Using an improved setup with a low temperature ion trap and a new spectrometer, vibrational structures of different cluster sizes have been resolved and analysed. In the spectrum of Nb_{26}^- an unexpectedly vibrational transitions have been observed, indicating a cluster geometry with high symmetry. Additionally, the electron affinity of these clusters has been determined at a higher precision.

MO 22.8 Thu 16:15 S Foyer LLM

Cryo kinetics and IR spectroscopy of N_2 and H_2 adsorbed to size selected Rhodium and Tantalum clusters — ●MATTHIAS KLEIN, ANNIKA STEINER, AMELIE EHRHARD, SEBASTIAN DILLINGER, JENNIFER MOHRBACH, and GEREON NIEDNER-SCHATTEBURG — Fachbereich Chemie and Forschungszentrum OPTIMAS, TU Kaiserslautern, Erwin-Schrödinger-Straße 52, 67663 Kaiserslautern

We recorded N_2 adsorption kinetics and InfraRed-PhotoDissociation (IR-PD) spectra of the isolated cluster adsorbate complexes $[\text{Rh}_6(\text{N}_2)_m]^+$, $m=1-12$. In conjunction with extensive DFT modelling, these measurements allow for assignments of the adsorbate arrangement at each adsorption step as well as possible reorganizations of the cluster core structure. By IR-PD spectroscopy combined with DFT modelling we observed a spin quenching with increasing N_2 coverage as well as an adsorption induced relaxation of the cluster structures [1].

Currently, we investigate the N_2 and H_2 adsorption to small size selected Ta_n^+ , $n=2-5$ clusters. Recent studies on the tantalum dimer cation have analyzed the catalytic formation of ammonia from N_2 and H_2 [2]. Our current cryo IR-PD spectroscopy as well as cryo adsorption kinetics may provide for further spectroscopic and kinetic information about reaction precursors and intermediates.

[1] M. P. Klein, A. A. Ehrhard, S. Dillinger, J. Mohrbach, and G. Niedner-Schatteburg, *Top. Catal.* (2018), **61**, 106-118. [2] C. Geng, J. Li, T. Weiske, H. Schwarz, *PNAS* (2018), **115**, 11680-11687.

MO 22.9 Thu 16:15 S Foyer LLM

Investigation of isotope effects in the formation of water clusters — ●REBECCA SCHAF, JOHANNES VIEHMANN, ANDREAS HANS, ARNO EHRESMANN, and ANDRÉ KNIE — Institut für Physik und CIN-SaT, Universität Kassel, Heinrich-Plett-Str. 40, 34132 Kassel, Germany

The production and mass spectrometry of water clusters doped with various molecules is a method suited for the investigation of the behaviour of different molecules in the process of cluster formation. Here, we present an exploration of isotope effects in the generation of clusters. Isotope enrichment is observed in exemplary studies using normal and deuterated water. To quantify the enrichment we calculate isotope distributions and simulate the experimental mass spectroscopy data. Our method is also applicable to cluster of other species, as is exemplarily demonstrated for van der Waals bound neon clusters.

MO 22.10 Thu 16:15 S Foyer LLM

Setup for photoelectron spectroscopy of metal clusters at FLASH — ●FRANKLIN MARTINEZ¹, NORMAN IWE¹, KLARA RASPE¹, MADLEN MÜLLER², JOSEF TIGGESBÄUMKER¹, and KARL-HEINZ MEIWES-BROER¹ — ¹Institut für Physik, Universität Rostock, Albert-Einstein-Str. 23-24, 18059 Rostock — ²Institut für Physik, Universität Greifswald, Felix-Hausdorff-Str. 6, 17489 Greifswald

Photoelectron spectroscopy experiments at a free electron laser, e.g. FLASH in Hamburg, allow studying highly excited nanoscopic particles in the gas phase by means of core-level ionization. In the case of metal clusters, such experiments can study effects like core-hole screening which can indicate size-dependent changes in the binding

character of such species. However, probing small, single-size selected clusters, for example, requires the preparation of a sufficiently high target density in the FEL interaction region. This condition is met by an experimental setup including a high-current cluster source, a radio-frequency ion trap and a dedicated interaction region. A newly designed interaction chamber provides a field-free environment for the operation of field-free electron spectrometers using time-of-flight or electrostatic deflection analyzers. The setup is completed by a high-resolution electron spectrometer designed and built at the group of Prof. v. Issendorff in Freiburg, and can also be supplemented by a wavelength spectrometer for FEL-radiation. The project is funded by the bmbf.

MO 22.11 Thu 16:15 S Foyer LLM

Photoelectron spectroscopy of size-selected clusters at free electron lasers — ●KARIMAN ELSHIMI, PHILIPP ELSÄSSER, FABIAN BÄR, ALEX RUF, and BERND V. ISSENDORFF — Physikalisches Institut Albert-Ludwigs Universität Freiburg

Investigation of small clusters using photoelectron spectroscopy at free electron lasers (FEL) not only will contribute to a better understanding of the electronic structure, and the resulting properties of nanoscale matter, but also will enable deep insights into the many-particle dynamics. Therefore, the aim of this project is to provide a specialized spectrometer system for studying the electronic structure and the dynamics of free mass-selected and temperature-controlled clusters at FEL. This system involves a high-resolution magnetic bottle type photoelectron spectrometer and an ion time-of-flight mass spectrometer. It is combined with an existing high-intensity magnetron cluster source and a low-temperature ion trap for cluster thermalization. The spectrometers are adapted to both the intense cluster beams as well as to the specific parameters imposed by the FEL. The whole machine is designed and built in a collaboration with the group of Prof. Meiwes-Broer in Rostock. One aspect of this development is the design and the construction of the magnetic bottle type photoelectron spectrometer based on experience gained in a similar experiment at FLASH. We present our newly constructed spectrometer including details about its unique features and results of recent measurements.

MO 22.12 Thu 16:15 S Foyer LLM

Strong field ionization probing of $(\text{NO}_2)_2$ intermolecular vibration with ion coincidence imaging — ●LUCIA MERKEL, KATRIN REININGER, JINGMING LONG, MARC J. J. VRACKING, FEDERICO FURCH, CLAUS PETER SCHULZ, and JOCHEN MIKOSCH — Max-Born-Institut, Max-Born-Straße 2A, 12489 Berlin

The intermolecular vibration of the NO_2 dimer has attracted considerable attention in the attosecond community.^[1,2] Collective vibrational excitation of a gas sample can be achieved via impulsive stimulated Raman scattering.

Here we report on a pump-probe study of the $\text{O}_2\text{N-NO}_2$ vibration in which the probing step is conducted via strong field ionization. The sub-8 fs laser pulses used for the experiment are produced by a high repetition rate OPCPA system.^[3] The resulting ions are detected with coincidence velocity mapping, employing three-dimensional (x, y, t) data acquisition with a digital pixelated detector based on the Timepix technology.^[4] To increase the time resolution, the ion time-of-flight is additionally recorded with a high-resolution time-to-digital converter. We present the data analysis, which allows us to characterize the different pathways in which NO_2^+ fragments are produced. Dissociative strong field ionization to the repulsive A_g state is utilized to characterize the vibrational motion in the ground state of $(\text{NO}_2)_2$.

[1] Li et al., *Science*, 322, 5905 (2008).

[2] Spanner et al., *Phys. Rev. A*, 85, 3 (2012).

[3] Furch et al., *Opt. Express*, 24, 19293 (2016).

[4] Long et al., *J. Chem. Phys.*, 147, 013919 (2017).

MO 22.13 Thu 16:15 S Foyer LLM

Imprints of the Molecular Electronic Structure in the Photoelectron Spectra of Strong-Field Ionized Triatomic Model Molecules — ●MATTHIAS PAUL — Friedrich-Schiller-Universität Jena, Institut für Physikalische Chemie, Helmholtzweg 4, 07743 Jena

We examine the circular dichroism in the angular distribution (CDAD) of photoelectrons of non-linear triatomic model systems by analyzing their ionization dynamics. For a detailed characterization of the ionization process of our system, we combine quantum dynamical and classical simulation to analyze the evolution of the electronic density during the interaction with circular polarized light. This builds the foundation for an understanding of the complex pattern of the photoelectron mo-

mentum distribution (PEMD) and thus the related CDAD effects. By applying a modified version of the strong-field-approximation (SFA) and the classical trajectory Monte Carlo (CTMC) method, we are able to discriminate the influence of the excited states and the long-range Coulomb interaction on the ionization dynamics, and assign their contributions to the characteristic pattern of the PEMDs. Increasing the internuclear distance or changing the symmetry of the potential strongly affects the three-folded structure in the PEMD, as well as the CDAD. Our analysis allows us to assign these modifications to contribution of excited states.

MO 22.14 Thu 16:15 S Foyer LLM

Strong-field dynamics of singly excited vibronic resonances in the hydrogen molecule — ●GERGANA D. BORISOVA, VEIT STOOSS, PAUL BIRK, MAXIMILIAN HARTMANN, TOBIAS HELDT, CHRISTIAN OTT, and THOMAS PFEIFER — Max-Planck-Institut für Kernphysik, Saupfercheckweg 1, 69117 Heidelberg, Deutschland

The effect of strong near-infrared (NIR) laser fields interacting with excited states of the helium atom has been studied with attosecond transient-absorption spectroscopy (ATAS) as well as using electron detection techniques. Looking at molecules, however, not only the electronic but also the nuclear degrees of freedom can be influenced by strong fields. Here, we investigate the dynamics in the presence of a strong NIR laser field in H_2 , the molecular analog of the helium atom. In ATAS spectra we resolve a forest of H_2 vibronic states in the energy region between 13 and 16.5 eV. Comparing to both theoretical [1] and experimental data [1-3] we assign most of the observed resonances to transitions between the ground state of H_2 and higher lying singly excited vibronic states. We observe changes in the XUV absorption spectrum in the presence of moderately strong NIR intensities, $I_{NIR} \sim 10^{12}$ W/cm². This includes the spectral region of the predissociating D-X system with its vibronic excitations, lying energetically above the first ionization threshold of H_2 , and thus coupling to continuum states. How the predissociating character of the D-X transitions is imprinted on the absorption spectrum and the laser control of the initiated dynamics is the main subject of this work. [1] Can. J. Phys. 72, 856 (1994) [2] PRA 94, 023403 (2016) [3] PRA 97, 023401 (2018)

MO 22.15 Thu 16:15 S Foyer LLM

Harmonic spectroscopy of a polymer — ●FRANZISKA FENNEL and STEFAN LOCHBRUNNER — Institute of Physics and Department of Life, Light, and Matter, University of Rostock, Albert-Einstein-Str. 23-25, 18051 Rostock

High-harmonic spectroscopy has developed to a versatile tool to probe structure and ultrafast light-induced processes in complex systems, ranging from multi-electron dynamics in molecules [1] to the electronic band structure of solids [2]. We aim to use harmonic spectroscopy in order to study systems that reside between bulk materials and isolated molecules such as polymers and organic molecular films.

The focus of the presented poster is the characterization of the setup for harmonic generation with MIR pulses. First proof of principle measurements with an organic polymer are presented.

[1] O. Smirnova et al., Nature 460, 972 (2009)

[2] G. Vampa et al., Phys. Rev. Lett. 115, 193603 (2015)

MO 22.16 Thu 16:15 S Foyer LLM

Semiclassical description of high order harmonic generation in H_2^+ — ●FERMÍN RODRÍGUEZ-HERNÁNDEZ¹, FRANK GROSSMANN², and JAN-MICHAEL ROST¹ — ¹Max-Planck-Institut für Physik komplexer Systeme, Nöthnitzer Strasse 38, D-01187 Dresden, Germany — ²Institut für Theoretische Physik, Technische Universität Dresden, D-01062, Germany

High order harmonic generation (HHG) is a key process in intense laser field-matter interaction which has enabled the generation of coherent XUV radiation and attosecond pulses. In this work we investigate HHG for a one-dimensional H_2^+ molecular model using a semiclassical description based on the Herman-Kluk propagator. We do this in the setting of laser assisted electron ion scattering [1], which avoids initial tunneling. We found the semiclassical approach is able to reproduce the major features of the HHG spectrum when (secondary) tunneling is not important. For certain nuclear separations and specific field intensities, structures appear in the HHG spectrum in addition to the ones familiar from atomic HHG. The semiclassical approach and in particular the trajectories facilitate the understanding of those phenomena.

[1] C. Zagoya, C.-H. Goletz, F. Grossmann, and Jan M. Rost, New

J. Phys. 14, 093050 (2012).

MO 22.17 Thu 16:15 S Foyer LLM

Angle-resolved Auger electron spectroscopy resulting from electron-impact ionization of molecules — ●SEBASTIAN FUCHS¹, DANIEL PAUL^{1,2}, TICIA BUHR¹, SÁNDOR RICZ³, and STEFAN SCHIPPERS¹ — ¹I. Physikalisches Institut, Justus-Liebig-Universität Gießen, Germany — ²Max-Planck-Institut für Kernphysik, Heidelberg, Germany — ³Institute for Nuclear Research, Hungarian Academy of Sciences, Debrecen, Hungary

In order to study the angle dependent interactions of polarized electrons as well as circular polarized photons with chiral molecules, an ESA-22-type electron spectrometer [1,2] in combination with an electron gun and focusing optical elements was upgraded and tested. The electron spectrometer is capable of simultaneous energy and angular analysis covering almost the entire polar angular range of emitted electrons. As test experiments, the O K-LL Auger spectra induced by 1.5-keV electron impact were measured using various gas targets (O_2 , CO_2 and N_2O). Auger electrons were detected simultaneously in the polar angular range of 15° to 165° relative to the electron beam direction. The present experimental data are compared with results from earlier experimental studies [3,4,5].

[1] S. Ricz et al., Phys. Rev. A 65, 042707 (2002).

[2] L. Ábrók et al., Nucl. Instrum. Methods B 369, 24 (2016).

[3] W. E. Moddeman et al., J. Chem. Phys. 55, 2317 (1971).

[4] A. Hiltunen et al., Nucl. Instrum. Methods B 154, 267 (1999).

[5] W. J. Griffiths et al., J. Phys. B 24, 4187 (1991).

MO 22.18 Thu 16:15 S Foyer LLM

TrapRemi - A Device to Investigate the Quantum Dynamics of Molecular Ions — ●FRANS SCHOTSCH, LUDWIG HOIBL, DENIS DJENDJUR, and ROBERT MOSHAMMER — Max-Planck-Institute for Nuclear Physics

Quantum few-body dynamics in atoms and molecules are of fundamental interest for physics and chemistry. Enabled by the innovation and development of Reaction Microscopes (REMI) during the last two decades, reactions such as ionization, dissociation and geometrical reformation can be investigated in an angle-resolved and kinematically complete manner. Excited with ultra-short LASER pulses, these dynamics can be even resolved on attosecond time scale. We designed a new experimental setup to extend this development, enabling similar investigations in charged systems: atomic and molecular ions of arbitrary charge and mass. These systems are of high interest since they often play key roles in astrochemical reactions as for example the Trihydrogen cation. Our setup combines a linear electrostatic ion trap (Zajfman-Trap) with a REMI. This poster describes the project progress from first ion optics simulations to successful ion storage.

MO 22.19 Thu 16:15 S Foyer LLM

Towards Single-Molecule Detection on a Smartphone — ●LARS RICHTER^{1,2}, CAROLIN VIETZ², MAX L. SCHÜTTE², QINGSHAN WEI³, AYDOGAN OZCAN⁴, PHILIP TINNEFELD⁵, and GUILLERMO P. ACUNA^{2,6} — ¹Department of Physics, Humboldt University of Berlin, Berlin, Germany — ²Institute for Physical & Theoretical Chemistry, and BRICS, and LENA, Braunschweig University of Technology, Germany — ³Department of Chemical and Biomolecular Engineering, North Carolina State University, Raleigh, USA — ⁴Electrical & Computer Engineering Department, and Bioengineering Department, and CNSI, and Department of Surgery, University of California, Los Angeles, USA — ⁵Department of Chemistry and Center for NanoScience, Ludwig Maximilian University of Munich, Germany — ⁶Department of Physics, University of Fribourg, Switzerland

Microscopy techniques based on smartphones have seen a rapid development during the last years. Necessitating only a small number of additional camera components, enables smartphone microscopes to detect analytes such as cells, viruses and bacteria.

We demonstrate and test a smartphone microscopy system with single-molecule sensitivity. By employing optical nanoantennas which rely on the plasmonic enhancement with metal nanoparticles, the emitted light intensity per molecule is greatly amplified.

The experimental results show that monochrome camera sensors outperform colour sensors reaching a sensitivity of 10 fluorophores. Furthermore, preliminary results indicate the detection of single fluorescent molecules on a smartphone.

MO 22.20 Thu 16:15 S Foyer LLM

Set-up for systematical studies on liquid flatjet systems

— •CHRISTINA ZINDEL, CHRISTIAN OZGA, ANDREAS HANS, DANA BLOSS, ANDREAS NEHLS, ARNO EHRESMANN, and ANDRÉ KNIE — Institut für Physik and CINSaT, University of Kassel, Heinrich-Plett-Str. 40, 34132 Kassel, Germany

Within the last years, liquid microjets were commonly used to study fluids and solutions under vacuum conditions. For various spectroscopic applications however, the required sample thickness is limited to a few micrometers down to nanometers, which is barely achievable with common cylindrical microjets. This problem can be solved by

using a so called flatjet system. The collision of two cylindrical jets within their laminar region leads to the formation of liquid sheets, each with an extension in the millimeter range and with a thickness down to a few hundred nanometers. So far, the behavior of these systems is not well understood with regard to different parameters like backing pressure, viscosity and angle of interaction. Here we present a set-up which allows the systematical study of flatjet systems by using a digital light microscope. Additionally, this enables the investigation of its mixing characteristics, i.e. mixing processes within those microjets and liquid sheets.