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Digest and Copyright Information

The papers included in this digest comprise the short summaries of the XXI International Conference on Ultrafast Phenomena held in Hamburg, Germany from 15 to 20 July 2018. The extended version of the papers (2-page summaries in pdf format) will be made available on-line within 2 months after the conference. A link with login and password is provided on a separate sheet.

All web browsers (Firefox, Internet Explorer, Safari or similar) allow you to download the digest.

A .pdf viewer (tested with Adobe Acrobat) is necessary to view the papers. This software can be downloaded from http://www.adobe.com

The papers reflect the authors’ opinion and are published as presented, without any changes in the interest of timely dissemination. Their inclusion in this publication and the extended on-line version does not necessarily constitute endorsement by the editors, the European Physical Society.

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This year’s event - the XXI biannual international conference - continues the tradition of bringing together a multidisciplinary group of researchers sharing a common interest in science and technology at the highest temporal resolution.

The conference will include 409 oral and poster contributions. We have scheduled 12 invited, 152 oral and 245 poster presentations from 26 countries for you to consider over what should be five very full days. Not only is the number of submissions and presentations exceptional, but in our opinion only is the number of submissions and presentations exceptional, but in our opinion the scientific quality and range of topics. As the technology matures, even more interesting ways of utilizing ultrashort electromagnetic pulses - from X-rays to THz - are found.

A tabletop exhibit featuring leading companies will be held in conjunction with the meeting.

We hope that you will enjoy the unique beauty of Hamburg, the program, and the opportunity to spend time with colleagues from around the globe.

Sincerely,

Giulio Cerullo,
Politecnico di Milano, Italy
Jennifer Ogilvie,
University of Michigan, USA
UP 2018 General Chairs
Franz Kärtner,
DESY-CFEL and University of Hamburg, Germany
Munira Khalil,
University of Washington, Seattle, USA
Ruxin Li,
Shanghai Institute of Optics and Fine Mechanics, China
UP 2018 Programme Chairs
Franz Kärtner,
DESY-CFEL and University of Hamburg, Germany
UP 2018 Local Chair

Conference Topics

Applications
Real world applications of ultrafast technology, including ultrafast near-field, nonlinear and confocal microscopes, coherent Raman microscopes, real-time/real-space electron microscopy, medical applications, high speed communication, micromachining, 3D nanofabrication and more.

Biology
Photosynthesis, vision, heme proteins, photoactive proteins, photoisomerization in chromoproteins, wavepacket dynamics, femtobiology, structural dynamics with X-rays and electrons, medical applications.

Chemistry
Vibrational and conformational dynamics, energy transfer, femtochemistry, proton and electron transfer, solvation dynamics, wave packet dynamics and coherent control of reactions, structural dynamics with X-rays and electrons.

Electronics & Optoelectronics
Photoconductivity, generation, propagation and detection of ultrafast electrical signals, plasmonics, terahertz radiation, electro-optical sampling and detectors.

Materials science
Highly correlated systems, coherent phonons in solids, carrier dynamics in nanoparticles, carbon-based materials, two-dimensional materials, structural dynamics with X-rays and electrons.

Physics
Ultrafast nonlinear optical processes, kinetics of non-equilibrium processes, quantum confinement, coherent transients, nonlinear pulse propagation, ultrafast nano-optics, novel ultrafast spectroscopic techniques, high intensity physics, attosecond dynamics.

Pulse Generation and Measurement
New sources, new wavelength regimes, frequency conversion techniques, amplifiers, attosecond pulse generation, free electron lasers, pulse shaping, pulse diagnostics, measurement techniques and frequency standards.

Poster Sessions
245 posters will be presented during three sessions:

- Tuesday 17 July 2018 from 15:45 to 17:15
- Wednesday 18 July 2018 from 14:00 to 15:30
- Thursday 19 July 2018 from 15:45 to 17:15.

There will be no oral presentations during this time. Coffee breaks will be organised during the sessions.

Instructions for Poster Presenters

Poster sessions are scheduled to provide an opportunity for selected papers to be presented in greater visual details and to facilitate discussions among attendees. To display his/her poster, each author is provided with a 92,5 cm wide x 132,5 cm high poster board (maximum dimensions). Fixing material (pins) will be provided. The boards will be marked with the poster session code. Authors are asked to put their posters in the morning of their assigned day. Poster presenters are absolutely asked to be present at their poster during their assigned poster session to allow informal discussions. Coffee break will take place at the same time.

Speakers’ Information

Durations of oral presentations are:
- 15 minutes (including 3 minutes for discussion) for contributed talks,
- 30 minutes (including 5 minutes for discussion) for invited talks.

WARNING! Speakers are requested to upload and check their presentations on the computers provided by the conference in the assigned lecture room during the coffee break preceding the talk or the afternoon of the day before for those scheduled early morning. This is mandatory as the schedule is tight and time has to be respected in order for listeners to move from one lecture hall to the other during parallel sessions. A student will be there to assist them. Speakers are asked to check-in with the session chair in the conference room ten minutes before the session begins. The lecture halls are equipped with microphones, projectors and computers.

Post-deadline contributions

As a tradition, the XXI International Conference on Ultrafast Phenomena will showcase post-deadline presentations. The purpose of these contributions is to give conference participants the opportunity to hear new and significant results in rapidly advancing areas. Only those papers judged to be truly excellent and
compelling in their timeliness will be accepted for presentation as an oral contribution. The post deadline papers are scheduled for oral presentation on Thursday 19 July 2018 between 17:15 - 19:00 in the Festsaal. Authors will be notified whether their papers have been accepted on Monday 16 July 2018 directly at the conference. Post-deadline papers may be included in the proceedings if the authors can submit the manuscript in a timely manner.

Proceedings

As at previous conferences, a book of Proceedings of the Ultrafast Phenomena XXI will be published. Authors of all accepted contributions (invited, oral and poster) are invited to submit a paper for the book of proceedings. We anticipate the latter to contain around 400 articles of 3 pages each. The proceedings will be published by EDP Sciences Web of Conferences (www.webofconferences.org), on-line with open access. All papers must follow the same format and style to meet the conditions for publication. These conditions are set by EPJ Web of Conferences to allow for a uniform appearance within the final volume. A detailed description of the paper format and layout is given on the conference web site. The most salient information is the following:

✓ The paper is limited to not more than 3 pages, including all text, figures, and references.
✓ Papers are to be submitted in pdf format by electronic upload. Papers must be submitted no later than 10:00 pm, 30 July 2018 - GMT+1, Hamburg local time.
✓ No late papers, incorrectly formatted papers, or papers longer than 3 pages will be accepted.

Conference Language

English.

Conference Digest

The registration fee includes an online technical digest including the two-page summaries.

Exhibition

A tabletop exhibit will be organised. See list of exhibitors in the separate leaflet.

The exhibit will run at the same times as the conference, except that Friday will be optional (anyway all equipments/material must be removed by Friday 14:00). Exhibitors are especially asked to be present at their stand during the following time schedules:

**Monday 16 July 2018**,
10:15 - 10:45 Exhibition and Coffee Break.
15:45 - 16:15 Exhibition and Coffee Break.

**Tuesday 17 July 2018**, 10:15 - 10:45 Exhibition and Coffee Break.
15:45 - 17:15 Exhibition, Coffee Break and Poster Session I.

**Wednesday 18 July 2018**, 10:15 - 10:45 Exhibition and Coffee Break.
14:00 - 15:30 Exhibition, Coffee Break and Poster Session II.

15:45 - 17:15 Exhibition, Coffee Break and Poster Session III

The exhibition space is located next to the lecture halls and by the poster area, in order to allow easy and frequent contact with the attendees. Coffee breaks are arranged to give the participants the opportunity to visit the stands.

Exhibitor Information

The conference site will be open on Sunday afternoon 15 July beginning from 15:00 to allow the exhibitors to prepare their stands. The conference registration (participants and exhibitors) will begin Sunday 15 July from 16:30 to 18:00 followed with a welcome reception at the Grand Elysée at 18:00. Exhibitors are welcome.

On-site Facilities

The whole hotel is equipped with WI-FI, which can be used free of charge without password round the clock. A message board around the registration area will be installed.

Lunches

Lunches are not included in the registration fees.
Six restaurants are directly located at the Grand Elysée Hotel Hamburg. These are among the best restaurants in Hamburg: Piazza Romana (Italian cuisine and Mediterranean fish specialties from the Hamburg fish market).

Opening hours: Lunch Monday - Friday 12:00 - 14:30. Daily changing lunch menu at 15.00€.

Brasserie Flum (French cuisine but also fish oysters, lobsters, vegetarian food). Opening hours: Monday - Friday 12:00 - 17:00.

Boulevard Café (culinary specialities, deli-cious snacks or home-made cakes, tarts and drinks).

Opening hours: Monday - Wednesday 07:30 - 24:00, Thursday - Friday 07:30 - 24:00, Saturday 07:30 - 01:00, Sunday 07:30 - 01:00.

Piano music: Monday - Wednesday 16:00 - 24:00, Thursday - Saturday 16:00 - 20:00, Sunday 15:00 - 20:00.

Jazz and swing band: Thursday - Saturday: 20:00 - 24:00

Oyster Bar (cocktail creations and fresh seafood: seafood platter with oysters, langoustines, river crabs, shrimp and lobster)

Opening hours: Monday - Sunday 12:00 - 24:00. The kitchen is open daily 12:00 - 23:30

Boulevard Café (with evening daily live music - jazz)

Opening hours: Monday - Thursday: 17:00 – 20:00, Friday - Saturday: 17:00 – 2:00, Sunday: 17:00 – midnight.

Food orders can be placed until midnight. Perfect at the end of the day or to ring in the evening, the Bourbon Street Bar is where you can enjoy your favourite cocktail in pleasant company, chat with both locals and international guests, watch live sports TV in HD quality or simply relax to some live music.

Piano music: Monday - Wednesday: 16:00 - 24:00, Thursday - Saturday: 16:00 - 20:00, Sunday: 15:00 - 20:00.

Jazz and swing band: Thursday - Saturday: 20:00 - 01:00

THEO’S Prime Beef Steakhouse (for beef and steak fans).

Opening hours: Monday - Saturday beginning from 18:00.

Coffee Breaks

Morning Coffee breaks are organised on Monday, Tuesday, Wednesday, Thursday and Friday from 10:15 to 10:45

Afternoon Coffee breaks are organised from 15:45 to 16:15 on Monday, from 15:45 to 17:15 on Tuesday, from 14:00 to 15:30.
on Wednesday, and from 15:45 to 17:15 on Thursday from 15:45. They take place in the Grand Foyer close to the exhibition area.

Warning

Eating or drinking in the lecture rooms is strictly forbidden.

Social Programme

Sunday 15 July, 18:00 - 21:00
= Welcome Reception
Grand Elysée hotel, Grand Foyer.

Wednesday 18 July, 18:30 - 22:00
= Conference dinner and harbour tour
on board of the MS Louisiana Star - Hamburg harbour.

No shuttle will be organised; the transportation to the harbour needs to be covered by the participant. It takes about 35 minutes by foot and 16-25 minutes by public transportation.

Boarding will begin at exactly 18:30. Be on time! No fee reduction can be applied in case the participant misses the boat departure.

The boat having a maximum capacity of 416 guests, it will not be possible to accept any person over this quota. The rule the first paid, the first reserved will be applied until the quota is reached. Registration is required and payment needs to be done in order to have the dinner reservation validated. No additional tickets will be sold on-site.

Conference Registration Hours:
Sunday 15 July 2018
= 16:30 - 18:00
Monday 16 July 2018
= 07:45 - 12:00 and 13:45 - 17:00
Tuesday 17 July 2018
= 08:00 - 12:00 and 13:45 - 17:00
Wednesday 18 July 2018
= 08:00 - 11:45 and 13:45 - 16:30
Thursday 19 July 2018
= 08:00 - 11:45 and 13:45 - 16:30
Friday 20 July 2018
= closed

Conference Hours:
Monday 16 July 2018
= 08:15 - 12:30 and 14:00 - 18:15
Tuesday 17 July 2018
= 08:30 - 12:30 and 14:00 - 19:45
Wednesday 18 July 2018
= 08:30 - 12:30 and 14:00 - 17:15
Thursday 19 July 2018
= 08:30 - 12:30 and 14:00 - 19:00
Friday 20 July 2018
= 08:30 - 12:45

Conference Management

European Physical Society
6 rue des Frères Lumière
F-68200 Mulhouse, France

This programme is edited by P. Helfenstein and A. Wobst.

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Conference Venue

The UP2018 conference will take place at the five star Grand Elysée Hotel Hamburg directly situated on the Moorweidenpark at Dammtor railway station. The centerpiece of the foyer is their beloved Boulevard with four restaurants, the famous Bourbon Street Bar and the Boulevard Cafe.
Coordinates: Grand Elysée Hotel Rothenbaumchaussee 10 20148 Hamburg Phone: +49 40 414120 www.grand-elysee.com/en

The oral sessions will be held in two lecture rooms: The Festsaal or so called Ballroom and the Spiegelsaal.

Poster sessions and Exhibition take place in the Grand Foyer and the “Altes Land” spaces. Coffee breaks take place in the Grand Foyer. The registration desks and message board are located in the “Pastry tunnel” connecting the lobby area (with reception) with the Grand Foyer.

More to know about the hotel:

Internet: The whole hotel is equipped with WI-FI, which can be used for free of charge without password round the clock.

Elyseum Wellness & Spa: The use of the pool and relaxation area is free for the hotel guests. The sauna and fitness areas are charged EUR 7,00 per day. For the guests who reserved via the direct conference hotel link the wellness area (pool fitness and sauna) is offered and the additional cost will not apply.

Parking at the hotel (at additional cost): The hotel has underground parking spaces. The maximum height is 2,05m. The following charges will be applicable per car: Up to 30 minutes: Free of charge. Any further 30 minutes: EUR 1,30. From 7 hours: EUR 18,00 per day.

The hotel is located close to a parc (Schanzenpark) and the Dammtor railway station, not far from the historical heart, the commercial Jungfernstieg quarter and the Alster lake (15 minutes to walk).

Smoking is forbidden in the whole building.

Transportation

The Grand Elysée Hotel Hamburg is ideally located a few minutes by foot from the ICE and Metro railway station at Dammtor (6-minute to walk) and close to Hamburg’s city center. The hotel’s surroundings offer everything the heart desires.

Arriving by train

From the main train station (Hauptbahnhof) of Hamburg, change for suburban train S1, S21 or S31 towards Dammtor. Departure at opposite platform. Single ticket for this route: 1,60€. The Grand Elysée is by the Moorweiden-park, opposite Dammtor railway station.

Arriving by plane

A taxi journey from Hamburg Airport to the hotel should take approximately 20 minutes. Alternatively, you can use of the S-Bahn suburban train link and take the S1 to main station (Hauptbahnhof) and change there for suburban train S11, S21 or S31 towards Dammtor (approx. 30 min.).

The S1 S-Bahn operates every 10 minutes. The station, “Hamburg Airport (Flughafen)” is directly in front of the terminals and is quick and easy to reach by elevator, escalator, or stairs.

Hamburg Public transportation (HVV)

One can easily reach the city centre using public transportation.

The U1 U-Bahn (underground rail) passes through Ohlsdorf, a junction station for U-Bahn and S-Bahn lines. From there, the S1 operates directly to Hamburg Airport.

The hotel nearest metro station stop is Stephansplatz on the U1 line (Norderstedt Mitte Ohlstedt).

Download the HVV transportation map at www.up2018.org/files/s_regio_4c_A4_12_2017_RZ_oS%20-%20hvv_linienplan_schnellbahnpaln_usar.pdf

Information can be found at www.hvv.de/en/tickets/single-day-tickets/overview/ or via the HVV app. Information is given in German or English. Single, day or group tickets can be bought. For those having time to visit, Hamburg cards or Hamburg city tours are more suitable.

Hamburg, Germany

With 1.8 million inhabitants, Hamburg is the second-biggest city in Germany and it offers singular features to its guests: Arts and culture at its finest, worldwide successful musicals, superior and entertaining theatre, a great variety of hotels, excellent restaurants, exquisite shopping possibilities, exciting nightlife and loads of historical landmarks that were left by the 1200 years old history of the city.

Hamburg is young, modern, friendly and open to the world - and a city full of contrasts at the same time. On the one hand, the colourful and simultaneously poorest quarter of the city, St. Pauli with its Reeperbahn, the most sinful mile in the world. On the other hand the rich and tidy quarter Blankenese with its numerous villas and romantic-beautiful views from the Elbhang and the lower beaches of the river Elbe. Each corner of Hamburg looks different but nevertheless everything joins together harmonically. And in the Port of Hamburg, in the heart of the city, ships from all over the world land.

The “Altstadt” (Old City) really is the oldest quarter of Hamburg and the main attraction for many tourists. The most well known are probably the Chilehaus (Chile House) and the Kontorhäuser (Office Buildings) at Burchardplatz but also Sprinkenhof, Mohlenhof and Messberghof are popular destinations for tourists.

At some places the “old Hamburg” can be pictured very well, e.g. in Cremon street. Here, you could formerly find store and residential houses with a loading canal and a street front so that trade goods could be transported by land as well as by sea. Deichstrasse (Dyke Street), an old traders’ street with store and residential houses from the 17th to the 19th century also reminds of old times. Numerous excellent restaurants and pubs invite you to stay.

For more information on Hamburg, visit www.hamburg-travel.com/?_{_ga=2.157107647.560639225.1529265043-977379505.1529265043&_trcontrol=0 (12 languages available).

Official language

German. All major languages are generally understood and spoken.

Currency

Euro is the official currency of Germany.
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- Jennifer Ogilvie, University of Michigan, Ann Arbor, USA

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- Ruxin Li, Shanghai Institute of Optics and Fine Mechanics, China

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- Wolfgang Zinth, Ludwig-Maximilians-Universität München, Munich, Germany
## PROGRAMME AT A GLANCE

### SUNDAY 15 JULY 2018

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<tr>
<td>Begin of Registration</td>
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<tr>
<td>Welcome Reception</td>
<td>Grand Foyer</td>
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### MONDAY 16 JULY 2018

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<tr>
<td>Invited, Oral MON.1</td>
<td>Ultrafast Processes in Photosynthesis</td>
<td>Festsaal</td>
<td>08:15 - 08:30</td>
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<td>Invited, Oral MON.2</td>
<td>High Harmonic Generation and Applications</td>
<td>Festsaal</td>
<td>10:15 - 10:45</td>
</tr>
<tr>
<td>Oral MON.3A</td>
<td>Pulse Characterization Methods</td>
<td>Spiegelsaal</td>
<td>14:00 - 15:45</td>
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<tr>
<td>Oral MON.3B</td>
<td>Ultrafast Spin Dynamics</td>
<td>Spiegelsaal</td>
<td>14:00 - 16:00</td>
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<tr>
<td>Invited, Oral MON.4A</td>
<td>Dynamics in Solids I</td>
<td>Festsaal</td>
<td>16:15 - 18:15</td>
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<tr>
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<td>Advances in 2D-Spectroscopy</td>
<td>Spiegelsaal</td>
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<tbody>
<tr>
<td>Invited, Oral TUE.1</td>
<td>Attosecond Science</td>
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<td>08:30 - 10:15</td>
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<tr>
<td>Invited, Oral TUE.2A</td>
<td>Dynamics in Solids II</td>
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<td>Oral TUE.2B</td>
<td>Novel Concepts in Pulse Generation</td>
<td>Spiegelsaal</td>
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<tr>
<td>Oral TUE.3A</td>
<td>Ultrafast Biology</td>
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<tr>
<td>Oral TUE.3B</td>
<td>Graphene and Semiconductors</td>
<td>Spiegelsaal</td>
<td>14:00 - 15:45</td>
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<tr>
<td>Invited, Oral TUE.4A</td>
<td>Ultrafast Electron Microscopy</td>
<td>Festsaal</td>
<td>17:15 - 19:00</td>
</tr>
<tr>
<td>Oral TUE.4B</td>
<td>Transition-Metals and Nanocrystals</td>
<td>Spiegelsaal</td>
<td>17:15 - 19:00</td>
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<tr>
<td>Invited, Oral WED.1</td>
<td>Ultrafast Sources</td>
<td>Festsaal</td>
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<tr>
<td>Invited, Oral WED.2A</td>
<td>Dynamics in Solids III</td>
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<tr>
<td>Oral WED.2B</td>
<td>Cluster and Gasphase Dynamics</td>
<td>Spiegelsaal</td>
<td>10:45 - 12:30</td>
</tr>
<tr>
<td>Poster WED.PO</td>
<td>EXHIBITION, COFFEE BREAK &amp; POSTER SESSION I</td>
<td>Grand Foyer</td>
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<tr>
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<td>Invited, Oral FRI.2</td>
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Monday 16 July 2018

08:30 Festsaal MON.1.1
Taking Snapshots of Reaction Intermediates in Metalloenzymes and Catalysts with X-ray Techniques
Junko Yano,
Molecular Biophysics and Integrated Bioimaging Division, Lawrence Berkeley National Laboratory, CA, USA

10:45 Festsaal MON.2.1
New Physical Insight Gained in Condensed Matter with Attosecond transient absorption spectroscopy
Ursula Keller1, F. Schlaepfer1, M. Volkov2, S.A. Sato3, M. Lucchini4, L. Gallmann1, and A. Rubio1
1 Physics Department, ETH Zurich, Zurich, Switzerland
2 Theory Department, Max Planck Institute for the Structure and Dynamics of Matter, Hamburg, Germany

Wednesday 18 July 2018

08:30 Festsaal WED.1.1
A Broadband Electro-Optic Light Source for Ultrafast Science
David R. Carlson, Daniel D. Hickstein, Wei Zhang, Andrew Metcalf, Franklyn Quinlan, Scott A. Diddams, and Scott B. Papp,
National Institute of Standards and Technology, Boulder, CO, USA

15:30 Festsaal WED.3A.1
Mapping Atomic Motions with Ultrabright Electrons: Fundamental Space-Time Limits to Imaging Chemistry
R.J. Dwayne Miller,
The Max Planck Institute for the Structure and Dynamics of Matter, Hamburg, Germany and University of Toronto, Canada

Thursday 19 July 2018

08:30 Festsaal THU.1.1
Ultrafast Coherent Exciton Dynamics in a Series of Cofacial Perylene Bisimide Stacks
Dongho Kim,
Dept of Chemistry and Spectroscopy Laboratory for Functional -Electronic Systems, Yonsei University, Seoul, Korea

10:45 Festsaal THU.2A.1
Free Space Laser Telecommunication Through Fogs and Clouds
Thomas Prodict1, Guillaume Schimmel1, Denis Mongin1, Jérôme Kasparian1,2, and Jean-Pierre Wolf1
1 Groupe de Physique Appliquée, Université de Genève, Genève, Switzerland
2 Institut des Sciences de l'environnement, Université de Genève, Genève, Switzerland
**MON.1: Ultrafast Processes in Photosynthesis**

**Chairing:** Jürgen Hauer, Technical University of Munich, Germany and Technical University of Vienna, Austria

**Time:** Monday, 8:30–10:15

**Location:** Festsaal

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**Invited**

**MON.1.1 8:30**

*Taking Snapshots of Reaction Intermediates in Metalloenzymes and Catalysts with X-ray Techniques — Junko Yano — Molecular Biophysics and Integrated Bioimaging Division, Lawrence Berkeley National Laboratory, 1 Cyclotron Road, Berkeley, CA 94720, USA*

The development of XFELs has open up opportunities for studying the dynamics of biological systems. We have used X-ray diffraction and spectroscopy methods to study photochemical activation of the water oxidation reaction of Photosystem II.

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**Oral**

**MON.1.2 9:00**

*Femtosecond Nonadiabatic Dynamics in Photosynthetic Light Harvesting — Peter W. Foster, Vivek Tiwari, William K. Peters, and David M. Jonas — Department of Chemistry and Biochemistry, University of Colorado, Boulder, CO 80309-0215 USA*

Fast and efficient energy transfer in photosynthetic antennas supports all life on earth. Nonadiabatic energy transfer drives unusual vibrations through tight coupling with electronic motion. Polarization dependent vibrational motion drives polarization independent femtosecond energy transfer.

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**Oral**

**MON.1.3 9:15**

*Ultrafast Energy Transfer Signatures in Qx band of Bacterial Reaction Center — Arka Prabha Konar, Riley Sechrist, and Jennifer P. Ogilvie — University of Michigan, Ann Arbor, MI, USA*

Two-dimensional electronic spectroscopy (2DES) employing broadband near-IR pump and visible continuum probe is used to investigate the early events in bacterial photosynthesis. Excitation wavelength resolution of cofactor Qx bands reveals spectral signatures of upper P exciton and ultrafast inter-exciton energy transfer.

---

**Oral**

**MON.1.4 9:30**

*Ultrabroadband Two-Dimensional Electronic Spectroscopy Reveals Energy Transfer Pathways of LHClI over the Entire Visible Spectrum — Min Jung Son, Albertina Pinnola, Roberto Bassi, and Gabriella S. Schlau-Cohen — Department of Chemistry, Massachusetts Institute of Technology, 77 Massachusetts Ave, Cambridge, Massachusetts 02139, USA — Dipartimento di Biotecnologie, Università di Verona, Strada Le Grazie 15, I-37134, Italy — Consiglio Nazionale delle Ricerche (CNR), Istituto per la Protezione delle Piante (IPP), Via Madonna del Piano 10, 50019, Sesto Fiorentino, Firenze, Italy*

We utilize ultrabroadband two-dimensional electronic spectroscopy to map out pathways of energy flow in LHClI across the entire visible region. Our results reveal additional energy transfer pathways involving chlorophyll Qe and carotenoid excited states.

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**Oral**

**MON.1.5 9:45**

*Spectroscopy and Dynamics in Light-Harvesting Systems — Roel Tempelaar, Jasper Knoester, and Thomas Jansen — 1Department of Chemistry, Columbia University, 3000 Broadway, New York, New York 10027, USA — 2Zernike Institute for Advanced Materials, University of Groningen, Nijenborgh 4, 9747AG Groningen, The Netherlands*

Simulated two-dimensional electronic spectroscopy of light-harvesting systems are presented and compared with experiments. Strategies for correctly interpreting the spectra and extracting ultrafast dynamical information as the electronic coherence times and exciton dynamics are discussed.

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**Oral**

**MON.1.6 10:00**

*Lack of Long-Lived Quantum Coherence in the Photosynthetic Energy Transfer — Hong-Guang Duan, Valentin I. Prokhorenko, Richard Cogdell, Khurram Ashraf, Amy L. Stevens, Emilie Wiemers, Roberta Croce, Michael Thorwart, and R. J. Dwayne Miller — Max Planck Institute for the Structure and Dynamics of Matter, Luruper Chaussee 149, 22761 Hamburg, Germany — 1Institut für Theoretische Physik, Universität Hamburg, Jungiusstraße 9, 20355 Hamburg, Germany — 2The Hamburg Center for Ultrafast Imaging, Luruper Chaussee 149, 22761 Hamburg, Germany — 3Institute of Molecular, Cell, and Systems Biology, College of Medical, Veterinary, and Life Science, University of Glasgow, Glasgow G12 8QQ, United Kingdom — 4Department of Chemistry, University of Toronto, Toronto, ON, Canada M5S 3H6 — 5Department of Physics, University of Toronto, Toronto, ON, Canada M5S 3H6 — 6Department of Physics and Astronomy and Institute for Lasers, Life and Biophotonics, Faculty of Sciences, VU University Amsterdam, De Boelelaan, 1081, 1081, HV, Amsterdam, The Netherlands*

We have studied the FMO, LHClI and PSII reaction center complex by electronic 2D spectroscopy. At ambient temperature the electronic coherences are too short lived to play any functional role in the natural energy transfer.

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**10:15–10:45: EXHIBITION AND COFFEE BREAK**

kindly sponsored by European XFEL
MON.2: High Harmonic Generation and Applications
Chaired by Erik Nibbering, Max-Born-Institute, Berlin-Adlershof, Germany

Time: Monday, 10:45–12:30

Invited MON.2.1 10:45
New physical insight gained in condensed matter with attosecond transient absorption spectroscopy — Ursula Keller1, F. Schlapfer1, M. Volkov1, S.A. Sato2, M. Lucchini1, L. Gallmann1, and A. Rubio2 — 1Physics Department, ETH Zurich, 8093 Zurich, Switzerland — 2Theory Department, Max Planck Institute for the Structure and Dynamics of Matter, 22761 Hamburg, Germany
After a general introduction in this invited talk I will discuss in more details some recent results from our group in diamond, GaAs and Ti-metal

Oral MON.2.2 11:15
The Molecular Attoclock: Sub-cycle Control of Electronic Dynamics during H2 Double Ionization — Vaclav Hanus1, Sarayoo Kangaparambil1, Seyyedreza Larimian1, Xinhuai Xie2, Markus Schöpfler2, André Staudte1, Gerhard Paulus3, Andrius Baltuska1, and Markus Kitzler2 — 1Photonics Institute, Technische Universität Wien, Gusshausstrasse 27, 1040 Wien, Austria — 2Institut für Kernphysik, J.W. Goethe-Universität, Max-von-Laue-Strasse 1, 60438 Frankfurt am Main, Germany — 3Joint Attosecond Science Lab. of the National Research Council and the University of Ottawa, 100 Sussex Drive, Ottawa, Ontario, — 4Friedrich-Schiller-Universität Jena, Max-Wien-Platz 1, 07743 Jena, Germany
We introduce and employ the molecular attoclock method. This allows us to simultaneously trace the nuclear and electron dynamics during H2 fragmentation, and to CEP-control the two-electron emission dynamics on sub-cycle time scales.

Oral MON.2.3 11:30
Circular Dichroism in High Harmonic Generation from Chiral Molecules — Yoichi Harada, Eisuke Haraguchi, Keikute Kaneshima, and Taro Sekikawa — Hokkaido University, Sapporo, Japan
Circularly polarized high harmonic generation from a chiral molecule was found to significantly depend both on the chirality and on the rotating direction of the circularly polarized counter-rotating two-color driving laser fields.

Oral MON.2.4 11:45
Enhanced Solid-State High-Harmonic Generation from an all-dielectric Metasurface — Hanzhe Liu1,2, Cheng Guo3,4, Giulio Vampa1, Jingyuan Zhang1,4, Tomas Sarmiento4,5, Meng Xiao1, Philip Bucksbaum1,2,6, Jelena Vučković1,4,5, Shanhui Fan1,4,5, and David Reis1,6,7,8 — 1Stanford PULSE Institute, SLAC National Accelerator Laboratory, Menlo Park, California, 94025, USA — 2Department of Physics, Stanford University, Stanford, California, 94305, USA — 3Department of Applied Physics, Stanford University, Stanford, California, 94305, USA — 4E. L. Ginzton Laboratory, Stanford University, Stanford, California 94305, USA — 5Department of Electrical Engineering, Stanford University, Stanford, California 94305, USA — 6Department of Photon Science, Stanford University, Stanford, California 94305, USA
We report resonantly enhanced non-perturbative high-harmonic emission by more than two orders of magnitude from a Si metasurface that possesses a Fano-like resonance resulting from a classical analog of electromagnetically induced transparency.

Oral MON.2.5 12:00
Broadband Extreme Ultraviolet Interferometry and Imaging — G. S. Matthias Jansen1,2, Anne C. C. de Beurs1,2, Kevin Liu1,3, Kjeld S. E. Eikema1,3, and Stefan Witte1,2 — 1Advanced Research Center for Nanolithography, Science Park 110, 1098 XG Amsterdam, The Netherlands — 2Department of Physics and Astronomy, and Laserlab, Vrije Universiteit, De Boelelaan 1081 HV Amsterdam, The Netherlands
Using a pair of phase-locked high-harmonic generation sources, we demonstrate extreme ultraviolet Fourier transform interferometry. This enables a wide range of spatially and spectrally resolved measurements at extreme ultraviolet wavelengths.

Oral MON.2.6 12:15
HHG probing of atomic dipoles by electronic wave-packet caustics — Davide Faccio1,2, Stefano Paszty1,3, Barry D. Bruner4, Anna G. Cirillo1,3, Michele Devetta1, Matteo Negro1, Hadas Soifer4, Nirit Dudovich4, Salvatore Stagira4, and Caterina Vozzi1 — 1Istituto di Fotonica e Nanotecnologie, CNR, Milan, Italy — 2Stanford PULSE Institute, SLAC National Accelerator Laboratory, Menlo Park (CA), USA — 3ITAMP Harvard-Smithsonian Center for Astrophysics, Cambridge (MA), USA — 4Department of Physics of Complex Systems, Weizmann Institute of Science, Rehovot, Israel — 5Dipartimento di Fisica, Politecnico di Milano, Milan, Italy
We exploit high-order harmonic spectroscopy at caustics for assessing the role of the electronic wave-packet enhancement in the xenon giant resonance. Results in argon show that this technique can be also applied to other targets.
**Monday Sessions**

**MON.3A: Pulse Characterization Methods**  
Chair by Giovanni Cirmi, DESY-CFEL, Hamburg, Germany  
Time: Monday, 14:00–15:45  
Location: Festsaal

**Oral** MON.3A.1 14:00  
In-situ measurement of the full electric field of octave-spanning light pulses with carrier-envelope phase d-scan —  
Miguel Miranda, Francisco Silva, Lana Neorici, Rosa Romero, Paulo Guerreiro, Miguel Canhota, Hans Koop, Vladimir Pervak, Anne L’Huillier, Cord L. Arnold, Ingo J. sola, and Helder Crespo — 1 Department of Physics, Lund University, P.O. Box 118, SE-221 00 Lund, Sweden — 2 IFIMUP-IN and Departamento de Física e Astronomia, Universidade do Porto, Rua do Campo Alegre 687, 4169-007 Porto, Portugal — 3 Sphere Ultrafast Photonics, S.A., Parque de Ciencia e Tecnologia U.P., R. do Campo Alegre 1021, Edificio FC6, 4169-007 Porto, Portugal — 4 UltraFast Innovations GmbH, Am Coulombwall 1, 85748 Garching, Germany — 5 Grupo de Aplicaciones del Laser y Fotonica, Dep. de Fisica Aplicada, Univ. Salamanca, P. I. de la Merced s/n, E-37008 Salamanca, Spain  
We demonstrate the generation and in-situ measurement of the electric field and CEP of intense near-single-cycle laser pulses using the new optical technique of CEP dispersion-scan.

**Oral** MON.3A.2 14:15  
Tracing the Phase of Focused Broadband Laser Pulses —  
Dominik Hoff, Michael Krüger, Lotar Maschenbacher, A. Max Sayler, Peter Hommelhoff, and Gerhard G. Paulus — 1 Helmholtz-Institut Jena and Institut für Optik und Quanteneletronik, Friedrich-Schiller-Universität Jena, Max-Wien-Platz 1, D-07743 Jena, Germany — 2 Department of Physics of Complex Systems, Weizmann Institute of Science, 234 Herzl St., Rehovot 76100, Israel — 3 Max-Planck-Institut für Quantenoptik, Hans-Kopfermann-Str. 1, D-85748 Garching, Germany — 4 Department of Physik, Friedrich-Alexander-Universität Erlangen-Nürnberg (FAU), Staudtstr. 1, D-91058 Erlangen, Germany  
We present a three-dimensional measurement of the local focal phase in a focused broadband Gaussian laser beam and find strong deviations from the commonly assumed Gouy phase, with wide ramifications for ultrafast physics.

**Oral** MON.3A.3 14:30  
Direct Sampling of a Light Wave using Tunnelling Ionization —  
Kyung Tae Kim, Wosik Cho, Sueng Beom Park, Kyungsung Kim, Sung In Hwang, Igor A Ivanov, and Chang Hee Nam — 1 Center for Relativistic Laser Science, Institute for Basic Science (IBS), Gwangju 61005, Korea — 2 Department of Physics and Photon Science, Gwangju Institute of Science and Technology, Gwangju 61005, Korea  
We report a new laser pulse characterization method in which tunneling ionization in air is used as a temporal gate. The method can be applied for wavelengths longer than 200 nm, regardless of the duration.

**Oral** MON.3A.4 14:45  
Spectrally resolved wavefront characterization of broadband ultrafast high-harmonic pulses —  
G. S. Matthijs Jansen, Lars Freismeier, Dennis Rudolph, Kjeld S. E. Eikema, and Stefan Witte — 1 Advanced Research Center for Nanolithography, Amsterdam, The Netherlands — 2 Vrije Universiteit, Amsterdam, The Netherlands  
We demonstrate a sensor that measures wavefronts of multiple extreme ultraviolet wavelengths simultaneously. Wavefronts of

**MON.3B: Ultrafast Spin Dynamics**  
Chair by Yves Acremann, ETH Zürich, Zurich, Switzerland  
Time: Monday, 14:00–16:00  
Location: Spiegelsaal

**Oral** MON.3B.1 14:00  
Towards Time-Resolved Nanoscale Magnetic Imaging with Circularly-Polarized High-Order Harmonics —  
Ofer Kfir, Sergey Zayko, Christina Nolte, Marcel Möller, Murat Svis, Birgit Hebler, Sri Sai Phani Kanti Areekapudi, Daniel Steil, Sascha Schäfer, Manfred Albrecht, Oren Cohen, Stefan Mathias, and Claus Ropers — 1 University of Göttingen, 4th Physical Institute, Göttingen 37077, Germany — 2 Solid State Institute and Physics Department, Technion — Israel Institute of Technology, Haifa 32000, Israel — 3 University of Göttingen, 1st Physical Institute, Göttingen 37077, Germany — 4 Institute of Physics, University of Augsburg, Augsburg 86139, Germany — 5 International Center for Advanced Studies of Energy Conversion (ICASEC), University of Göttingen, Germany  
We demonstrate nanoscale magnetic imaging using high-harmonics – the missing step for magnetic movies with femtosecond and nanometric resolution.

**Oral** MON.3B.2 14:15  
Critical behavior within 20fs drives the out-of-equilibrium laser-induced magnetic phase transition in Nickel —  
Phoebe Tengdin, Wening You, Cong Chen, Xin Shi, Dmitriy Zusin, Yingchao Zhang, Christian Gentry, Adam Blonsky, Mark Keller, Peter Oppeneer, Henry Kapteyn, Margaret Murnane, and Zhensheng Tao — 1 Department of Physics and JILA, University of Colorado and NIST, Boulder, Colorado 80309, United States — 2 National Institute of Standards and Technology (NIST), 325 Broadway, Boulder, Colorado 80305, United States — 3 Department of Physics and Astronomy, Uppsala University, Box 516, 75120 Uppsala, Sweden  
We show that the same critical behavior that dominates magnetic phase transitions under equilibrium conditions also governs the ultrafast magnetic phase transition in nickel, on an exceptionally fast timescale of 20fs.

**Oral** MON.3B.3 14:30  
Directly Probing Femtosecond Spin Dynamics in a Molecular Magnet —  
Olof Johansson, Ji-Wan Kim, Emily Allwright, David M. Rogers, Neil Robertson, and Jean-Yves Bigot — 1 EASCHEM School of Chemistry, University of Edinburgh, Edinburgh, UK — 2 University of Strasbourg and CNRS, IPCMS, Strasbourg, France  
Time-resolved Faraday rotation was used to observe spin dynamics in V-Cr Prussian blue molecular magnets. Results demonstrate inter-system crossing in less than 250 fs and open up possibilities to study dynamics in molecular magnets.

**Oral** MON.3B.4 14:45  
Excitation and control of spin waves in FeBO3 by a strong-field THz pulse —  
Anne-Laure Calendron, Emma Kunst, Liwei Song, Giovanni Cirmi, Lars Bocklage, Franz X. Kärner, and Ralph Röhlberger — 1 Deutsches Elektronen-Synchrotron (DESY), Notkestrasse 85, 22607 Hamburg, Germany — 2 Center for Free-Electron Laser Science, Notkestrasse 85, 22607 Hamburg, Germany — 3 The Hamburg Centre for Ultrafast Imaging, University of Hamburg, Luruper
up to nine high harmonics at 25-49 nm wavelength are retrieved, and ultrafast spatiotemporal couplings can be characterized.

**Oral**

**MON.3A.5 15:00**

**Complete Temporal Characterisation of Attosecond SXR Pulses Generated by MIR Laser Sources** — Thomas Gaumnitz, Arohi Jain, Yoann Pertot, Martin Huppert, Inga Jordan, Fernando Ardana-Lamas, and Hans Jörg Wößer — ETH Zürich, Laboratory of Physical Chemistry, Vladimir-Prelog-Weg 2, CH-8049 Zürich, Switzerland

Isolated 43-attosecond pulses are generated from passively CEP-stable few-cycle MIR pulses. As-streaking is used to sample the laser field and to characterize SXR supercontinua reaching 180eV. Multi-line VTPGA is used for reconstruction with highest fidelity.

Chaussée 149, 22761 Hamburg, Germany — 4 Department of Physics, University of Hamburg, Luruper Chaussee 149, 22761 Hamburg, Germany — 5 Research Laboratory of Electronics, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139, USA

The dynamically resolved response of the canted-antiferromagnet FeBO$_3$ excited near a magnon resonance shows fast oscillations after THz-excitation, followed by the magnons’ intrinsic relaxation, enabling to probe transient magnetic relaxation dynamics over large frequency range.

**Oral**

**MON.3B.5 15:00**

**Imaging the ring opening reaction of 1,3-cyclohexadiene with MeV ultrafast electron diffraction** — Thomas J. A. Wolf$^1$, Jie Yang$^2$, David Sanchez-Portal$^3$, Joao P. F. Nunes$^4$, Robert M. Parrish$^1$, Xiaozhe Shen$^2$, Martin Centurion$^5$, Ryan Coffey$^2$, James P. Cryan$^6$, Markus Gühr$^6$, Ken Hagedorn$^1$, Adam Kirrander$^2$, Renkai Li$^2$, Jennifer Ruddock$^6$, Theodore Vecchione$^8$, Stephen P. Weathersby$^9$, Peter M. Weber$^1$, Kyle Wilkin$^5$, Hai-Wang Yong$^6$, Quiang Zheng$^2$, Todd J. Martinez$^1$, Xihe Wang$^2$, and Michael P. Minitti$^1$ — 1 Stanford PULSE Institute, SLAC National Accelerator Laboratory, Menlo Park, USA — 2 SLAC National Accelerator Laboratory, Menlo Park, USA — 3 Department of Chemistry, Stanford University, Stanford, USA — 4 Department of Chemistry, University of York, Heslington, York, UK — 5 Department of Physics and Astronomy, University of Nebraska-Lincoln, Lincoln, USA — 6 Institut für Physik und Astronomie, Universität Potsdam, Potsdam, Germany — 7 School of Chemistry, University of Edinburgh, Edinburgh, UK — 8 Department of Chemistry, Brown University, Providence, USA

We resolve the structural dynamics of the ultrafast photoinduced ring opening reaction of 1,3-cyclohexadiene in space and time employing megaelectronvolt gas phase ultrafast electron diffraction. We, furthermore, observe coherent large amplitude motions of the photoproduct.

**Oral**

**MON.3A.6 15:15**

**Direct measurement of pulse duration and frequency chirp of a seeded XUV Free Electron Laser** — Armin Azima$^1$, Joern Bödewadt$^2$, Oliver Becker$^1$, Stefan Dürsterer$^2$, Nagitha Ekanayake$^5$, Rosen Ivanov$^3$, Mehdi M Kazemi$^1$, Leslie Lamberto Lazarin$^5$, Christoph Lechner$^1$, Bastian Manschwetus$^2$, Theophil Maltezopoulos$^4$, Velizar Milchev$^1$, Jost Müller$^1$, Tim Plath$^1$, Andreas Przystawik$^2$, Marek Wieland$^1$, Ralph Assmann$^3$, Ingmar Hartl$^2$, Tim Laarmann$^2$, Jörg Rosbach$^1$, Wilfried Wurth$^3$, and Markus Drescher$^1$ — 1 Universität Hamburg, Institut für Experimentalphysik, Luruper Chaussee 149, 22761 Hamburg, Germany — 2 Deutsches Elektronen-Synchrotron DESY, Notkehstr. 85, 22607 Hamburg, Germany — 3 Zentrum für Synchrotronstrahlung, Technische Universität Dortmund, Maria-Goepert-Mayer-Straße 2, 44221 Dortmund — 4 XFEL GmbH, Holzkoppel 4, 22869 Schenefeld, Germany — 5 The Hamburg Centre for Ultrafast Imaging CUI, 22761 Hamburg, Germany

We report on a direct time-domain measurement of pulse duration and chirp of a seeded free-electron laser pulse of the sFLASH experiment at FLASH in the XUV spectral range utilizing the THz streak camera technology.

**Oral**

**MON.3B.6 15:15**

**Probing Time-resolved Magnetization Dynamics in Rare-earth Ferromagnets using High-flux Soft X-ray Source** — Guangyu Fan$^1$, Katherine Légarde$^2$, Vincent Cardin$^2$, Edgar Kaksis$^1$, Giedrius Andriukaitis$^1$, Xinghua Xie$^1$, Audrius Pugzlys$^1$, Bruno Schmidt$^3$, Jean-Pierre Wolf$^4$, François Légarde$^2$, Jan Lünig$^2$, Andrius Baltuska$^1$, and Tadas Balcione$^1$ — 1 Institute of Photonics, TU Wien, Gussensstrasse 27/387, Vienna, Austria — 2 Institut National de la Recherche Scientifique, Varennes, Quebec J3X 1S2, Canada — 3 few-cycle, Inc., 2890 Rue de Beaurivage, Montreal, Quebec H1L 5W5, Canada — 4 GAP-Biophotonics, Université de Genève, 1205 Geneva, Switzerland — 5 Université Pierre et Marie Curie, LCPMR, UMR CNRS 7614, 75005 Paris, France

We present for the first time for a table-top system, measurement of magnetization dynamics in terbium at the N-edge at 155 eV with fs temporal resolution using high flux HHG source reaching 220eV driven directly by a <20fs, 10mJ, kHz Yb laser amplifier system.
Monday Sessions

Oral MON.3A.7  15:30
Widely Tunable Cavity-Enhanced Ultrafast Spectroscopy — Myles C. Silfies¹, Yuning Chen¹, Henry Timmers³, Abijith S. Kowligiy², Alex Lind²,⁴, Scott A. Diddams²,⁵, and Thomas K. Allison¹ — ¹Stony Brook University, Stony Brook, USA — ²National Institute of Standards and Technology, Boulder, USA — ³University of Colorado, Boulder, USA

Generation of widely tunable frequency combs in the UV, visible, and infrared is discussed for use in cavity-enhanced transient absorption spectroscopy on gas-phase clusters. Progress towards cavity-enhanced two-dimensional spectroscopy is also presented.

Oral MON.3B.7  15:30
Direct Observation of Structural Dynamics upon Photoexcitation in a Spin Crossover Crystal with Femtosecond Electron Diffraction — Yifeng Jiang¹, Lai Chung Liu², Henrik Müller-Werkmeister¹, Cheng Lu², Dongfang Zhang³, Ryan Field², Antoine Sarracin¹, Gustavo Moriena¹, Eric Collet¹, and R. J. Dwayne Miller¹,² — ¹Max Planck Institute for the Structure and Dynamics of Matter, Hamburg, Germany — ²University of Toronto, Toronto, Canada — ³University Potsdam, Potsdam, Germany — ⁴University Rennes 1, Rennes, France

Photoinduced spin crossover is studied by femtosecond electron diffraction to understand ultrafast structural dynamics. The results indicate the structural reorientation occurs within 2.3 ps, as the metal-ligand bond distribution narrows during intramolecular vibrational energy redistribution.

Oral MON.3B.8  15:45
Mapping spin correlations with hard X-ray free electron laser — Yinpeng Zhong — Max-Planck institute for the structure and dynamics of matter, Luruper chaussee 149, D-22761 Hamburg, Germany

Time resolved X-ray-diffraction from Ga_0.91Mn_0.09As was measured with the X-ray free-electron-laser. We observe the influence of phonons by spin orders, which may bring a method for mapping the spin correlations in low doped magnetic systems.

15:45–16:15: EXHIBITION AND COFFEE BREAK
kindly sponsored by Cycle GmbH

MON.4A: Dynamics in Solids I
Chaired by Oliver D. Mücke, DESY Center for Free-Electron Laser Science, Hamburg, Germany
Time: Monday, 16:15–18:15 Location: Festsaal

Invited MON.4A.1  16:15
Defect-Mediated Ultrafast Transitions in Charge Density Waves — Nuh Gedik — Massachusetts Institute of Technology

Non-equilibrium phase transitions are often characterized by the appearance of topological defects. We demonstrate that they dictate the ultrafast dynamics in a charge-density-wave (CDW) and can create novel CDW configurations switchable by a single pulse.

MON.4B: Advances in 2D-Spectroscopy
Chaired by Rocio Borrego Varillas, Politecnico di Milano, Milan, Italy
Time: Monday, 16:15–18:15 Location: Spiegelsaal

Oral MON.4B.1  16:15
Frequency comb-based multidimensional coherent spectroscopy — Steven Cundiff and Bachana Lomsadze — Department of Physics, University of Michigan, Ann Arbor, MI, USA

We present multidimensional coherent spectroscopy that utilizes frequency combs and multi-heterodyne detection. We demonstrate its capability to measure collective hyperfine resonances in atomic vapor induced by long-range dipole-dipole interactions.

Oral MON.4B.2  16:30
Cavity-enhanced ultrafast two-dimensional spectroscopy using higher-order modes — Thomas Allison — Stony Brook University, Stony Brook, NY U.S.A

We describe methods using frequency combs and cavities for recording two-dimensional ultrafast spectroscopy signals with high sensitivity. By coupling multiple frequency combs to modes of an optical resonator, cavity-enhanced 2D spectroscopy signals are naturally generated.
Optical-pump–soft x-ray scattering studies of ordered dynamicsof chargedensity waves, which is inturn strongly related to the transientoptical properties.

We report on lighth-induced superconducting-like state in YBCO via Ultrafast X-Ray Scattering — Scott Wandel1, Fabio Boschini2,3, Eduardo da Silva Neto2,4, Grant Welch1, Matthew Seaberg1, Jake Koralek1, Georgi Dakovski1, Will Hette1, Ming-Fu Lin1, Stefan Moeller1, Ryan Coffee1, Robert Kainde1, Ruxing Liang2,3, Doug Bond2,3, Walter Hardy2,3, Mike Minetti1, David Hawthorn2, Andrea Damascelli2,3, Claudio Giannetti1, Joshua Turner1, and Giacomo Coslovich1 — 1Linac Coherent Light Source, SLAC National Accelerator Laboratory, Menlo Park, California 94025, USA — 2Department of Physics and Astronomy, University of British Columbia, Vancouver, V6T 1Z4, Canada — 3Quantum Matter Institute, University of British Columbia, Vancouver, V6T 1Z4, Canada — 4Department of Physics, University of California, Davis, California 95616, USA — 5Materials Sciences Division, Lawrence Berkeley National Laboratory, Berkeley, California 94720, USA — 6Department ofPhysics and Astronomy, University of Waterloo, Waterloo, N2L 3G1, Canada — 7Department ofMathematics and Physics, Università Cattolica delSacro Cuore, Brescia, BS 1-25121, Italy

We report optical pump–soft x-ray scattering probe studies ofYBCO single crystals. The experiments reveal a picosecondrelaxation dynamics of charge density waves, which is in turn stronglymodified by the onset of superconductivity.

Pressure tuning of light-induced superconductivity in K$_{30}$C$_{60}$ — Michele Buzzì1, Alice Cantaluppi1, Gregor Jotzu1, Matteo Mitranò1, Daniele Nicoletti1, Stefan Kaiser1, Andrea Perucchi1, Steffano Lutti1, Paola Di Pietro2, Daniele Pontiroli1, Mauro Ricco3, Stephen R. Clark1, Dieter Jaksch6, and Andrea Cavalleri1,6 — 1Max Planck Institute for the Structure and Dynamics of Matter, Hamburg, Germany — 2Institut für Struktur- und Dynamik der Materie, Universität Heidelberg, D-69120 Heidelberg, Germany

We report on a light-induced superconducting-like state in K$_{30}$C$_{60}$, induced by photo-excitation of an on-ball molecular mode. External pressure quenches the photo-induced state validating that the transient-optical properties are the signature of a transient superconductor.

We demonstrate a new method for multidimensional coherent spectroscopy of nanostructures. We use a heterodyne technique implemented with a confocal microscope to record the amplitude and phase of all degenerate third-order wave-mixing processes.

Setup Shaper-Based Infrared Spectroscopy in a Nonlinear Raman — Scott Wandel1, Fabio Boschini2,3, Eduardo da Silva Neto2,4, Grant Welch1, Matthew Seaberg1, Jake Koralek1, Georgi Dakovski1, Will Hette1, Ming-Fu Lin1, Stefan Moeller1, Ryan Coffee1, Robert Kainde1, Ruxing Liang2,3, Doug Bond2,3, Walter Hardy2,3, Mike Minetti1, David Hawthorn2, Andrea Damascelli2,3, Claudio Giannetti1, Joshua Turner1, and Giacomo Coslovich1 — 1Linac Coherent Light Source, SLAC National Accelerator Laboratory, Menlo Park, California 94025, USA — 2Department of Physics and Astronomy, University of British Columbia, Vancouver, V6T 1Z4, Canada — 3Quantum Matter Institute, University of British Columbia, Vancouver, V6T 1Z4, Canada — 4Department of Physics, University of California, Davis, California 95616, USA — 5Materials Sciences Division, Lawrence Berkeley National Laboratory, Berkeley, California 94720, USA — 6Department ofPhysics and Astronomy, University of Waterloo, Waterloo, N2L 3G1, Canada — 7Department ofMathematics and Physics, Università Cattolica delSacro Cuore, Brescia, BS 1-25121, Italy

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We report on a light-induced superconducting-like state in K$_{30}$C$_{60}$, induced by photo-excitation of an on-ball molecular mode. External pressure quenches the photo-induced state validating that the transient-optical properties are the signature of a transient superconductor.
Monday Sessions

Oral MON.4A.5 17:30

 Collapse of high-Tc superconductivity via ultrafast quenching of phase coherence — Fabio Boschiniv1,2, Elia Razzoli1,2, Eduardo H. da Silva Neto1,2,3,4, Marta Zonno1,2, Ryan P. Day1,2, Matteo Michiardi1,2, Genda D. Gu5, Arthur K. Mills1,2, Giorgio Levy1,2, David J. Jones1,2, Claudio Giannetti1,2, and Andrea Damascelli1 — 1Department of Physics & Astronomy, University of British Columbia, Vancouver, BC V6T 1Z1, Canada — 2Quantum Matter Institute, University of British Columbia, Vancouver, BC V6T 1Z4, Canada — 3Max Planck Institute for Solid State Research, Heisenbergstrasse 1, D-70569 Stuttgart, Germany — 4Department of Physics, University of California, Davis, CA 95616, USA — 5Condensed Matter Physics and Materials Science, Brookhaven National Laboratory, Upton, NY 11973, USA — 6Department of Mathematics and Physics, Università Cattolica del Sacro Cuore, Brescia, BS 25121, Italy — 7Interdisciplinary Laboratories for Advanced Materials Physics (ILAMP), Università Cattolica del Sacro Cuore, Brescia 25121, Italy

We exploit TR-ARPES to drive and probe the phase fragility in cuprate superconductors not affecting the electron pairing. This work demonstrates the dominant role of phase coherence in the emergence of high-temperature superconductivity in copper-oxides.

Oral MON.4A.6 17:45

 On the photo-induced monoclinic metal phase of vanadium dioxide — Martin Otto1, Laurent René de Cotret1, David Valverde-Chavez1, Kunal Tiwari1, Nicolas Emond1, Mohamed Chaker2, David Cooke1, and Bradley Swick1,3 — 1Department of Physics, Center for the Physics of Materials, McGill University, 3600 University Street, Montreal, QC, CA, — 2Institut National de la Recherche Scientifique, Centre Énergie Matériaux et Télécommunications, Université du Québec, Varennes, Quebec J3X 1S2, Canada. — 3Department of Chemistry, McGill University, 801 Sherbrooke Street W, Montreal, QC, CA

We combined ultrafast electron diffraction and time-resolved THz spectroscopy to unravel the photo-induced insulator-metal transitions in VO₂. We determined the structure of the monoclinic metallic phase and relate the fluence-dependent multi-phase character to the conductivity.

Oral MON.4A.7 18:00

 Universal nature of the ultrafast magnetic phase transition in nickel revealed by correlating EUV MOKE and ARPES spectroscopies — Zhenheng Tao1, Wenhao You1, Phoebe Tengdin1, Cong Chen1, Xun Shi1, Dmitriy Zusin1, Yingchao Zhang1, Christian Gentry1, Adam Blonsky1, Mark Keller2, Peter Openee3, Henry Kapteyn1, and Margaret Murnane1 — 1Department of Physics and JILA, University of Colorado and NIST, Boulder, Colorado 80309, United States — 2National Institute of Standards and Technology (NIST), 325 Broadway, Boulder, Colorado 80305, United States — 3Department of Physics and Astronomy, Uppsala University, Box 516, 75112 Uppsala, Sweden

We investigate ultrafast demagnetization in Ni using multiple high-harmonic spectroscopies, to reveal the universal nature of the laser-induced magnetic phase transition. We uncover two competing recovery channels with distinct timescales, suggesting a phase coexistence.

Oral MON.4B.6 17:30

 Fluorescence-Detected Two-Quantum and One-Quantum Two-Quantum 2D Electronic Spectroscopy of Rhodamine 700 — Stefan Müller, Simon Draeger, Niklas Klosterhalfen, and Tobias Brixner — Institut für Physikalische und Theoretische Chemie, Universität Würzburg, Am Hubland, 97074 Würzburg, Germany

We demonstrate the simultaneous acquisition of different nonlinear signal contributions using a shot-to-shot-modulating pulse shaper and fluorescence detection. Two different species of two-quantum contributions can be extracted without scattering artefacts.

Oral MON.4B.7 17:45

 Spatially resolved coherent 2D fluorescence spectroscopy within a high-NA optical microscope — Donghao Li1, Sebastian Goetz2, Verena Kolb2, Jens Pflaum2,3, and Tobias Brixner1,4 — 1Institut für Physikalische und Theoretische Chemie, Universität Würzburg, 97074 Würzburg, Germany — 2Experimental Physics VI, Universität Würzburg, 97074 Würzburg, Germany — 3Bavarian Center for Applied Energy Research e.V. (ZAE Bayern), 97074 Würzburg, Germany — 4Center for Nanosystems Chemistry (CNC), 97074 Würzburg, Germany

We have developed coherent two-dimensional (2D) fluorescence micro-spectroscopy which probes the nonlinear optical response at surfaces via fluorescence detection with sub-micron spatial resolution. This enables the investigation of microscopic variations in laterally heterogeneous film samples.

Oral MON.4B.8 18:00

 Spatially Resolved Fluorescence-Detected Two-Dimensional Electronic Spectroscopy via Confocal Microscopy — Vivek Tiwari1, Yasel Acosta Matutes1, Alastair T. Gardner2, Richard J. Cogdell2, and Jennifer P. Ogilvie1 — 1University of Michigan, Ann Arbor, USA — 2Institute of Molecular Cell and Systems Biology, Glasgow, Scotland

We present a fluorescence-detected two-dimensional electronic spectroscopy setup integrated with a confocal microscope as an in vivo probe of spatial heterogeneity in a mixed photosynthetic bacterial colony, with significantly better sensitivity than current 2D measurements.
TUE.1: Attosecond Science

Chaired by Ruxin Li, Shanghai Institute of Optics and Fine Mechanics, Shanghai, China

Time: Tuesday, 8:30–10:15

Invited

**TUE.1.1** 8:30

**Attosecond science in the liquid phase** — **HANS JAKOB WöRNER** — ETH Zürich, Zurich, Switzerland

The extension of several types of attosecond time-resolved spectroscopies to the liquid phase will be presented. These include attosecond interferometry of photoemission delays from liquid water, as well as attosecond high-harmonic spectroscopy of water and alcohols.

**TUE.1.2** 9:00

**Real-time Reconstruction of Non-equilibrium Quantum Dynamics** — **PAUL BIRK**<sup>1</sup>, **VÉIT STOOS**<sup>1</sup>, **STEFANO M. CAVALLETTI**<sup>2</sup>, **STEFAN DONSÁ**<sup>3</sup>, **ALEXANDER BLÄTTERMANN**<sup>1</sup>, **CHRISTOPH H. KEITEL**<sup>1</sup>, **IVA BREZINOVÁ**<sup>2</sup>, **JOACHIM BURGDÖRFER**<sup>2</sup>, **CHRISTIAN OTRI**<sup>1</sup>, and **THOMAS PFIEFFER** — **1Max-Planck-Institut für Kernphysik, Saupfercheckweg 1, 69117 Heidelberg, Germany, EU — 2Institute for Theoretical Physics, Vienna University of Technology, Wiedner Hauptstraße 8, 1040 Vienna, Austria, EU Using ultrashort laser pulses, we present a method to retrieve the explicitly time-dependent response function of a quantum system which is nonlinearly driven to a non-equilibrium state directly from spectroscopic absorption data.

**TUE.1.3** 9:15

**Anisotropic photoemission time delays close to a Fano resonance** — **CLAUDIO CIRELLI**<sup>1,2</sup>, **CARLOS MARANTE**<sup>1</sup>, **SEBASTIAN HEUSER**<sup>1</sup>, **LEON PETERSON**<sup>2</sup>, **ÁLVARO JIMÉNEZ-GALÁN**<sup>3,4</sup>, **LUCA ARGENTI**<sup>3,5</sup>, **SHIYANG ZHONG**<sup>6</sup>, **DAVID BUSTO**<sup>7</sup>, **MARCUS ISINGER**<sup>8</sup>, **SAIKAT NANDI**<sup>8</sup>, **SYLVAIN MACLOT**<sup>8</sup>, **LINNEA RADING**<sup>9</sup>, **PER JOHNSSON**<sup>10</sup>, **MATTHIEU GISSIBELRECH**<sup>11</sup>, **MATTEO LUCCHINI**<sup>11</sup>, **LUKAS GALLMANN**<sup>1</sup>, **MARCUS DAHLSTRÖM**<sup>4</sup>, **EVA LINDROTH**<sup>2</sup>, **ANNE L’HULLIER**<sup>4</sup>, **FERNANDO MARTÍN**<sup>3,8</sup>, and **URSULA KELLER**<sup>1</sup> — **1Institute of Quantum Electronics, ETH Zurich, 8093 Zurich, Switzerland — 2Empa, Swiss Federal Laboratories for Material Science and Technology, CH-8600 Dübendorf, Switzerland — 3Departamento de Química, Módulo 13, Universidad Autónoma de Madrid, 28049 Madrid, Spain — 4Max Born Institute, Max Born Strasse 2a, D-12489 Berlin, Germany — 5Department of Physics and CREOL College of Optics & Photonics, University of Central Florida, Orlando, Florida 32816, USA — 6Department of Physics, Lund University, SE-221 00 Lund, Sweden — 7Department of Physics, Stockholm University, AlbaNova University Center, SE-10691 Stockholm, Sweden — 8Instituto Madrileño de Estudios Avanzados en Nanociencia (IMDEA-Nano), Cantoblanco, 28049 Madrid, Spain — 9Condensed Matter Physics Center (IFIMAC), Universidad Autónoma de Madrid, 28049 Madrid, Spain

We extract energy and angle-dependent atomic time delays in argon with an attosecond interferometric method. Comparisons with theoretical models allow us to attribute part of the observed delay anisotropy to the presence of autoionizing resonances.

**TUE.1.4** 9:30

**Helicity with a twist: polarization control of high harmonic attosecond pulses through spin-orbital angular momentum coupling** — **KEVIN M. DORNEY**<sup>1</sup>, **LAURA REGO**<sup>1</sup>, **EMILIO PISANTY**<sup>2</sup>, **JULIO SAN ROMÁN**<sup>3</sup>, **ANTONIO PICÓN**<sup>4</sup>, **CHENG-TING LIAO**<sup>5</sup>, **NATHAN BROOKS**<sup>1</sup>, **JENNIFER L. ELLIS**<sup>1</sup>, **MACiej LEWENSTEIN**<sup>1</sup>, **HENRY C. KAPTEYN**<sup>1</sup>, **MARGARET M. MURNANE**<sup>1</sup>, **LUIS PLAJA**<sup>2</sup>, and **CARLOS HERNÁNDEZ-GARCÍA**<sup>2</sup> — **1JILA, Department of Physics, University of Colorado Boulder and NIST, Boulder, Colorado, USA — 2Grupo de Investigación en Aplicaciones del Láser y Fotónica, Departamento de Física Aplicada, University of Salamanca, Salamanca, Spain — 3ICFO - Institut de Ciencies Fotoniques, The Barcelona Institute of Science and Technology, Castelldefels (Barcelona, Spain)

High-order harmonics with controllable spin and orbital angular momentum are generated for the first time. The conservation rules for spin-orbit coupling in high harmonic generation allow direct control of the polarization state of attosecond pulses.

**TUE.1.5** 9:45

**Atomic scale electronic structure and response in attosecond photoemission delays: A case study using non-centrosymmetric BiTeCl** — **SERGEI NÉB**<sup>1</sup>, **CHRISTIAN OBERER**<sup>1</sup>, **WALTER ENNS**<sup>1</sup>, **ANDREAS GEBAUER**<sup>1,2</sup>, **NORBERT MÜLLER**<sup>1</sup>, **JAN H. DIJN**<sup>1,4</sup>, **EVGENEI V. CHULKOV**<sup>5,6</sup>, **NIKOLAY M. KARACHNIK**<sup>1,5,9</sup>, **PEDRO M. ECHENIQUE**<sup>5,6,10</sup>, **ANDREY K. KAZANSKY**<sup>5,6,11</sup>, **ULRICH HEINZMANN**<sup>1</sup>, and **WALTER PFIEFFER** — **1Bielefeld University, Universitätstr. 25, 33615 Bielefeld, Germany — 2Institute of Kaiserslautern, Erwin Schrödinger Str. 46, 67663 Kaiserslautern, Germany — 3Paul-Scherrer-Institut, PSI, 5232 Villigen, Switzerland — 4Ecole Polytechnique Fédérale de Lausanne, Route Cantonale, 1015 Lausanne, Switzerland — 5Donostia International Physics Center (DIPC), Paseo Manuel de Lardizabal 4, 20018 San Sebastián, Spain — 6University of the Basque Country, 20080 San Sebastián, Spain — 7Tomsk State University, Lenin Avenue 36, 634050 Tomsk, Russia — 8Skobeltsin Institute of Nuclear Physics, Lomonosov Moscow State University, 1(2), Leninsky gory, GSP-1, 119991 Moscow, Russia — 9European XFEL GmbH, Holzkoppel 4, 22869 Schenefeld, Germany — 10Centro de Física de Materiales CEM/MPC (CSIC-UPV/EHU), Paseo de Manuel Lardizabal 5, 20018 San Sebastián, Spain — 11IKERBASQUE, Basque Foundation for Science, Maria Diaz de Haro 3, 48013 Bilbao, Spain

Attosecond time-resolved photoemission from the differently terminated BiTeCl surfaces yield relative delays that cannot be attributed to bulk propagation effects. Instead, the atomic scale differences between both surface terminations have to be taken into account.

**TUE.1.6** 10:00

**Electric dipole oscillation in solids characterized by Fourier transform extreme ultraviolet attosecond spectroscopy** — **YUTA CHISUGA**<sup>1,2</sup>, **HIROKI MASHIKO**<sup>1</sup>, **KATSUYA OGURI**<sup>1</sup>, **IKUFUMI KATAYAMA**<sup>1</sup>, **JUN TAKEDA**<sup>1</sup>, and **HIDEKI GOTOH**<sup>1</sup> — **1NTT Basic Research Laboratories, 3-1 Morinosato Wakamiya, Atsugi, Kanagawa 243-0198, Japan — 2Department of Physics, Yokohama National University, 79-3 Tokiwadai, Hodogaya, Yokohama 240-8501, Japan

We characterized electronic dipole oscillations in solids using Fourier transform extreme ultraviolet attosecond spectroscopy (FTXUV) combined with an isolated attosecond pulse, which reveals the electric band-structure and dopants of semiconductors and insulators.
Tuesday Sessions

10:15–10:45: EXHIBITION AND COFFEE BREAK
kindly sponsored by DESY

TUE.2A: Dynamics in Solids II
Chaired by Isabella Gierz, The Max Planck Institute for the Structure and Dynamics of Matter (MPSD), Hamburg, Germany
Time: Tuesday, 10:45–12:30 Location: Festsaal Hamburg, Germany

The Structure and Dynamics of Matter (MPSD),
TUE.2A: Dynamics in Solids II
— potential of solids
TUE.2A.1 10:45 Invited

Strong-field nonlinear phononics: a probe of the interatomic potential of solids — •Alexander von Hoegen1, Roman Mankowsky1, Michael Fechner1, Michael Först1, and Andrea Cavalleri1,2 — 1 Max Planck Institute for the Structure and Dynamics of Matter, Hamburg, Germany — 2 Department of Physics, Oxford University, Clarendon Laboratory, Parks Road, Oxford, United Kingdom

Using resonant excitation, we drive the 19-THz A1-symmetry phonon in LiNbO3 to large amplitude and find phonon harmonics up to the fifth overtone. The time-resolved optical response is used to reconstruct the underlying interatomic potential.

Oral
TUE.2A.2 11:15
Coherent phonon generation in extremely nonlinear regime — •Kento Uchida1, Kohei Nagai1, Naotaka Yoshikawa1, and Koichiro Tanaka1,2 — 1 Department of Physics, Kyoto University, Kyoto, Japan — 2 Institute for Integrated Cell-Material Sciences (iCeMS), Kyoto University, Kyoto, Japan

Response of lattice under intense and non-resonant mid-infrared laser field is studied in bulk GaSe by using mid-infrared-pump and near-infrared-probe spectroscopy. We observed large amplitude coherent oscillation of A1 phonon mode associated with high harmonic generation, indicating the strong driving of phonons.

Oral
TUE.2A.3 11:30
Ultra-low thermal conductivity and acoustic dynamics of silicon nanostructured metalattices probed using ultrafast high harmonic beams — •Begoña Abad1, Travis Frazer1, Joshua Knoblock1, Jorge Nicolas Hernandez-Charpak1, Huu Yang Cheng1,4, Alex Grede1,5, Noel Griebink1,5, Thomas Mallouk2,3,4,7, Pratibha Mahale1, Weinan Chen1,3,4, Yihuang Xiong1,3,4 Ismaila Dabo1,3, Vincent Crespi1,3,4, Disho Talreja1, Venkat Gopalan1,4, John Badding1,3,4, Henry Kaptay1, and Margaret Murnane1 — 1 Department of Physics, University of Illinois at Urbana-Champaign, Urbana, USA — 2 Department of Chemistry, Georgia Institute of Technology, Atlanta, USA — 3 Department of Chemistry, University of Michigan, Ann Arbor, USA — 4 Department of Physics, Max Planck Institute for the Structure and Dynamics of Matter, Hamburg, Germany — 5 Department of Chemistry, University of Minnesota, Minneapolis, USA — 6 Department of Physics, Stanford University, Stanford, USA — 7 Department of Chemistry, Massachusetts Institute of Technology, Cambridge, USA

We examine mid-IR light bullets generated in ambient air. Two optical cycle pulses confined in space are generated in filamentation regime. Few-fold solitonic self-compression is achieved for strongly chirped mid-IR pulses.

TUE.2B: Novel Concepts in Pulse Generation
Chaired by Jeffrey Moses, Cornell University, Ithaca, NY, USA
Time: Tuesday, 10:45–12:30 Location: Spiegelsaal

Linearity and DynamicsofMatter,Hamburg,Germany—
TUE.2B.1 10:45 Oral

Linearizing Nonlinear Optics — •Bruno E. Schmidt1, Philippe Lassonde2, Guilmot Ernotte3, Matteo Clerici1, Roberto Morandotti4, Heide Ibrahim5, and François Légaré2 — 1 few-cycle Inc., Montreal, Canada — 2 INRS-EMT, Varennes, Canada — 3 University of Glasgow, School of Engineering, Galsgow, UK

Fourier nonlinear optics merges the simplicity of linear optics with the power of nonlinear optics to achieve a decoupling of frequencies, amplitudes and phases in nonlinear processes - enabling first deep UV shaping at 207nm.

Oral
TUE.2B.2 11:00
Generation of Sub-Two-Cycle CEP-Stable Optical Pulses at 3.5 μm by Multiple-Plate Pulse Compression for High-Harmonic Generation in Crystals — •Pei Yu Xia1, Faming Li2, Nobuhisa Ishii1, Teruto Kanai3, and Jiro Itatani — The institute for Solid State Physics, the University of Tokyo, 5-1-5 Kashiwanoha, Kashiwa 277-8581, Japan

Multi-plate pulse compression of femtosecond mid-infrared pulses is demonstrated using YAG and Si windows. With this robust compression scheme, we produce sub-two-cycle, CEP-stable optical pulses and observe CEP-dependent high harmonic generation in crystals.

Oral
TUE.2B.3 11:15
Multi-mJ Mid-IR Light Bullets in Air — Valentina Shumakova1, Skirmantas Alisauskas1, Andrius Baltuska1,2, Pavel Malevich1, Alexander Voronin1,4, Alexander Mitrofanov3,4, Dmitriy Sidorov-Biryukov2,4, Alexey Zheltikov1,3,5, Daniil Kartashov6, and Audrius Puzyls2 — Photonics Institute, TU Wien, Gusshausstrasse 27-387, A-1040 Vienna, Austria — 2 Center for Physical Sciences & Technology, Savanoriu Ave. 231 LT-02300 Vilnius, Lithuania — 3 Department of Physics and Astronomy, Texas A&M University, College Station TX, 77843–4242, USA — 4 Friedrich-Schiller University Jena, Max-Wien Platz 1, 07743 Jena, Germany

We examine mid-IR light bullets generated in ambient air. Two optical cycle pulses confined in space are generated in filamentation regime. Few-fold solitonic self-compression is achieved for strongly chirped mid-IR pulses.

Oral
TUE.2B.4 11:30
Coherent amplification of femtosecond laser pulses in optically excited silica — •Thomas Winkler1, Lasse Haahr-Lilevang2, Cristian Sarpe1, Bastian Ziehlski1, Nadine Götte1, Arne Senftleben1, Peter Balling1, and Thomas Baumert2 — 1 Institute of Physics and CINet, University of Kassel, Kassel, Germany — 2 Department of Physics and Astronomy, Aarhus University, Aarhus, Denmark

We present experimental results of light amplification in laser-excited silica. Two temporally separated amplification
of Physics and JILA, University of Colorado and NIST, Boulder, Colorado 80309, USA — 2Department of Chemistry, Pennsylvania State University, University Park, PA 16802, USA — 3Materials Research Institute, Pennsylvania State University, University Park, PA 16802, USA — 4Department of Materials Science and Engineering, Pennsylvania State University, University Park, PA 16802, USA — 5Department of Electrical Engineering, Pennsylvania State University, University Park, PA, 16802, USA — 6Department of Physics, Pennsylvania State University, University Park, PA, 16802, USA — 7Department of Biochemistry and Molecular Biology, Pennsylvania State University, University Park, PA, 16802, USA

We extend ultrafast high harmonic nanometrology to probe transport and acoustic dynamics in novel metamaterials with ≈10-50nm features. The data indicate extremely low thermal conductivity due to impeded phonon transport, with implications for designer thermoelectrics.

Oral TUE.2A.4 11:45
Direct observation of photo-mechanical stiffness in alkanethiol-capped gold nanoparticles supracrystals by ultrafast small-angle electron diffraction — Giulia Fulvia Mancini1,2. Francesco Pennacchio1, Tatiana Latychevskaya3, Javier Reguera4, Franceso Stellacci1, and Fabrizio Carboni5 — 1Laboratory for Ultrafast Spectroscopy, Lausanne Center for Ultrafast Science (LACUS), Ecole Polytechnique Federale de Lausanne, CH1015 Lausanne, Switzerland. — 2Paul Scherrer Institut, WSLA/210, 5232 PSI Villigen, Switzerland. — 3Laboratory for Ultrafast Microscopy and Electron Scattering, Lausanne Center for Ultrafast Science (LACUS), Ecole Polytechnique Federale de Lausanne, CH-1015 Lausanne, Switzerland. — 4Physics Institute, University of Zurich, Winterthurerstrasse 190, 8057 Zurich, Switzerland. — 5CIC biomaGUNE, Paseo de Miramón 182C, 20009 Donostia-San Sebastian, Spain. Ikerbasque, Basque Foundation for Science, 48011 Bilbao, Spain. — 6Supramolecular Nanomaterials and Interfaces Laboratory, Institute of Materials, Ecole Polytechnique Federale de Lausanne, CH-1015 Lausanne, Switzerland. We demonstrate that ultrastiff bonding between nanoparticles can be engineered by ad hoc assemblies of ligands, reaching strengths comparable to that of strong covalent bonds. Our observation relies on femtosecond small-angle electron diffraction.

Oral TUE.2A.5 12:00
Ultrafast Dynamic Imaging of Thermal and Acoustic Dynamics in Nanosystems using a Tabletop High Harmonic Source — Charles Bevis1, Robert Karl1, Giulia Mancini1,2, Dennis Gardner1, Elisabeth Shanblatt1, Joshua Knobloch1, Travis Frazer1, Begoña Abad Mayor2, Michael Tanksalvala1, Christina Porter1, Daniel Adams1, Henry Kaptyn1, and Margaret Murnane1 — 1JILA, 440 UCB, University of Colorado, Boulder, CO 80309 USA — 2Paul Scherrer Institut, WSLA/210, 5232 PSI Villigen, Switzerland

We demonstrate the first stroboscopic full-field EUV nanoscope using high harmonics. We image the propagation of thermal and surface acoustic waves in nickel with 80nm transverse, 0.5 Å axial, and 10 fs resolution.

Oral TUE.2B.5 11:45
Sub-Optical-Cycle Control of Relativistic Plasma Mirrors — Frederik Böhlé1, Maimouna Bocoum1, Adrien Denoeud2, Ludovic Chopineau3, Guillaume Blacard3, Henri Vincenti4, Marie Ouelle1, Magali Lozano1, Jean-Philippe Rousseau1, Aurélie Jullien1, Aline Vernier1, Peter Simon2, Tamas Nagy3,5,6, Thévenet Maxence7, Fabien Quéré7, Stefan Haessler8, and Rodrigo Lopez-Martens8 — 1Laboratoire d’Optique Appliquée, ENSTA ParisTech, Ecole Polytechnique, CNRS, Université Paris-Saclay, Palaiseau, France — 2LIDYL, CEa, CNRS, Université Paris-Saclay, CEa Saclay, Gif-sur-Yvette, France — 3ELI AttoLight Pulse Source, Szeged, Hungary — 4Institut für Quantenoptik, Leibniz Universität Hannover, Hannover, Germany — 5Laser Zentrum Hannover e.V., Hannover, Germany — 6Max Born Institute for Nonlinear Optics and Short Pulse Spectroscopy, Berlin, Germany — 7Lawrence Berkeley National Laboratory, Berkeley, CA, USA

We present experiments using a waveform-controlled 2-colour multi-cycle laser and a CEP-controlled 1.3-cycle laser to drive high-harmonic-generation and electron emission off relativistic plasma mirrors. Both examples demonstrate attosecond control over the underlying collective electron dynamics.

Oral TUE.2B.6 12:00
Spectral meta-moments reveal hidden signatures of vortex pulses — Max Liebmann1, Alexander Treffer1, Martin Bock1, Thomas Seiler2, Jürgen Jahns1, Thomas Elsaesser1, and Ruediger Grunwald1 — 1Max Born Institute for Nonlinear Optics and Short-Pulse Spectroscopy, Berlin, Germany — 2FernUniversität Hagen, Micro- and Nanophotonics, Hagen, Germany

Ultrashort vortex pulses carry specific spatio-spectral signatures due to Gouy phase shift. Meta-moment analysis allows for identifying related characteristic patterns in weakly modulated spectral maps. The method is transferable to other fields of ultrafast spectroscopy.
Tuesday Sessions

Oral TUE.2A.6 12:15
Optical Pump – THz Probe Response of VO$_2$ under High Pressure — Johannes M. Braun$^{1,2}$, Harald Schneider$^1$, Manfred Heida$^{1,2}$, Rafał Mirek$^1$, Lynn A. Boatner$^4$, Robert E. Marve$^3$, Richard F. Haglund$^4$, and Alexei Pashkin$^3$ — $^1$Helmholtz-Zentrum Dresden-Rossendorf, Dresden, Germany — $^2$Technische Universität Dresden, Dresden, Germany — $^3$University of Warsaw, Warsaw, Poland — $^4$Oak Ridge National Laboratory, Oak Ridge, USA — $^5$Vanderbilt University, Nashville, USA

We present the ultrafast THz response of VO$_2$ under high pressures. Pump-probe signals and a photoexcitation threshold are detected even in a metallic state. Our observations can be described as a pressure-driven Mott-Hubbard transition.

Oral TUE.2B.7 12:15
Coherent control and interferometric detection of lateral beam profile by use of dual-optical vortex comb — Akifumi Asahara$^{1,2}$, Satoru Shoji$^{1,2}$, Ken-ichi Kondo$^{1,2}$, Yue Wang$^{1,2}$, and Kaoru Minoshima$^{1,2}$ — $^1$The University of Electro-Communications, Tokyo, Japan — $^2$Japan Science and Technology Agency, ERATO MINOSHIMA Intelligent Optical Synthesizer Project, Tokyo, Japan

Proof-of-principle experiments on a novel concept, a “dual-optical vortex comb,” are performed. Coherent spatiotemporal phase control of optical ring lattice and interferometric detection of partially extracted dual-optical vortex comb light are successfully demonstrated.

TUE.3A: Ultrafast Biology

Chaired by Howe Siang Tan, Nanyang Technology University, Singapore

Time: Tuesday, 14:00–15:45
Location: Festsaal

Oral TUE.3A.1 14:00
Interactions of RNA and Water probed by 2D-IR Spectroscopy — Benjamin P. Fingerhut, Eva M. Bruening, Jakob Schauss, Torsten Siebert, and Thomas Elsaesser — Max-Born-Institut für Nichtlineare Optik und Kurzzeitpektroskopie, 12489 Berlin, Germany

Combined experimental-theoretical investigation of ultrafast hydration dynamics of an A-form RNA double helix in water reveals an ordered arrangement of water molecules and provides boundary conditions for the ion atmosphere around the polyanionic RNA.

Oral TUE.3A.2 14:15
Ultrafast Photorelaxation of Uracil Embedded in an RNA Strand — Daniel Kepfer, Sebastian Reiter, and Regina de Vivie-Riedle — Department Chemie, Ludwig-Maximilians-Universität München, Butenandtstr. 11, 81377 München, Germany

Ultrafast photorelaxation of uracil can be hindered by its natural RNA environment. Multiscale quantum dynamical simulations show that the wave packet can be trapped in the photocexcited electronic state, which could potentially lead to photodamage.

Oral TUE.3A.3 14:30
Conical intersection dynamics in pyrimidine nucleosides tracked with sub-20-fs UV pulses — Rocío Borrego-Vanillas$^1$, Artur Nenov$^1$, Lucia Ganzar$^1$, Aurelio Oliana$^1$, Irene Conti$^{1,2}$, Ines Delfino$^1$, Cristian Manzoni$^1$, Marco Garavelli$^{1,2}$, and Giulio Cerullo$^3$ — IFN-CNR, Dipartimento di Fisica, Politecnico di Milano, Piazza Leonardo da Vinci 32, I-20133 Milano, Italy — $^2$Dipartimento di Chimica Industriale, Università degli Studi di Bologna, Viale del Risorgimento 4, I-40136 Bologna, Italy — $^3$Dipartimento di Scienze Ecologiche e Biologiche, Università della Tuscia, Largo dell’Università snc, I-01100 Viterbo, Italy

By combining transient absorption spectroscopy with sub-20-fs UV pulses and ab-initio numerical simulations we follow the ultrafast dynamics in pyrimidine nucleosides and visualize the passage through conical intersections presiding excited state deactivation.

TUE.3B: Graphene and Semiconductors

Chaired by Stefano Dal Conte, Politecnico di Milano, Milan, Italy

Time: Tuesday, 14:00–15:45
Location: Spiegelsaal

Oral TUE.3B.1 14:00
Lightwave-controlled Electron Dynamics in Graphene — Christian Heide, Takuya Higuchi, Konrad Ullmann, Heiko B. Weber, and Peter Hommelhoff — Friedrich-Alexander-Universität Erlangen-Nürnberg (FAU), Staudtstrasse 1, D-91058 Erlangen, Germany

Currents induced in graphene by ultrashort laser pulses are sensitive to the electric-field waveform. We found a transition of light–matter interaction from the weak-field to the strong-field regime, where intraband dynamics influence interband transitions.

Oral TUE.3B.2 14:15
Ultrafast heat dynamics in graphene and van der Waals heterostructures — Klaas-Jan Tilbrook$^1$, Andrea Tomadin$^2$, Sam M. Hornett$^3$, Niels C.H. Hess$^4$, Alessandro Principi$^5$, Evan Hendry$^3$, Marco Polini$^2$, and Frank H.L. Koppens$^3$ — $^1$ICFO – The Institute of Photonic Sciences, Barcelona Institu- tion of Science and Technology, Castelldefels (Spain) — $^2$Istituto Italiano di Tecnologia, Graphene Labs, Via Morego 30, I-16163 Genoa, Italy — $^3$School of Physics, University of Exeter, Stocker Road, Exeter EX4 4QL, UK — $^4$Radboud University, Institute for Molecules and Materials, Nijmegen, The Netherlands

I will present time-resolved studies of photocexcited graphene and graphene-bHBN-based photodetectors, discussing ultrafast carrier heating, out-of-plane cooling of hot graphene electrons to hyperbolic phonons in the surrounding bHBN, and the conductivity of photocexcited graphene.

Oral TUE.3B.3 14:30
Two-dimensional electronic spectroscopy of graphene nanoribbons in organic solution — Tetsuhiko Nagahara$^{1,3}$, Lucia Ganzar$^1$, Franco Camargo$^1$, Yinjuan Huang$^1$, Fugui Xu$^1$, Yiyong Mao$^1$, Giulio Cerullo$^1$, and Xinhai Feng$^2$ — IFN-CNR, Dipartimento di Fisica, Piazza L. da Vinci 32, 20133 Milano, Italy — $^1$Department of Chemistry and Materials Technology, Kyoto Institute of Technology, 606-8585 Kyoto, Japan — $^2$School of Chemistry and Chemical Engineering, Shanghai Jiao Tong University, 800 Dongchuan Road, Shanghai 200240, China — $^3$Department of Chemistry and Food Chemistry, Technische Universität Dresden, Mommsenstrasse 4, 01062 Dresden, Germany

We unravel the electronic structure of graphene nanoribbons in solution using 2D electronic spectroscopy. We identify different excitons, their vibrational couplings and find that exciton diffusion in the graphene moiety takes place in ~300 fs.
Oral TUE.3A.4 14:45
Intersystem crossing in thiobases proceeds by a dark intermediate state — •Danielle Cristina Teles Ferreira1, Rocío Borrego-Varillas2, Lucia Ganzerti3, Bárbara Elza Nogueira Faría1, Cristian Manzi1, Sandro De Silvestri2, Artur Nenov3, Irene Conti1, Marco Garavelli1, Giulio Cerullo4, and Ana Maria de Paula1 — 1Departamento de Física, Universidade Federal de Minas Gerais, 31270-901 Belo Horizonte-MG, Brazil — 2IFN-CNR, Dipartimento di Fisica, Politecnico di Milano, Piazza Leonardo da Vinci 32, I-20133 Milano, Italy — 3Dipartimento di Chimica Industriale, Università degli Studi di Bologna, Viale del Risorgimento 4, I-40136 Bologna, Italy

4-thiouracil is studied by transient absorption spectroscopy employing sub-20 fs UV-pulses and hybrid QM(CASP2T) / MM(AMBER) computations (static and dynamic), evidencing that, along the photoexcited relaxation pathway, intersystem crossing originates from a dark intermediate state.

Oral TUE.3A.5 15:00
Exciton dynamics in DNA oligomers studied by broadband deep-UV transient absorption spectroscopy — •Benjamin Bauer, Malte Oppermann, Fran van Mourik, and Majeed Cherghui — École Polytechnique Fédérale de Lausanne, Lausanne, Switzerland

We report the first broadband transient absorption measurements of adenine strands in the deep-UV (250-370 nm). By varying the strand length we resolve the interplay between inter-base stacking and exciton formation and dynamics in DNA oligomers.

Oral TUE.3A.6 15:15
Anabaena Sensory Rhodopsin: Effect of point mutations on PSBR photo-isomerization speed — •Damianos Agathangelou1, Yolovis Orozco-Gonzalez1, María Del Carmen Marin2, Johanna Brazard1, Hideki Kandas1, Kwang Hwan Jung3, Jérémie Léonard1, Nicolas Ferre1, Massimo Olyuccia1,6, and Stefan Haacke1 — 1Université de Strasbourg – CNRS UMR 7504, Institut de Physique et Chimie des Matériaux de Strasbourg, Strasbourg 67034, France — 2Department of Biotechnology, Chemistry & Pharmacy, Università di Siena,2, I-53100 Siena, Italy — 3Department of Frontiers Materials, Nagoya Institute of Technology, Showa-ku, Nagoya 466-8555, Japan — 4Department of Life Science and Institute of Biological Interfaces, Sogang University, South Korea — 5Aix-Marseille Université, CNRS, ICR, 13284 Marseille, France — 6Department of Chemistry, Bowling Green State University, Bowling Green, Ohio 43403, United States

We report experimental results on the ultrafast photo-isomerization of the ASRs -PSBR where point mutations lead to an up to 7-fold increase of the photo-isomerization speed, correlated with the absorption maxima shift.

Oral TUE.3B.4 14:45
Raman spectroscopy of graphene under ultrafast laser excitation — •Carino Ferrante1,2, Alessandra Virga1,2, Lara Benaffatto3, Miles Martinati1, Domenico De Fazio1, Ugo Sassì1, Claudia Fasolato1, Anna Katharina Ott1, Paolo Postorino1, Duhee Yoon1, Giulio Cerullo2, Francesco Mauri1, Andrea Carlo Ferrari1, and Tullio Scopigno1,2 — 1Physics Department, University Rome “Sapienza”, Rome, Italy — 2Istituto Italiano di Tecnologia, Center for Life Nano Science @Sapienza, Rome, Italy — 3ISC-CNR, Rome, Italy — 4Cambridge Graphene Centre, University of Cambridge, Cambridge CB3 0FA, UK — 5IFN-CNR, Dipartimento di Fisica, Politecnico di Milano, Piazza L. da Vinci 32, 20133 Milano, Italy

The out-of-equilibrium Raman response of graphene is addressed by pulsed laser excitation. Phonon spectrum is rationalized by revisiting the electron-phonon picture in the light of a transient broadening of the Dirac cone.

Oral TUE.3B.5 15:00
Strong-field and two-color phase-controlled photoemission from zero- and one-dimensional nanostructures — •Tim Paschen1, Michael Förster1, Christian Heid1, Ryan Roussel2, Michael Krüger1, Christoph Lemell1, Georg Wachter1, Florian Libisch1, Thomas Maderlen1, Joachim Burgdörfer1, James Rosenzweig2, and Peter Hommelhoff1,4 — 1Department of Physics, Friedrich-Alexander-Universität Erlangen-Nürnberg (FAU), Staudtstrasse 1, 91058 Erlangen, Germany — 2UCLA Physics and Astronomy, 475 Portola Plaza, Los Angeles, CA 90095-1547, USA — 3Institute for Theoretical Physics, Vienna University of Technology, 1040 Vienna, Austria — 4Max Planck Institute for the Science of Light, Staudtstrasse 2, 91058 Erlangen, Germany

We present photoemission from zero- and one-dimensional nanostructures. Electrons emitted from nanotips are controlled by a two-color laser field with a fidelity of 97.5 percent. One-dimensional blade structures show clear indications of strong-field electron recollision.

Oral TUE.3B.6 15:15
Subcycle Wannier-Stark Localization by Mid-Infrared Bias in Gallium Arsenide — •Johannes Bühler1, Christian Schmidt1, Alexander-Cornelius Heinrich2, Jonas Allerbeck1, Reinold Podziocki1, Daniel Berghoff2, Torsten Meier1, Wolf Gerb Schmidt2, Christian Reichl1, Werner Wegscheider1, ·Danielle Brida4, and Alfred Leitenstorfer1 — 1Department of Physics and Center for Applied Photonics, University of Konstanz, D-78457 Konstanz, Germany — 2Department of Physics and Center for Optoelectronics and Photonics Paderborn, University of Paderborn, D-33098 Paderborn, Germany — 3Solid State Physics Laboratory, ETH Zurich, CH-8093 Zürich, Switzerland

The fundamental interband absorption in gallium arsenide shows a strong blue shift when biased by mid-infrared transients exceeding 10 MV/cm. This subcycle feature is induced by the localization of electronic wavefunctions from 3D to 2D.
Tuesday Sessions

Oral TUE.3A.7 15:30
Mapping the Ultrafast Vibrational Dynamics of all-Trans and 13-Cis Retinal Isomerization in Anaebaena Sensory Rhodopsin — Partha Roy1, Rei Yoshizumi2, Hideki Kandori2, and Tiago Buckup4 — 1Physikalisch-Chemisches Institut, RWTH Aachen University, Aachen, Germany — 2Institute of Life Science and Applied Chemistry, Nagoya Institute of Technology, Japan
The ground and excited state evolution of fingerprint vibrational modes of all-trans- and 13-cis-retinal are mapped by impulsive vibrational spectroscopy. All-trans-retinal shows slower frequency shift dynamics in the excited state in comparison to 13-cis-retinal.

Oral TUE.3B.7 15:30
White-light 2D Coherent Spectroscopy Reveals Coherent Coupling of Confined and Continuum States in InAs/InGaAs Nanostructures — Mirco Kolaczk, Kevin Thommes, Bastian Herzog, Sophia Helmerich, Nina Owchimikow, and Ulrike Woggon — Institut für Optik und Atomare Physik, Technische Universität Berlin, Berlin, Germany
The In(Ga)As quantum dot/quantum well system of a semiconductor optical amplifier is investigated by coherent white-light two-dimensional Fourier-transform spectroscopy. The spectrally broad probe field coherently couples exciton states separated by ~200 meV and reveals crossed excitons.

TUE.PO.1 15:45
Amorphization in Crystalline Tellurium by Femtosecond Pulses — Yu-Hsiang Cheng, Samuel Teitelbaum, Frank Gao, and Keith Nelson — Massachusetts Institute of Technology, Cambridge, USA
Crystalline tellurium undergoes photoinduced amorphization after irradiation with femtosecond laser pulses. The phase transition is monitored by single-shot pump-probe spectroscopy.

TUE.PO.2 15:45
Ultrafast electron-phonon coupling and photo-induced strain in the morphotropic phase boundary of BixDy1-xFe3O3 films — Zeyu Zhang1, Lu You2, Jian Du2, Junling Wang2, Guohong Ma3, and Yuxin Leng1 — 1State Key Laboratory of High Field Laser Physics, Shanghai Institute of Optics and Fine Mechanics, Chinese Academy of Sciences, Shanghai 201800, China — 2School of Materials Science and Engineering, Nanyang Technological University, Singapore 639798, Singapore — 3Department of Physics, Shanghai University, Shanghai 200444, China.
Using ultrafast two-color pump-probe spectroscopy, the dysprosium doped-BiFe3O3 films on SrTiO3 substrate have been investigated systematically. The doping induced structural transition and magnetic enhancement in BFO is observed by ultrafast electron-phonon and spin-lattice interaction, respectively.

TUE.PO.3 15:45
Tailoring Ultrafast Singlet Fission by Structural Modification of Phenazinodithiazoles — Nicola Alagna1, Jie Han2, Julia Herz3, J. Luis Perez Lustres1, Sebastian Hahn4, Silke Koser5, Florian L. Geyer2, Uwe Bunz2, Andreas Dreuw4, Tiago Buckup1, and Marcus Motzkus2 — 1Physikalisch-Chemisches Institut, Universität Heidelberg, D-69120 Heidelberg, Germany — 2Organisch-Chemisches Institut, Universität Heidelberg, D-69120 Heidelberg, Germany — 3Institut für Wissenschaftliches Rechnen, Universität Heidelberg, D-69120 Heidelberg, Germany
Ultrafast transient absorption and quantum chemistry calculations are combined to demonstrate singlet fission in newly functionalized TIPS-Tetracenes. The coupling strength (but not the energy gap) between S1 and 1(TT) states gauges singlet fission efficiency and rate.

TUE.PO.4 15:45
Enhanced absorption of monolayer molybdenum disulphide with silver nano-prisms studied using transient absorption — Qiang Li1, Christopher C. S. Chan1, Jing Kong1, and Kam Ping Wong1 — 1Department of physics, Hong Kong University of Science and Technology Clear Water Bay, Kowloon, Hong Kong
Kong, People’s Republic of China — 2Electrical Engineering & Computer Science, Massachusetts Institute of Technology, Massachusetts, USA
Absorption dynamics of silver nano-prismss dispersed on atomically thin molybdenum disulphide was studied using pump probe spectroscopy. We demonstrate that absorption efficiency can be greatly enhanced through localised surface plasmon resonance supported by the nano-prisms.

TUE.PO.5 15:45
Ultrafast near-field spectroscopy at the nanoscale — Aina Reich, Max Eisele, and Sergiu Amarie — Nesacp GmbH, Martinsried, Germany
Near-field microscopy and spectroscopy are invaluable tools for the optical characterization of matter with spatial resolutions <10 nm. This talk shows how our neSNOM microscope can be utilized to perform ultrafast measurements.

TUE.PO.6 15:45
Ultrafast time resolved Brillouin spectroscopy as a probe for light induced spin-crossover — Marina Servol1, Tymur Parpiev2, Maciej Lorenci, Ievgenia Chaban2, Ronan Lefort3, Eric Collet4, Hervé Cailleau5, Pascal Ruello4, Nathalie Daro4, Guillaume Chastenet4, and Thomas Pezeri2 — 1Institut de Physique de Rennes, UMR CNRS 6251, Université de Rennes 1, 35042 Rennes, France — 2Institut Molécules et Matériaux du Mans, UMR CNRS 6283, Université du Maine, 72085 Le Mans, France — 3Institut de Chimie de la Matière Condensée de Bordeaux, UPR CNRS 9048, Université de Bordeaux, 33608 Pessac, France
We monitored thermal spin crossover of a Fe2+ compound by ultrafast Brillouin spectroscopy. The acoustic phonons properties and generation mechanisms are sensitive to the spin state. This paves the way to futur pump-pump-probe experiments.

TUE.PO.7 15:45
Observation of electron decay dynamics in Pt nano-structures by femtosecond infrared luminescence — Tomoharu Suzuki1, Noriaki Sugimoto2, Kazutaka Nishikawa3, Kenichi Yamanaka2, and Shinji Inagaki3 — 1Toyota Physical and Chemical Research Institute, Nagakute-shi, Japan — 2Toyota Central R&D Labs., Inc., Nagakute-shi, Japan
Femtosecond infrared luminescence has been observed in Pt nano-dots and wires, and very broad spectra are ascribed to hot luminescence within metal like continuous states. In addition, a nonlinear luminescence was found in Pt-wire.
Tuesday Sessions

Poster
TUE.PO.8 15:45
Electron Wave Functions in Heteronanostructures Control the Electron Transfer Dynamics — Lars Dworak, Sina Roth, and Josef Wachtveitl — Institute of Physical and Theoretical Chemistry, Goethe-University, Max-von-Laue-Straße 7, D-60438 Frankfurt/Main
Electron transfer dynamics in CdTe/CdSe and CdSe/CdS core/shell heteronano-structures decorated with molecular acceptors are determined via transient absorption spectroscopy. The CdSe shell accelerates the electron transfer whereas the CdS shell leads to a retardation.

Poster
TUE.PO.9 15:45
Ultrafast near-field dynamics of polariton-exciton in WSe2 slab waveguides at room temperature — Michael Mjeben, Lena Yadgarov, Assaf Levanon, and Haim Suchowski — School of Physics and Astronomy, Tel Aviv University, 69978 Tel Aviv, Israel
We observe the propagation of an exciton-polariton wave in a WSe2 nanometric slab. We directly visualize with unprecedented spatio-temporal resolution (50 nm, <70 fs) a strikingly slow polaritonic wave with a velocity of ~0.017c.

Poster
TUE.PO.10 15:45
Cation substitution reduces non-radiative charge carrier recombination in hybrid lead halide perovskites — Sascha Feldmann, Jasmine P.H. Rivett, Tudor H. Thomas, Michael Saliba, and Felix Deschler — Cavendish Laboratory, University of Cambridge, J.J. Thomson Avenue, CB3 0HE Cambridge, United Kingdom — Adolphe Merkle Institute, University of Fribourg, CH-1700 Fribourg, Switzerland
We show by means of ultrafast transient absorption and photoluminescence spectroscopy that substitution of the A-site cation can drastically reduce non-radiative losses in hybrid halide perovskites of the type ABX3.

Poster
TUE.PO.11 15:45
Ultrafast THz coherent excitation of optical and acoustic phonon modes in topological insulators — Vincent Juvé, Mateusz Weis, Brice Arnault, Gwenaëlle Vaudel, Bartosz Wilk, Jazek Szadziewski, and Pascal Ruegg — Institution des Molécules et Matériaux du Mans, UMR CNRS 6283, Le Mans Université, 72085 Le Mans, France — A. Chelkowski Institute of Physics and Silesian Center for Education and Interdisciplinary Research, 75 Pulku Piechoty 1A University of Silesia, 41-500, Chorzów, Poland
Intense picosecond TeraHertz pulses are used to drive out-of-equilibrium electrons and phonons dynamics in nanometric films of topological insulators Bi2Te3 measured in time-resolved experiments. Below the material band gap excitations lead to efficient electrons and phonons dynamics.

Poster
TUE.PO.12 15:45
Probing biexciton structure in CdSe nanocrystals using 2D optical spectroscopy — Hélène Seiler, Samuel Palato, and Patanjali Kamblhampati — Chemistry Department, McGill University, Montréal, Canada
Coherent Multi-dimensional Spectroscopy is ideally suited to investigate many-body effects in semiconductor nanostructures. Here we employ 2D optical spectroscopy on the model system of CdSe quantum dots to reveal the structure of the bandedge biexciton.

Poster
TUE.PO.13 15:45
Ultrafast Carrier Dynamics in Wide Bandgap Semiconductors — Roderick Davidson, Adam Dunkelberger, Joanna Chatzakis, Daniel Ratchford, David Storm, Scott Katzer, Joshua Caldwell, and Jeffrey Owratsky — National Research Council postdoctoral associate, Washington, D.C., USA — Chemistry Division, Naval Research Laboratory, Washington, D.C., USA — ASE postdoctoral associate, Washington, D.C., USA — Electronics Science and Technology Division, Naval Research Laboratory, Washington, D.C., USA — School of Engineering, Vanderbilt University, Nashville, TN, USA
The electronic dynamics of two semiconductors with wide bandgaps, >5eV, are characterized with sub-picosecond temporal resolution. Coupling between electronic states and longitudinal optical phonons in these materials is quantified via restrahlen band edge softening.

Poster
TUE.PO.14 15:45
Ultrafast Carrier Generation in Bi2−xSb Thin Films Induced by Intense Monocycle Terahertz Pulses — Ikuoaki Katayama, Hiroki Kawakami, Kotaro Arai, Yuusuke Arashida, Yasuo Minami, Orie Sele, Tadaaki Nago, Masahiro Kitajima, and Jun Takeda — Yokohama National University, Yokohama, Japan — Tokushima University, Tokushima, Japan — National Institute for Materials Science, Tsukuba, Japan — CREST JST, Japan — LxRay Co. Ltd., Japan
Using terahertz-pump and terahertz-probe spectroscopy, we investigated terahertz-induced carrier generation processes in Bi2−xSb thin films. The field dependence of the terahertz-induced transmittance change indicates distinct nonlinearity related to the Zener tunneling in narrow band-gap materials.

Poster
TUE.PO.15 15:45
Ultrafast Carrier Dynamics in Hybrid Pb-Sn Binary Perovskites — Sachin Dev Verma, Qifei Gu, Vijay Vengopal, Aditya Sadhana, and Arshay Rao — Cavendish Laboratory, University of Cambridge, J.J. Thomson Avenue, Cambridge CB3 0HE, UK
Transient absorption spectroscopy is being employed to understand carrier dynamics in hybrid Pb-Sn perovskites. Broadening and shifting of photobleaching band towards lower energies upon Sn substitution will unravel intricate details of thermalization and carrier cooling.

Poster
TUE.PO.16 15:45
Ultrafast pump-probe spectroscopy is used to measure the properties of excited CdSe quantum dots within a CdS rod. Due to electron delocalization into the rod, this system shows single exciton gain and reduced Auger recombination.
Tuesday Sessions

Poster TUE.PO.17 15:45

Charge Transfer and Fluorescence Quenching in Carbon Nanodots in the Presence of Metal Ions — Andrea Cannizzo1, Alice Scirtori1,2,3, Michela Gazzetta1, M. Laura Soriano4, Egmont J. Roehwer1, Thomas Feurer1, Marco Cannas5, and Fabrizio Messi1,5 — 1Institute of Applied Physics, University of Bern, Sidlerstrasse 5, CH-3012 Bern, Switzerland — 2Dipartimento di Fisica and Astronomia, Università degli Studi di Catania, Via Santa Sofia 64, 95123 Catania, Italy — 3Dipartimento di Fisica e Chimica, Università degli Studi di Palermo, Via Archirafi 36, 90123 Palermo, Italy — 4Department of Analytical Chemistry, Institute of Fine Chemistry and Nanochemistry, Campus de Rabañales, 14071 Córdoba, Spain — 5CHAB – ATN Center, Università degli Studi di Palermo, Viale delle Scienze, Edificio 18, 90128 Palermo, Italy

We present our experimental results and model of rocking curves resolved by ultrafast electron diffraction on monocrystalline Silicon nanomembranes. We demonstrate that multiple scattering processes can lead to giant photo-induced responses on high quality crystals.

Poster TUE.PO.22 15:45

Interube energy transfer in dilute SWNT-polymer matrices — Pascal Kunkel and Tobias Hertel — Institute of Physical and Theoretical Chemistry, Julius Maximilian University Würzburg, Germany

We present two-color transient absorption experiments of dilute single-wall carbon nanotube-polymer matrices. Our studies reveal, that coupling between proximal tubes does not only allow for intertube exciton transfer but also facilitates non-radiative exciton decay.

Poster TUE.PO.23 15:45

Evidence and Implications for Exciton Driven Carrier Formation in Lead Halide Perovskites — Vandana Tiwari1,2, Hong-Guang Duan1,2,3,4, Ajay Jha1, Pabitra Nayak1,2, Michael Thorwart1,2,3,4, Henry Smith5,6, and R. J. Dwayne Miller1,2,3,4 — 1Max Planck-Institute for the Structure and Dynamics of Matter, Luruper Chaussee 149, 22761 Hamburg, Germany — 2Department of Chemistry, Universität Hamburg, Martin-Luther-King Platz 6, Germany — 3Institut für Theoretische Physik, Universität Hamburg, Jungiusstraße 9, 20355 Hamburg, Germany — 4Center for Ultrafast Imaging, Luruper Chaussee 149, 22761 Hamburg, Germany — 5Department of Physics, University of Oxford, Clarendon Laboratory, Parks Road, Oxford OX1 3PU, United Kingdom — 6The Departments of Chemistry and Physics, University of Toronto, 80 St. George Street, Toronto, M5S 3H6 Canada

We have employed ultrafast transient-grating and two-dimensional electronic spectroscopy to probe dynamics of photo-excited CH3NH3PbI3 thin films with 16-fs temporal resolution. We distinctly capture the 30-fs decay of excitons, weakly coupled to the phonons.

Poster TUE.PA.24 15:45

Light-Induced Ultrafast Lattice Dynamics in Soft Semiconductor Hybrid Organic-Inorganic Perovskites — Tim van de Goor1, Matthew Smith2, Aaron Lindenberg2, and Felix Deschler1 — 1Cavendish Laboratory, University of Cambridge, JJ Thomson Avenue, Cambridge CB3 0HE, UK — 2Stanford Department of Chemistry, 333 Campus Drive, Room 121, Stanford, CA 94305, USA — 3Stanford Department of Materials Science and Engineering, 476 Lomita Mall, Room 219, Stanford, CA 94305, USA.

Hybrid perovskites are highly dynamic “soft” semiconductors with favorable optoelectronic properties. Here we present findings from ultrafast optical pump — x-ray probe measurements that explore light-induced ultrafast structural motions of the lattice.

Poster TUE.PA.25 15:45

Large Polaron evidence in the Ultrafast THz response of Lead-Halide Perovskites — Eugenio Cincinata1,2, Daniele Megghiaro3,4, Marina Gandini1,2, Edoardo Mosconi1,2, Silvia G. Motti1,2, Marcoel Alcocer1,2, Cristian Manzoni1,2, Caterina Vozzi1,2, Annamaria Petrozza2, Filippo De Angelis2,3, and Salvatore Stagira1 — 1Dipartimento di Fisica, Politecnico di Milano, Piazza Leonardo da Vinci 32, 20133 Milano, Italy — 2CNR-IFN, Piazza Leonardo da Vinci 32, 20133 of Wisconsin-Madison, Wisconsin , USA — 3LSI, Palaiseau, France — 4CEMES, Toulouse, France

Of Wisconsin-Madison, Wisconsin, USA — 3LSI, Palaiseau, France — 4CEMES, Toulouse, France

We present our experimental results and model of rocking curves resolved by ultrafast electron diffraction on monocrystalline Silicon nanomembranes. We demonstrate that multiple scattering processes can lead to giant photo-induced responses on high quality crystals.
Tuesday Sessions

Milano, Italy; — 3Computational Laboratory for Hybrid/Organic Photovoltaics, CNR-IMSc, Via Elce di Sotto 8, I-06123 Perugia, Italy; — 4D3-ComputNet, Istituto Italiano di Tecnologia, Via Morego 30, 16163 Genova, Italy; — 5Center for Nano Science and Technology, Istituto Italiano di Tecnologia, Via Giovanni Pascoli 70/3, Milan 20133, Italy;

We unveil the large polaron formation in lead-halide perovskites by combining ultrafast Thz spectroscopy with DFT calculations. We clarify the mechanism underlying the physics of full-inorganic lead-halide perovskites that explain their fascinating dielectric properties.

Poster TUE.PO.26 15:45
Instantaneous charge separation in non-fullerene acceptor bulk-heterojunction of highly efficient solar cells — 1Franco V. A. Camargo1, Nicola Gasparini1, Tsuyoshi Nagahara1,2, Larry Lieber2, Giulio Cerullo1, and Christoph Brabak1,3 — 1IFN-CNR, Dipartimento di Fisica, Milano, Italy — 2Institute of Materials for Electronics and Energy Technology (I- MEFET), Friedrich Alexander-University Erlangen-Nuremberg, Erlangen, Germany — 3Kyoto Institute of Technology, Department of Chemistry and Materials Technology, Kyoto, Japan

Using broadband transient absorption in a high efficiency (>11%) photovoltaic blend with a non-fullerene acceptor, we observe instantaneous (sub-30 fs) charge separation, demonstrating close to ideal donor-acceptor level matching and nanomorphology in this blend.

Poster TUE.PO.27 15:45
Non-thermal nature of photoinduced insulator-to-metal transition in NbO3 — 1Rakesh Rana1, J. Michael Klopff1, Joerg Grenzer2, Harald Schneider1, Manfred Helml1, and Alexei Fashkin1 — 1Institute of Ion Beam Physics and Material Research, Helmholtz-Zentrum-Dresden-Rossendorf, Bautzner Landstrasse 400, 01328 Dresden, Germany — 2Technische Universitaet Dresden, 01062 Dresden, Germany

We demonstrate ultrafast metallization of NbO3 in the excitation regime where the transient temperature remains well below the thermal insulator-to-metal transition temperature of 1080 K. This attests for the non-thermal character of the photo-induced transition.

Poster TUE.PO.28 15:45
Magnetic and Structural Dynamics in Antiferromagnetically Coupled Fe/Cr Superlattices — 1Daniel Schick1,2, Martin Hennecke1, Ilie Radu1, Niro Pontius3, Stefan Eisibett4, Daniel E. Burgler4, and Christian Schussler-Lageheime1 — 1Max-Born-Institut fur Nichtlineare Optik und Kurzzeitspektroskopie, Max-Born-Str. 2a, 12489 Berlin, Germany — 2Institut für Methoden und Instrumentierung der Forschung mit Synchrotronstrahlung, Helmholtz-Zentrum Berlin für Materialien und Energie GmbH, Albert-Einstein-Str. 15, Berlin, 12489, Germany — 3Peter Grünberg Institute, Forschungszentrum Jülich GmbH, Wilhelm-Johnen-Straße, 52428 Jülich, Germany

We use resonant and non-resonant soft X-ray diffraction and X-ray magnetic circular dichroism in reflection to disentangle the photoinduced spin and lattice dynamics on pico- to femtosecond time scales in antiferromagnetically coupled Fe/Cr superlattices in one and the same experiment.

Poster TUE.PO.29 15:45
Ultrashort laser-induced pressure pulse to stabilize a high-pressure phase in InSb at ambient conditions — 1Alelie Jarnac1,2, Xiaociui Wang2, Aasa Bengtssson2, Matthias Burza1, Carl Ekstrom2, Henrik Enquist1, Andreas Jurjilaitis1, Norman Kretzschmar1, Anna Persson1, Chen-Ming Tu2, Michael Wulff2, Fabien Dorches1, and Jorgen Larsson1,2 — 1MAX IV Laboratory, Lund University, P.O. Box 118, SE-221 00 Lund, Sweden — 2Department of Physics, Lund University, P.O. Box 118, SE-221 00 Lund, Sweden — 3ESRF The European Synchrotron, 71 Avenue des Martyrs, 38000 Grenoble, France — 4Univ. Bordeaux, CNRS, CEA, CELIA (Centre Lasers Intenses et Applications), UMR 5107, 33400 Talence, France

We describe the stabilisation of indium antimonide (InSb) in the high-pressure orthorhombic phase (InSb-III) at ambient conditions. To achieve the stabilisation, we developed a laser-based experimental system that can deliver picosecond, uniaxial pressure pulses.

Poster TUE.PO.30 15:45
Ultrafast Vibrational Energy Transfer from photoexcited carbon nanotubes to protein — 1Tomohito Nakayama1,2, Shunsuke Yoshizawa1, Atsushi Hirano2, Takeshi Tanaka2, Kentaroh Shiraki1, and Muneki Hase1 — 1University of Tsukuba, Tsukuba, Japan — 2National Institute of Advanced Industrial Science and Technology (AIST), Tsukuba, Japan

We demonstrate that ultrafast energy transfer from carbon nanotubes to adsorbed materials depends on phonon density of states of protein and surfactant, by observing relaxation dynamics of coherent radial breathing modes.

Poster TUE.PO.31 15:45
Light and Spin Interactions: an Ultrafast Investigation in Topological Insulators — 1Davide Bugini1,2, Hamoon Hedaya1, Fabio Boschini1, Heman Y1, Chiayu Chen1, Xingjiang Zhou1, Cristian Manzoni1, Claudia Dallera1, Giulio Cerullo1, and Ettore Carpen1 — 1Dipartimento di Fisica, Politecnico di Milano, 20133 Milan, Italy — 2Center for Nano Science and Technology@PoliMi, Istituto Italiano di Tecnologia, Milan 20133, Italy — 3Department of Physics and Astronomy, University of British Columbia, Vancouver, BC V6T 1Z1, Canada — 4National Lab for Superconductivity, Institute of Physics, Chinese Academy of Science, Beijing 100190, China — 5CNR-IFN, Dipartimento di Fisica, Politecnico di Milano, 20133 Milan, Italy

We present time- and angle-resolved photoemission spectroscopy measurements on SbBi2(2-x)SeS(3-y) topological insulators. Exploiting circularly polarized femtosecond pulses we investigated spin-related ultrafast phenomena such as photoinduced spin current and spin-dependent relaxation processes.

Poster TUE.PO.32 15:45
The Early Stages of Ultrafast Demagnetization — 1Rafael Gort1, Kevin Bühllmann1, Simon Däster1, Andreas Fognini1, Andreas Vaterlaus1, and Yves Acremann1 — 1Laboratory for Solid State Physics, ETH Zurich, Switzerland — 2Department of Quantum Nanoscience, TU Delft, The Netherlands

With time and spin resolved photoemission we demonstrate, that the spin polarization shows different dynamics depending on the electron energy: At the Fermi energy the spin polarization is reduced faster than in the valence band.
Tuesday Sessions

Poster TUE.PO.33 15:45
Ultrafast lattice dynamics in lead selenide quantum dot — Xuan Wang¹, Matthew Gorfien², and Jianming Cao² — ¹Institute of Physics, Chinese Academy of Sciences, P.O. Box 603, Beijing, 100190, China — ²Physics Department and National High Magnetic Field Laboratory, Florida State University, Tallahassee, Florida, 32310, USA
We monitored lattice dynamics in PbSe quantum dots by ultrafast electron diffraction. The electron-phonon coupling didn’t show phonon bottleneck. And lattice dilation exhibited unusual features. Heat transport to the substrate deviated significantly from Fourier’s Law.

Poster TUE.PO.34 15:45
Applying a new ‘split-and-measure’ method, the dynamics of the Mott metal-insulator transition of VO₂ was probed via ultra-fast X-ray absorption spectroscopy, near the photon-noise limit. Two time-constants emerge, respectively in the femto- and picosecond regimes.

Poster TUE.PO.35 15:45
An on-demand magnonic crystal induced by an optical interference pattern — Cha-Lin Chiang¹, Szymon Mieszczak¹, Mateusz Zeleń¹, Ronnie Tamminu¹, Julius Janusonis¹, Piotr Graczyk¹, Jaroslav Klos¹, and Ra’anan Tober¹ — ¹Zernike Institute for Advanced Materials, University of Groningen, Groningen, The Netherlands — ²Faculty of Physics, Adam Mickiewicz University in Poznan, Poznan, Poland — ³Institute of Physics, Greifswald University, Greifswald, Germany — ⁴Los Alamos National Laboratory, Los Alamos, USA
Light interference of ultrafast laser pulse on a uniformly magnetized film induces the onset of magnonic bandstructure which can be visualized by the resonant interaction of the spin wave modes with elastic waves.

Poster TUE.PO.36 15:45
Femtosecond XUV-only transient absorption spectroscopy at FLASH — Christian Ott¹, Thomas Ding¹, Lennart Aufleger¹, Marc Rebholz¹, Alexander Magunia¹, Patrick Ruppprech¹, Carina da Costa Castanheira¹, Maximilian Hartmann¹, Veit Stooss², Paul Brek³, Gerhana D Borisova³, Kristina Meyer³, David Wach³, Stefano M Cavalletto³, Andrew R Attar³, Thomas Gaummitz³, Zhi Heng Loh³, Sebastian Roling³, Marco Butz³, Helmut Zacharias³, Stefan Dürstere³, Rolf Treusch³, and Thomas Pfeiffer³ — ¹Max-Planck-Institut für Kryophysik, Saupfercheckweg 1, 89117 Heidelberg, Germany — ²Department of Chemistry, University of California, Berkeley, CA 94720, USA — ³Institut für Physikalische Chemie, Eidgenössische Technische Hochschule Zürich, Vladimir-Pregl-Weg 2, 8093 Zürich, Switzerland — ⁴Division of Chemistry and Biological Chemistry, School of Physical and Mathematical Sciences, Nanyang Technological University, Singapore 637371, Singapore — ⁵Physikalisches Institut, Westfälische Wilhelms-Universität Münster, Wilhelm-Klemm-Straße 10, 48149 Münster, Germany — ⁶Deutsches Elektronen-Synchrotron DESY, Notkestr. 85, 22607 Hamburg, Germany
Multi-electron transitions in helium and neon are measured with XUV-only transient absorption spectroscopy at the Free-Electron-Laser in Hamburg (FLASH). Ultrafast line-shape changes are resolved at high spectral resolution despite the much larger FEL photon bandwidth.

Poster TUE.PO.37 15:45
Graphite-like dynamical behaviour of graphite oxide — Amul Shinde¹, Christoph Tzeltud¹, Katrin Adamczyk¹, and Nils Huse — ¹Department of Physics, University of Hamburg & Center of Free Electron Laser Science, Hamburg, Germany
We report two-colour pump-probe spectroscopy of coupled structural and electronic dynamics of graphite oxide probed with 6-um and THz pulses upon femtosecond IR excitation.

Poster TUE.PO.38 15:45
Monitoring Hot Exciton Dissociation in Hybrid Lead Halide Perovskite Films with Sub-10 fs Pulses — Tufan Ghosh, Sigalit Aharon, Liao Etgar, and Sanford Ruhman — Institute of Chemistry, The Hebrew University of Jerusalem, 91904, Israel
Sub-10 fs pump-probe experiments which uncover exciton dissociation and carrier cooling in hybrid perovskite films are described. Coherent wave packets were also detected in the form of spectral modulation, revealing electron-phonon coupling in these materials.

Poster TUE.PO.39 15:45
Decomposing Electronic and Lattice Contributions in Optical Pump–X-Ray Probe Transient Inner-SHELL Absorption Spectroscopy of CuO — Johannes Mahl¹, Stefan Nepp¹, Friedrich Roth¹, Catherine Saladrigas¹, Hendrik Bluem¹, Jinghua Guo¹, Wanli Yang¹, Nils Huse¹, Wolfgang Ebhard², and Oliver Gessner² — ¹Chemical Sciences Division, Lawrence Berkeley National Laboratory, Berkeley, CA, 94720 USA — ²Physics Department Universität Hamburg, 22607 Hamburg, Germany — ³Helmholtz-Zentrum Berlin für Materialien und Energie, 14109 Berlin, Germany — ⁴Institute for Experimental Physics, TU Bergakademie Freiberg, 09599 Germany — ⁵Center for Free-Electron Laser Science DESY, 22607 Hamburg, Germany — ⁶Chemistry Department UC Berkeley, 94720 USA — ⁷Advanced Light Source, Lawrence Berkeley National Laboratory, Berkeley, CA, 94720 USA
Electronic and lattice contributions to transient X-ray absorption spectra of CuO are analyzed using picosecond time-resolved and temperature-dependent measurements. Superbandgap excitation with 355 nm and 532 nm laser pulses leads to significantly different trends.

Poster TUE.PO.40 15:45
Adaptive optical concept and applications for ultrafast imaging and spectroscopy with high-brightness electron beam — Faran Zhou, Joseph Williams, Tianxin Sun, Daniel Bartles, Elliot Wozniak, and Chong-Yu Ruan — Michigan State University, East Lansing, USA
We report an electron optics concept enabling high throughput material investigation with temporal, spatial and spectral resolutions. Signatures of topological transformation of charge-density waves are discussed in the context of fluctuating orders and universal dynamics.
Ultrafast Extreme Ultraviolet Photoemission Without Space Charge — Peng Zhao1, Christopher Corder1, Jin Bakalis1, Xinlong Li1, Matthew D. Kershis1,2, Amanda R. Muraca1, Michael G. White1,2, and Thomas K. Allison1 — Stony Brook University, Stony Brook, NY, 11794 USA — Stony Brook Nanoscience Institute, Stony Brook University, Stony Brook, NY, 11794 USA

We present photoelectron spectroscopy experiments using an 88 MHz cavityenhanced high-harmonic source operating from 8 to 40 eV. Nanopapere space-charge free sample photo currents enable us to record time-resolved photo-electron spectra from weakly excited samples.

Polarization selection rule of high-order sideband generation in transition metal dichalcogenides — Koh-i i Nagai1, Natokar Yoshikawa1, and Koichiro Tanaka1,2 — Department of Physics, Kyoto University, Kyoto, Japan — Institute for Integrated Cell-Material Sciences, (ICEMS), Kyoritsu University, Kyoto, Japan

We observed high-order sideband generation in monolayer transition metal dichalcogenides. Polarization selection rule of the sideband emission under circularly polarized light excitation comes from 3-fold rotational symmetry of the crystal.

Time-domain THz spectroscopy of Mn2Au — Nilasha Bhattacharjee1, Alexey Sapozhnikov1,2, Stanislav Bodnar2, Olena Gomonay1, Martin Jourdan3, and Jure Dmegas1,2 — Institute of Physics, Johannes Gutenberg-University Mainz, 55099 Mainz, Germany — Graduate School of Excellence, Materials Science in Mainz (MAINZ), Mainz, Germany

THz spectroscopy is performed to investigate the antiferromagnetic resonance in metallic antiferromagnet. A gigantic response is observed at one THz, which is driven by N’eeil orbit torque and softens with increasing temperature.

Transiant dynamics in an excitonic insulator: Fast computation of nonequilibrium Green’s function — Rikku Tuovinen1, Denuis Golle2, Michael Schuler3, Martin Eckstein1, and Michael Senter1 — Max Planck Institute for the Structure and Dynamics of Matter, 22761 Hamburg, Germany — Department of Physics, University of Fribourg, 1700 Fribourg, Switzerland — Department of Physics, University of Erlangen-Nuernberg, 91058 Erlangen, Germany

A fast time-propagation method for the nonequilibrium Green’s function is presented and applied to an excitonic insulator. We investigate the ultrafast transient dynamics and concentrate on the balance between competing ordered states.

Two-Dimensional Control of Electron Localization in H2 Dissociation with Elliptically Polarized Few-Cycle Laser Pulses — Sarayoo Kangaparambil1, VACLAV Hanus1, Seyedrezar Larimian1, Xinhua Xie1, Markus Schöffler2, Gerhard Paulus3, and Andrei Baltuska1, and Markus Kitzler1 — Photons Institute, Technische Universität Wien, Gussmannstrasse 27, 1040 Wien, Austria — Institute für Kernphysik, J.W. Goethe-Universität, Max-von-Laue-Straße 1, 60438 Frankfurt am Main, Germany — Friedrich-Schiller-Universität Jena, Max-Wien-Platz 1, 07743 Jena, Germany

We demonstrate two-dimensional control over the charge-localization in H2 dissociation using elliptically polarized laser pulses. The influences of the CEP and the laser phase at the instant of ionization are investigated.

Relaxation and Fragmentation Dynamics of Large Polymeric Aromatic Hydrocarbons Excited by an Ultrafast XUV Pulse — Marius Hervé1, Pablo Castellanos2, Gabriel Karras1, Victor Despre1, Alexandre Marciniak1, Eric Constant1, Vincent Loriot1, Alexander I. Kulepp2, Alexander G. M. Tielen1, and Frans Lépine1 — Université de Lyon, Université Claude Bernard Lyon 1, CNRS, Institut Lumière Matière, F-69622 Villeurbanne, France — Leiden Observatory, Leiden University, PO. Box 9513, 2300 RA Leiden, The Netherlands — 1Sackler Laboratory for Astrophysics, Leiden Observatory, Leiden University, PO. Box 9513, 2300 RA Leiden, The Netherlands — Physikalisch-Chemisches Institut, Universität Heidelberg, Im Neuenheimer Feld 229, Heidelberg 69120, Germany

XUV excitation of Polymeric Aromatic Hydrocarbons (PAHs) produces highly excited cationic states. Their subsequent femtosecond dynamics are probed in small and large PAHs using XUV-IR pump-probe techniques. This reveals the importance of many-body quantum effects.

Non-monochromatic effects in band-structure modification by electron/hole oscillations driven by few-cycle laser pulses — Vitaly Grudzinev1 and Olga Serganov1,2 — Department of Mechanical and Aerospace Engineering, University of Missouri, Columbia, MO, USA — ITMO University, St. Petersburg, Russia

Non-monochromatic electron/hole oscillations driven by high-intensity ultrashort laser pulses produce specific modifications of band structure of wide-band-gap solids that affect inter-band electron excitation and nonlinear absorption. We analyse special features of those non-monochromatic band-structure modifications.

Generation of Raman active phonons in a thin Bi2Se3 film by THz pulses — Alexey Melnikov1, Kirill Boldyrev1, Yuri Selivanov1, Victor Martovitski2, Sergey Chekaln1, and Eugene Ryabov1 — Institute of Spectroscopy Russian Academy of Sciences, Troitsk Moscow, Russia — PN. Lebedev Physics Institute Russian Academy of Sciences, Moscow, Russia

Three Raman active phonon modes are coherently excited in a single-crystal Bi2Se3 film via anharmonic coupling with an infrared active phonon mode that is resonantly driven by an intense THz pulse.

Gaining control on thermally driven ground-state reactions — T. Stenitzki1, Y. Yang1, V. Kozich2, A. A. Ahmed2,3, O. Künn1, and K. Heyne1 — Department of Physics, Arnimallee 14, 14195 Berlin, Germany — Faculty of Science, Department of Chemistry, University of Cairo, 12613 Giza, Egypt — Institute of Physics, University of Rostock, Albert Einstein-Strasse 23-24, 18059 Rostock, Germany

We used infrared light to control the outcome of a chemical ground-state reaction in solution. Vibrational enhancement is demonstrated for the otherwise thermally driven reaction between phenyl isocyanate and cyclohexanol, and toluene-2,4-dicarbonyl and 2,2,2-trichloroethanol-1,1-diol, respectively.

Attosecond transient Absorption and Four-Wave Mixing with Wavelength Tunable Laser Pulses — Nathan Harkema1, Jens Baekhoj2, Kenneth Schaffer2, Mette Gaarde2, Chen-Ting Liao1, and Arvinder Sandhu1 — University of Arizona, Tucson USA — Louisiana State University, Baton Rouge USA
We extend the technique of attosecond transient absorption spectroscopy by incorporating wavelength tunable IR pulses. This technique is used to control Au/tert-Butyl-Tirones splitting and drive XUV four-wave mixing processes in Helium.

**Poster** TUE.PO.51 15:45
Ellipticity dependence of high-order harmonic generation from benzene molecules with and without a YAG laser field — Wataru Komatsubara, Shinichirou Minemoto, and Hirofumi Sakai — Department of Physics, Graduate School of Science, The University of Tokyo, 7-3-1, Hongo, Bunkyo-ku, Tokyo 113-0033, Japan

We measure ellipticity dependence of high-order harmonic generation from benzene molecules with and without a YAG laser field. Electron trajectory analysis uncovers the dynamics of the electron wave packet, being insensitive to the nonlinear medium.

**Poster** TUE.PO.52 15:45
Induced absorption reveals bieicton fine structure in monolayer tungsten diselenide — Alexander Steinhoff, Matthias Florian, Akshay Singh, Kha Tran, Mirco Kolarczik, Sophia Helmrich, Alexander Achteine, Ulrike Wogg, Nina Owsczhimikow, and Frank Jahnke, and Xiaojun Li — 1Institut für Theoretische Physik, Universität Bremen, Bremen, Germany — 2Physics Department, University of Texas, Austin, Texas, USA — 3Institut für Optik und Atomare Physik, Technische Universität Berlin, Berlin, Germany

We show in pump-probe experiments and material-realistic calculations that electron-hole exchange gives rise to a pronounced fine structure of biectons in monolayer transition metal dichalcogenides.

**Poster** TUE.PO.53 15:45
Photoemission time versus streaking delay in attosecond time-resolved solid state photoemission — Andreas Gebauer, Sergei Neb, Walter Enns, Ulrich Heinemann, Andrey K. Kazansky, and Walter Pfeiffer — 1Bielefeld University, Universitätsstr. 25, 33615 Bielefeld, Germany — 2University of Kaiserslautern, Erwin Schrödinger Str. 46, 67663 Kaiserslautern, Germany — 3University of the Basque Country, 20080 San Sebastián, Spain — 4Donostia International Physics Center (DIPC), Paseo Manuel de Lardizabal 4, 20018 San Sebastián, Spain — 5IKERBASQUE, Basque Foundation for Science, Maria Díaz de Haro 3, 48013 Bilbao, Spain

Time-dependent Schrödinger equation simulations for a one-dimensional model potential reveal that the delay extracted from a streaking spectrum does not reflect the photoemission time if the streaking field inside the solid cannot be neglected.

**Poster** TUE.PO.54 15:45
Robust sub-50 fs cavity-laser phase stabilization for ultrafast electron diffraction instruments — Martin Otto, Laurent René de Cotret, Mark Stern, and Bradley Swickey — 1Department of Physics, Center for the Physics of Materials, McGill University, 3600 University Street, Montreal, QC, CA, 2Department of Chemistry, McGill University, 801 Sherbrooke Street W, Montreal, QC, CA

A novel laser-RF cavity synchronization scheme was developed for ultrafast electron diffraction instruments. Timing stability improved from 100 fs to 5 fs RMS and long-term time-zero stability improved to below our measurement resolution of 50 fs.

**Poster** TUE.PO.55 15:45
Spectral shifts in mid-infrared assisted high-order harmonic generation in gases — Balázs Major, Émeric Balogh, Katalin Kovács, Songhee Han, Bernd Schütte, Paul Weber, Marc J. J. Vrakking, Valer Tosa, Arnaud Rouzé, and Katalin Varjú — 1ELI-ALPS, 2ELI-HU Non-Profit Ltd., Szeged, Hungary — 3Department of Optics and Quantum Electronics, University of Szeged, Szeged, Hungary — 4National Institute for R&D of Isotopic and Molecular Technologies, Cluj-Napoca, Romania — 5Max-Born-Institut, Berlin, Germany

We study high-order harmonic generation in a two-color configuration. Additionally to yield enhancement, cut-off extension and continuum generation, we report and explain a spectral shift of harmonic peaks controlled by the delay between the pulses.

**Poster** TUE.PO.56 15:45
Manipulating the distribution of photoexcited electrons on ultrafast timescales — E Laine Wong, Andrew J. Winchester, Vivek Pareek, Julien Maseo, Michael K. L. Man, and Keshav M. Dani — Okinawa Institute of Science and Technology Graduate University, Okinawa, Japan

By exploiting the spatial intensity variation within an optical pulse, we separated the gaussian distribution of photoexcited electrons into two. We controlled the degree of separation by tuning the intensity of the pulse.

**Poster** TUE.PO.57 15:45
Photoelectron Circular Dichroism at the Few-cycle Limit — Václav Hanuš, Sarayoo Kangaparambil, Seyedreza Larijman, Maurice Tia, Xinhua Xie, Sébastien Eckart, Markus Schönflers, Andrius Baltuska, and Markus Kitzler — 1Photonics Institute, Technische Universität Wien, Gussnassstrasse 27, 1040 Wien, Austria — 2Institut für Kernphysik, J.W. Goethe-Universität, Max-von-Laue-Strasse 1, 60438 Frankfurt am Main, Germany

Photoelectron circular dichroism (PDC) was investigated for methylxiran with intense few-cycle pulses. The observed PDC shows a dependence on electron energy. This may signify an influence of the chiral potential on the outgoing electron’s trajectory.

**Poster** TUE.PO.58 15:48
Single pulse spontaneous polarization of polariton emission in GaAs microcavity: time-resolved measurements — Michael Kochiev, Vasiliy Belykh, and Nikolai Sheldin — 1P. N. Lebedev Physical Institute of the Russian Academy of Sciences, Moscow 119991, Russia — 2Experimentelle Physik 2, Technische Universität Dortmund, D-44221 Dortmund, Germany

The dynamics of spontaneous polarization of single emission pulses of polariton Bose-Einstein condensate in GaAs microcavity is studied with high temporal resolution.

**Poster** TUE.PO.59 15:45
A First-principles Simulation Method for Ultrafast Nano-optics — Kazukihiro Yabana, Mitsuheru Uemoto, Shunsuke A. Satō, Yuta Hirokawa, and Taisuke Boku — 1Center for Computational Sciences, University of Tsukuba, Tsukuba, Japan — 2Max Planck Institute for the Structure and Dynamics of Matter, Hamburg, Germany — 3Graduate School of Systems and Information Engineering, University of Tsukuba, Tsukuba, Japan

We develop a first-principles computational approach for ultrafast nano-optics solving Maxwell and time-dependent Kohn-Sham equations simultaneously. Electronic excitations in silicon nanosphere by strong and ultrashort pulsed light are presented as an illustrative example.
Two-color above threshold ionization of atoms by using femtosecond XUV free electron laser and NIR laser pulses — Shinichiro Minemoto¹, Hiroyuki Shimada², Kazma Komatsu¹, Wataru Komatsubara¹, Takuya Majima³, Tomoya Mizuno³, Shigeki Owada³, Hirofumi Saka³, Tadashi Togashi³, Shintaro Yoshida¹, Makina Yabashi¹, and Akira Yagisita¹ — ¹Graduate School of Science, The University of Tokyo, Tokyo, Japan — ²Institute of Material Structure Science, KEK, Tsukuba, Japan — ³Quantum Science and Engineering Center, Kyoto University, Kyoto, Japan — ²Institute of Solid State Physics, The University of Tokyo, Kashiwa, Japan — ³Japan Synchrotron Radiation Research Institute, Sayo, Japan — ²Department of Nuclear Engineering, Kyoto University, Kyoto, Japan — ¹RIKEN SPring-8 Center, Sayo, Japan

We successfully observed Ar 3p photoelectron sideband spectra using femtosecond XUV free-electron laser and synchronized NIR laser pulses. Our theoretical calculation well reproduced the sideband spectra by considering the timing jitter of ~1 ps.

Development of an apparatus for femtosecond laser-assisted (e,2e) experiments — Takashi Hiron¹, Yuya Morimoto², Reika Kanya¹, and Kaoru Yamanouchi¹ — ¹The University of Tokyo, Bunkyo-ku, Tokyo 1130033, Japan — ²Max Planck Institute of Quantum Optics, D-85748 Garching, Germany

We developed an electron scattering apparatus equipped with dual angle-resolved time-of-flight analyzers designed for laser-assisted (e,2e) experiments, with which atomic and molecular orbitals influenced by intense laser fields can be investigated.

Measurement of Nanoplasmonic Field Enhancement with Ultrafast Photoemission — Péter Ráczi¹, Zsuzsanna Pápa², István Márton¹, Judit Budai¹,², Piotr Wróbel³, Tomasz Stefanik⁴, Christine Priest³, Joachim R. Krenn⁴, and Péter Dombo³,² — ³MTA “Lendület” Ultrafast Nanoptics Group, Wigner Research Centre for Physics, 1121 Budapest, Hungary — ²ELI-ALPS Research Institute, ELI-HU Nonprofit Kft., 6720 Szeged, Hungary — ³Department of Optics and Quantum Electronics, University of Szeged, 6720 Szeged, Hungary — ⁴Faculty of Physics, University of Warsaw, 02-093 Warsaw, Poland — ⁵Institut für Physik, Karl-Franzens Universität Graz, 8010 Graz, Austria

We demonstrate a novel experimental method to measure nanoplasmonic field enhancement in any metallic surface environment utilizing ultrafast photoemission. Directly measured field enhancement values agree well with simulations of the samples without any fit parameters.

CEP Dependences in Single and Double Ionizations of Methanol in Intense Few-cycle Laser Fields — Qiqi Zhang¹, Shinichi Fukahori¹, Toshiaki Ando¹, Atsushi Iwasaki¹, Tim Rathe², Gerhard G. Paulus³, and Kaoru Yamanouchi¹ — ¹Department of Chemistry, School of Science, The University of Tokyo, Tokyo, Japan — ²Institut für Optik und Quantenelektronik, Friedrich-Schiller-Universität, Jena, Germany

Carrier-envelope phase dependences of the ejection direction of the fragment ions from methanol induced by intense few-cycle laser fields revealed that methanol dication is produced by electron recollision while methanol cation is produced by tunnel ionization.

Time-Evolution of Vibrational Mode Amplitudes of H₂O⁺ in the X²Bᵣ State — Hiroyuki Kageyama, Toshiaki Ando, Atsushi Iwasaki, and Kaoru Yamanouchi — Department of Chemistry, The University of Tokyo, 7-3-1 Hongo, Bunkyo-ku, Tokyo 113-0033, Japan

The time-frequency analysis of the yield of H⁺ ejected from H₂O⁺ created by pump-probe few-cycle laser pulses revealed the time evolution of the amplitudes of the vibrational modes ascribable to the anharmonic vibrational coupling.

Fourier Transform Vibrational Spectroscopy of CH₂CCH₂⁺ and CHCH₃⁺ by Intense Few-Cycle Laser Pulses — Peng Liu¹, Toshiaki Ando¹, Atsushi Iwasaki¹, and Kaoru Yamanouchi¹ — ¹Department of Chemistry, School of Science, The University of Tokyo, 7-3-1 Hongo, Bunkyo-ku, Tokyo 113-0033, Japan — ²Shanghai Institute of Optics and Fine Mechanics, Chinese Academy of Sciences, 390 Qinghe Rd, fiading district, Shanghai 201800, China

The vibrational-mode frequencies of CH₂CCH₂⁺ and CHCH₃⁺ were determined by the Fourier transform of the time-dependent yields of the fragment ions generated from the Coulomb explosion pathways with and without hydrogen migration.

Transition state spectroscopy of the thermal reactions induced by coherent molecular vibrational excitation using a visible 5-fs pulse laser — Izumi Ikawara and Atsushi Yabushita — Kanagawa University, Yokohama, Japan

A visible 5-fs pulse laser has excited vibrational modes to trigger the reaction in the electronic ground state. Using the “reaction by coherent molecular vibration”, transition state spectroscopy of the “thermal” reactions was implemented.

Monitoring nonadiabatic dynamics in molecules by ultrafast X-Ray diffraction — Markus Kowalewski, Kochise Bennett, and Shaul Mukamel — Department of Chemistry, University of California, Irvine, United States

We theoretically examine time-resolved diffraction from molecules which undergo nonadiabatic dynamics and identify contributions from inelastic scattering that indicate the presence of an avoided crossing and the corresponding nuclear configuration.

Simulation of Ultrafast Nonlinear XUV and X-ray Spectroscopy by Phase Cycling RT-TDDFT — Daehoon Cho¹, Jeremy Rouxel¹, Markus Kowalewski¹, Prasoon Sauhabi¹, Jin Yong Lee¹, and Shaul Mukamel¹ — ¹Department of Chemistry and Physics and Astronomy, University of California, Irvine, California 92697, United States — ²Department of Chemistry, Sungkyunkwan University, Suwon 16419, Korea

XUV and X-ray four-wave mixing signals are simulated by real-time time-dependent density functional theory propagation of the many-electron system. A phase cycling protocol is implemented to single out the desired third order signals.

Ultrafast Hydrogen Migration in Methanol in Intense Femtosecond Laser Fields — Takuya Matsubara, Shinichi Fukahori, Toshiaki Ando, Atsushi Iwasaki, and Kaoru Yamanouchi — Department of Chemistry, School of Science, The University of Tokyo, Tokyo, Japan
The time required for hydrogen migration in methanol exposed to an intense laser field was determined to be ~14 fs by the coincidence momentum imaging using pump (40 fs) and probe (6 fs) laser pulses.

**Poster**

**TUE.PO.70 15:45**

**Ultrafast Exciton Dynamics in DNA-Templated J-Aggregates**

- Su Lin1, Xu Zhou2, Sarthak Mandal1, Alessio Andreon1, Remi Veneziano1, Etienne Boula1,a, Nicolas Sahaya1,6,7, James Banak1,6,7, Toru Kondo1,6, Gabriela Schlau-Cohen1,6, Alan Aspuru-Guzik6,7, Mark Bathe6,4, Neal Woodbury1,3, and Hao Yan2,3 — 1Center for Innovation in Medicine, the Biodesign Institute, Arizona State University, Tempe, AZ 85287, USA — 2Center for Molecular Design and Biomimetics, the Biodesign Institute, Arizona State University, Tempe, AZ 85287, USA — 3School of Molecular Sciences, Arizona State University, Tempe, AZ 85287, USA — 4Department of Biological Engineering, Massachusetts Institute of Technology, Cambridge, MA 02139, USA — 5Department of Chemistry, Massachusetts Institute of Technology, Cambridge, MA 02139, USA — 6MIT-Harvard Center for Ex制动ics, Massachusetts Institute of Technology, Cambridge, MA 02139, USA — 7Department of Chemistry and Chemical Biology, Harvard University, Cambridge, MA 02138, USA

Exciton dynamics of DNA-templated-dye-aggregates was studied using femtosecond transient absorption spectroscopy. The spectra and kinetics vary with spatial organization of densely packed dye clusters and exhibit excitonic properties of J-aggregates as in natural light-harvesting systems.

**Poster**

**TUE.PO.71 15:45**

**Ultrafast Photodissociation of F2 by Intense Laser Pulses: a Time-Resolved Fragment Imaging Study**

- Abhishek Shahi1, Yshai Albeck2, and Daniel Strauss1 — Institute of Chemistry, Hebrew University of Jerusalem, Jerusalem, Israel

We present time-resolved coincidence imaging of F2 photodissociation by 400nm and intense 800nm ultrafast pulses. Coincidence fragment imaging reveals parallel and perpendicular single photon dissociation on $\Sigma_g^+$ and $\Pi_g$ states, and additional intense-field dissociation features.

**Poster**

**TUE.PO.72 15:45**

**Ultrafast Direct Electron Transfer at Organic Semiconduc- tor and Metal Interfaces**

- Yiming Li1, Bo Xianga, C. Huy Pham1, Francesco Paesani1,2, and Wei Xiong1,2 — 1Department of Chemistry and Biochemistry, University of California, San Diego, La Jolla, California, United States — 2Materials Science and Engineering Program, University of California, San Diego, La Jolla, California, United States

Using transient electric-field-induced vibrational sum frequency generation spectroscopy, we observed ultrafast direct electron transfer at a buried interface between an organic semiconductor thin film and a gold substrate.

**Poster**

**TUE.PO.73 15:45**

**Simulating excitation and annihilation dynamics in higher order spectroscopies of a molecular trimmer**

- Constantin Heshmatpour1, Frantisek Sanda1, Craig Lincoln1, Vaclav Perlik1, Pavel Malevich1, and Jürgen Hauer1,2 — 1Photonics Institute TU Wien, Vienna, Austria — 2Professor für Dynamische Spektroskopien Technische Universität München, Munich, Germany — 3Institute of Physics Charles University, Prague, Czech Republic

Standard Redfield theory of excitation migration in a molecular trimmer is extended to include the process of exciton–exciton annihilation. The developed model allows for the simulation of both 3rd and 5th order multidimensional time-dependent signals.

**Poster**

**TUE.PO.74 15:45**

**Fourier Transform Vibrational Spectroscopy of Cd2O2** by Few-Cycle Near-Infrared Intense Few-Cycle Laser Pulses**

- Toshiaki Ando, Atsushi Iwasaki, and Kaoru Yamanouchi — Department of Chemistry, School of Science, The University of Tokyo, Japan

The vibrational mode frequencies of Cd2O2 were determined with high precision (~0.04 cm⁻¹) by the Fourier transform of the time-dependent yield of Cd2O2 obtained by the pump-probe measurements using near-IR intense few-cycle laser pulses.

**Poster**

**TUE.PO.75 15:45**

**Ultrafast Intersystem Crossing Dynamics of [Re(CO)3(Imi- dazole)(Phenanthroline)]** in Solution**

- Sébastien Ma1 and Leticia González — Institute of Theoretical Chemistry, Faculty of Chemistry, University of Vienna, Vienna, Austria

We present the first surface hopping simulations of a transition metal complex including solution effects and spin–orbit perturbed potential energy surfaces to unravel the femtosecond intersystem crossing dynamics of [Re(CO)3(ImH)( Phen)] (ImH = imidazole, Phen = phenanthroline).

**Poster**

**TUE.PO.76 15:45**

**Photochemistry of the Triiodide Anion Captured by Fem- tosecond Electron Diffraction**

- Rui Xian1,2, Stuart Hayes1,2, Gaston Corthey1,2, Alexander Marx1,2, Carole Morrison1, Cheng Lu1, Valenty Prokhorenko2, and Dwayne Miller1,2,4 — 1Max Planck Institute for the Structure and Dynamics of Matter, Hamburg, Germany — 2Hamburg Centre for Ultrafast Imaging, Germany — 3School of Chemistry and EaStCHEM Research School, University of Edinburgh, United Kingdom — 4Departments of Chemistry and Physics, University of Toronto, Canada

The photochemistry of the triiodide anion has been investigated by femtosecond electron diffraction. The data indicate the presence of reaction products and large amplitude coherent motion. New approaches for atomic-level reconstruction are considered.

**Poster**

**TUE.PO.77 15:45**

**Ultrafast Charge Dynamics in Thin Films of Prussian Blue Analogues**

- Luke Hedley1, Mitch Horbury2, Florian Liedt1, Neil Robertson3, and J. Olof Johanson1 — 1University of Edinburgh, Edinburgh, UK — 2University of Warwick, Coventry, UK

Ultrafast transient absorption and spectroelectrochemical measurements have been applied to the V-Cr analogue of the Prussian Blue family of compounds, which exhibit diverse optical and magnetic properties. Fast intersystem crossing was observed after charge-transfer excitation.

**Poster**

**TUE.PO.78 15:45**

**withdrawn**

**Poster**

**TUE.PO.79 15:45**

**Model-free Decomposition of Transient Absorption Spectra into Components with Temporally Non-constant Shape**

- Bernhard Lang, Arndt Rosspeintner, and Eric Vauthery — Department of Physical Chemistry, University of Geneva, Switzerland

Time-Resolved broadband anisotropy is used to disentangle transient absorption spectra containing overlapping contributions from different states and species. Spectral components with changing shape can be extracted without the use of a kinetic model.
Ultrafast dissociation of vinyl bromide after passage through a conical intersection: an attosecond transient absorption spectroscopy study — • Maurizio Reduzzi1, Yuki Kobayashi1, Florian Rott2, Thomas Schmappinger1, Henry Timmers1, Kristina Chang1, Sven Osterling2, Daniel M. Neumark1,2, Regina de Vivie-Riedle1, and Stephen R. Leone1,3,4 — 1Department of Chemistry, University of California, Berkeley, California 94720, USA — 2Department of Chemistry, Ludwig-Maximilians-Universität München, Baten unhappy 5-13, 81377 Munich, Germany — 3Chemical Sciences Division, Lawrence Berkeley National Laboratory, Berkeley, CA 94720, USA — 4Department of Physics, University of California, Berkeley, California 94720, USA

Ultrafast dissociation of vinyl bromide after strong-field excitation is characterized experimentally and numerically. Multiphoton excitation of the π → π* transition, followed by passage through a conical intersection, results in Br dissociation within 100 fs.

Parallel and perpendicular transition contributions in bond softening fragmentation of O2+ in intense laser field — • Arnab Sen1, Ram Gopal2, Shilpa Sahu3, Anbru Venkataraman4, M Anand2, and Vandana Sharma2 — 1Indian Institute of Science Education and Research, Pune, India — 2Tata Institute of Fundamental Research, Hyderabad, India — 3Indian Institute of Technology, Hyderabad, India

We observed bond softening fragmentation of O2+ molecular ion in a moderately intense laser field. O+ ion angular distribution spectrum suggests that probability of perpendicular transition is higher than parallel transitions.

Vibrational Coherence in Ultrafast Electron Transfer Reaction Observed by Broadband Transient Absorption Spectroscopy — • Yusuke Yoneda1, Bryan Kudisch1, Shahnawaz Rafiq1, Margherita Majuri2, Gregory Scholes4, and Hiroshi Miyasaka4 — 1Osaka University, Toyonaka, Osaka, Japan — 2Princeton University, Princeton, USA

Ultrafast electron transfer reaction was investigated by means of broadband transient absorption spectroscopy. Vibrational coherence of 310 cm⁻¹ mode was reduced with increasing electron transfer rate, suggesting this vibration is coupled to electron transfer reaction.

Tuneable Intramolecular Charge Separation States in Molecular Dyads for Molecular Photonics and Electronics — Maryam Akbarimooosay1, Egmont Rohwer1, Ariana Rondi1, Jihane Hankahe2, Yan Geng3, Silvio Decurtins3, Andreas Hauser3, Shi-Xia Liu4, Thomas Feurer1, and Andrea Cannizzo2 — 1Institute of Applied Physics, University of Bern, Sidlerstrasse 5, CH-3012 Bern, Switzerland — 2Department of Physical Chemistry, University of Geneva 30 Quai Ernest Ansermet, 1211 Geneva, Switzerland — 3Department für Chemie und Biochemie Universität Bern, Freiestrasse 3, 3012 Bern, Switzerland

We investigated with ultrafast transient absorption a new family of metal-free donor-acceptor dyads with charge separation lifetime tunable over almost 3 orders of magnitude varying periphery substituents and polarity of the environment.

Pump-probe spectroscopy with single cycle THz pulses: Stark effects in liquid-phase solvated molecules — • Egmont J. Rohwer1, Zoltan Ollmann1, Shi-Xia Liu2, and Thomas Feurer1 — 1Institute of Applied Physics, University of Bern, Bern, Switzerland — 2Department of Chemistry and Biochemistry, University of Bern, Bern, Switzerland

We report on Stark effects observed in the ground state visible absorption spectrum induced by a single cycle THz pulse with peak electric fields on the order of 1 MV/cm in liquid-phase solvated molecules.

Intersystem crossing dynamics in thionated uracils studied by time-resolved photoelectron spectroscopy: The effect of substituent position — • Susanne Ullrich and Abed Mohamadzade — Department of Physics and Astronomy, University of Georgia, Athens, GA, USA

The photophysics of thionated uracils are investigated using time-resolved photoelectron spectroscopy with emphasis on evaluating differences in intersystem crossing dynamics with respect to substituent position.

Probing Conical Intersection Dynamics Facilitating Photostability and Photodamage in Heterocyclic Molecule — • Shunsuke Adachi1, Tom Schattenburg2, and Toshinori Suzuki1 — 1Department of Chemistry, Graduate School of Science, Kyoto University, Kitashirakawa Oiwakecho, Sakyo-ku, Kyoto 606-8502, Japan — 2Laboratorium für Physikalische Chemie, ETH Zurich, 8093 Zurich, Switzerland

Conical intersection dynamics upon photoexcitation in furan are studied by time-resolved photoelectron spectroscopy using vacuum-ultraviolet probe pulses. The ring-puckering pathway is dominant and facilitates photostability, while the ring-opening pathway is minor and responsible for photodamage.

Exciton Exciton Annihilation as a Mechanism for Uphill Transfer in a Molecular exciton System — • Pavel Malevich1, Craig N. Lincoln1, Matthias Block1, Bastian Bausch1, Hans v. Berlepsch2, Eberhard Riedle2, and Juergen Hauser1,4 — 1Photonics Institute, Vienna University of Technology, Gußhausstrasse 27, 1040 Vienna, Austria — 2Lehrstuhl für BioMoleküle Optik, Ludwig-Maximilians-Universität (LMU), Oettingenstr. 67, 80538 Munich, Germany — 3Forschungszentrum für Elektronenmikroskopie, Institut für Chemie und Biochemie, Freie Universität Berlin, Fabrikstrasse 36a, D-14195 Berlin, Germany — 4Professor für Dynamische Spektroskopie, Fakultät für Chemie, Technische Universität München, Lichtenbergstr. 4, D-85748, Garching b. Muencheng, Germany

By combining transient absorption and flux-dependent emission intensity on a strongly excitonically coupled molecular system, we show how EEA facilitates energetic uphill transfer. The excitonic dynamics have both barrier-free and FRET-controlled diffusion contributions.
Tuesday Sessions

Poster TUE.PO.88 15:45
Unveiling the TT State in Singlet Fission from Concentration Dependent Photodynamics — NIKOLAS WOLLSCHEDE1,2, NICOLÒ ALAGNA1,∗, LUIS PEREZ LUSTRES1,3, TAO BUCKUP, SEBASTIAN HAHN1,∗∗, UWE BUNZ1,2, and MARCUS MOTZKUS1,2 — 1Physikalisch-Chemisches Institut, Universität Heidelberg, D-69120 Heidelberg, Germany — 2Centre for Advanced Materials, Universität Heidelberg, D-69120 Heidelberg, Germany — 3Organisch-Chemisches Institut, Universität Heidelberg, D-69120 Heidelberg, Germany

Singlet fission is slowed down in highly concentrated solutions compared to thin films. The underlying mechanism and the spectrum of an intermediate TT state with significant singlet character were resolved.

Poster TUE.PO.89 15:45
Broadband 2DES Probes Alternative Charge-generation Pathways in Organic Donor-Acceptor Blend Heterojunctions — YIN SONG1, XIAO LUI2, STEPHEN FORREST1,2,∗, and JENNIFER OGILVIE1,∗— 1Department of Physics, University of Michigan, Ann Arbor, Michigan, USA — 2Department of Electrical Engineering and Computer Science, University of Michigan, Ann Arbor, Michigan, USA

We investigated the charge-generation dynamics in organic donor-acceptor blends using broadband two-dimensional electronic spectroscopy spanning 540–1000 nm. Using global-target analysis, we find alternative charge-generation pathways initiated by photoexcitation in both acceptor and donor domains.

Poster TUE.PO.90 15:45
withdrawn

Poster TUE.PO.91 15:45
Real-Time Probing of Charge-Transfer Induced Interfacial Fields in a Dye-Semiconductor System using Time-Resolved XPS — JOHANNES MAHL1,2, STEFAN NEPP1,3, FRIEDRICH ROTH1,2, ANDREY SHAVORSKY1,3, NILS HUSE1,5, HENDRIK BLUM1,2, WOLFGANG EBERHARD1,5, and OLIVER GESSNER1 — 1Chemical Sciences Division, Lawrence Berkeley National Laboratory, Berkeley, CA, 94720 USA — 2Physics Department Universität Hamburg, 22607 Hamburg, Germany — 3Helmholtz-Zentrum Berlin für Materialien und Energie, 14109 Berlin, Germany — 4Institute for Experimental Physics, TU Bergakademie Freiberg, 09599 Germany — 5Center for Free-Electron Laser Science DESY, 22607 Hamburg, Germany — 6MAX IV Laboratory, 225 94 Lund, Sweden

Photo-induced charge carrier dynamics and transient interfacial fields at the interface between N3 polypyridine complexes and films of nanocrystalline ZnO are probed by picosecond time-resolved X-ray photoelectron spectroscopy.

Poster TUE.PO.92 15:45
Solvation effects in Ultrafast Intramolecular Electron Back-Transfer in Molecular Fe-based Photosensitizers — KRISTIAN KUNNU1, LIN LI1, MARCO REINHARD1, KATHRYN LEDBETTER1, KASPER KAER1,2, SERGEI KOROJOV1, KIYORO HONG1, ELISA BLAIR1, CHARLES TUTT1, SANG JUN LEE2, DENNIS NORDLUND1, DIANA BREGENHOLT-ZEDERKOF1, TIM VAN DRIEL3, ROBERTO ALONSO-MORI1, SIEKE NELSON4, MICHAEL KOZINA5, AMY CORDONES-HAHN1, and KELLY GAFFNEY2,∗— 1Stanford PULSE Institute, SLAC National Accelerator Laboratory, Menlo Park, USA — 2Department of Physics, Technical University of Denmark, Lyngby, Denmark — 3Stanford Synchrotron Radiation Laboratory, SLAC National Accelerator Laboratory, Menlo Park, USA — 4Linac Coherent Light Source, SLAC National Accelerator Laboratory, Menlo Park, USA

MLCT excited state lifetimes of [Fe(CN)3(2,2’-bipyridine)]2− and [Fe(CN)3(2,3-bis(2-pyridyl)pyrazine)]2− exhibit large solvent dependence, described by Marcus-like model with changing driving force and constant reorganization energy. By contrast, [Fe(CN)3(2,2’-bipyrindine)]2− MLCT lifetimes show very small influence on solvatochroism.

Poster TUE.PO.93 15:45
Directional Control of dissociative Ionization by a mid-infrared two-colour Laser Field — VINCENT WANG1,2,∗, HEIDE IBRAHIM1, SAMUEL BEAULIEU1, NICOLAS THIRE1, BRUNO SCHMIDT1, YUNPEI DENG1, ALI ALNASSER1, IGOR LITVINYUK4, XIAO-MIN TONG1, and FRANÇOIS LÉGARE1 — 1Institut National de la Recherche Scientifique, Varennes, QC, Canada — 2Institute for Photonics and Nanotechnologies CNR-IFN, Milano, Italy — 3few-cycle Inc., Montreal, QC, H1L 5W5, Canada — 4Paul Scherrer Institut, Villigen, Switzerland — 5Physics Department, American University of Sharjah, Sharjah, UAE — 6Centre for Quantum Dynamics, Griffith University, Queensland, Australia — 7Center for Computational Sciences and Faculty of Pure and Applied Sciences, University of Tsukuba, Ibaraki, Japan

Using asymmetric two-color laser fields composed of 1800 and 900nm, we have simultaneously controlled four well identified fragmentation channels in dissociative ionization of the hydrogen molecule, resulting in enhanced electron-localization sensitivities of up to 65%.

Tuesday Sessions

TUE.4A: Ultrafast Electron Microscopy

Chairered by Bradley Siwick, McGill University, Montreal, Canada

Time: Tuesday, 17:15–19:00
Location: Festsaal

Oral TUE.4A.1 17:15
Ultrafast Electron Diffraction of THz-excited Nanostructures — KATHRYN MOHLER1,2 and PETER BAUM1,2 — 1Ludwig-Maximilians-Universität München, Garching, Germany — 2Max Planck Institute of Quantum Optics, Garching, Germany

We study the electromagnetic response of nanostructures to single-cycle THz excitation using ultrafast electron diffraction. There are complex sub-THz-cycle Bragg spot dynamics that relate via time-dependent Aharonov-Bohm-like phase shifts to the nanoscale electromagnetic potentials.

TUE.4B: Transition-Metals and Nanocrystals

Time: Tuesday, 17:15–19:00
Location: Spiegelsaal

Oral TUE.4B.1 17:15
Ballistic Excited State Dynamics Revealed by Polarized fs-XANES — ROSEANNE SENSON1,2,∗, RICHARD MILLER1, ANIRUDDHA DE2, ROBERTO ALONSO-MORI1, JAMES GLOWNIK1, and JAMES PENNER-HAHN1,∗— 1Department of Chemistry, University of Michigan, Ann Arbor, MI 48109 USA — 2Biophysics, University of Michigan, Ann Arbor, MI, 48109 USA — 3Department of Physics, University of Michigan, Ann Arbor, MI 48109 USA — 4Linac Coherent Light Source, SLAC National Accelerator Laboratory, Menlo Park, CA 94025, USA
Polarized time-resolved XANES is used to characterize the sequential ballistic excited state dynamics of cyanocobalamin and adenosylcobalamin. Excitation at 550 nm and 365 nm allows resolution of axial and equatorial contributions to the dynamics.

Oral TUE.4B.2 17:30
Characterizing divergent spin-orbit coupling effects on ultrafast nonradiative decay in transition-metal compounds — William Carberry and Daniel Turner — New York University, New York City, USA
Two-dimensional electronic spectroscopy reveals divergent, spin-orbit coupling mediated, electronic relaxation dynamics in iridium(IV) hexabromide ([IrBr6]2-) and a ruthenium(II)-based molecule used in dye-sensitized solar cells.

Oral TUE.4A.2 17:30
Structural Phase Transitions and Phase Ordering at Surfaces Probed by Ultrafast LEED — Jan Gerrit Horstmann1, Gero Storeck1, Bareld Wit1, Theo Dierkens1, Dennis Epp2, Kai Rossnagel2, Sascha Schäfer2, Simon Vogelgesang3, and Claus Ropers2 — 1IV, Physical Institute, University of Göttingen, Friedrich-Hund-Platz 1, 37077 Göttingen, Germany — 2Institute for Experimental and Applied Physics, University of Kiel, 24098 Kiel, Germany
We demonstrate the capability of ultrafast low-energy electron diffractometry to resolve phase-ordering kinetics and structural phase transitions on their intrinsic time scales with ultimate surface sensitivity.

Oral TUE.4A.3 17:45
Time-Resolved Photoemission Electron Microscopy of a Plasmonic Silt Resonator using 1 MHz, 25 fs, UV-to-NIR-Tunable Pulses — Bernhard Huber1, Matthias Hensen1, Sebastian Pres1, Victor Lienstiet1, Julian Lütting1, Emanuel Wittmann2, Enno Krauss3, Daniel Friedrich1, Bert Hecht1, Eberhard Riedle1, and Tobias Brixner1 — 1Institut für Physikalische und Theoretische Chemie, Universität Würzburg, Am Hubland, 97074 Würzburg, Germany — 2Lehrstuhl für BioMolekulare Optik, LMU München, Oettingenstr. 67, 80538 München, Germany — 3Nanos-Optics & Biophotonics Group, Experimentelle Physik 5, Universität Würzburg, Am Hubland, 97074 Würzburg, Germany
We discriminate different field dynamics across spatial distances as small as 33 nm within a plasmonic silt resonator using aberration-corrected photoemission electron microscopy and a tunable broadband optical parametric amplifier at 1 MHz repetition rate.

Oral TUE.4A.4 18:00
Ultrafast Electron Microscopy of Electromagnetic Waveforms — Andrey Ryzov1 and Peter Baum2 — 1Ludwig-Maximilians-Universität München, Am Coulombwall 1, 85748 Garching, Germany — 2Ludwig-Maximilians-Universität München, Am Coulombwall 1, 85748 Garching, Germany
We advance ultrafast electron microscopy from atomic motions into the domain of electron-dynamics. Time-frozen shadow imaging with sub-light-cycle-electron pulses reveals the electromagnetic fields around a metamaterial element with sub-cycle and sub-wavelength resolution.

Oral TUE.4A.5 18:15
Optical-Field-Controlled Photoemission from Plasmonic Nanotennas with a Sub-Two-Cycle, 6 nj, Octave-spanning Ti:sapphire Oscillator — Shih-Hsuan Chia1,2, Phillip Keathley3, William Putnam3,4, Fabian Scheib3,4, Richard Hobbs1,2,3, Karl Berggren1, and Franz Kärtner1,2,3 — 1Center for Free-Electron Laser Science, Deutsches Elektronen-Synchrotron, Notkestraße 85, 22607 Hamburg, Germany — 2Department of Electrical Engineering and Computer Science and Research Laboratory of Electronics, Massachusetts Institute of Technology, 77 Massachusetts Ave., Cambridge, MA 02139, USA — 3Physics Dept., University of Hamburg and the Hamburg Center for Ultrafast Imaging, Luruper Chaussee 149, 22761 Hamburg, Germany — 4Northrop Grumman Corporation, NG Next, 1 Space Park Blvd., Redondo Beach, CA
The optical bandgap of anatase TiO2 nanoparticles is governed by bulk excitonic effects. Ultrafast deep-ultraviolet spectroscopy allows probing the electron cooling in the conduction band, which is found to occur in tens of femtoseconds.
Tuesday Sessions

90278, USA — 5Centre for Research on Adaptive Nanostructures and Nanodevices (CRANN), Advanced Materials and Bio-Engineering Research Centre (AMBER), and School of Chemistry, Trinity College Dublin, Dublin 2, Ireland

We develop a carrier-envelope-phase-stable Ti:sapphire oscillator that generates 6 nJ pulses compressible to sub-two-optical cycles in duration. We use the optimized oscillator to demonstrate carrier-envelope-phase-sensitive (CEP-sensitive) photomission from metallic nanoantennas in the near-infrared.

Invited

Single-Cycle Autocorrelation in Attosecond Coherent Nanotransport — Markus Ludwig1, Tobias Rybka1, Felix Ritzkowsky1, Dana-Codruta Marinica2, Andrei Borissov2, Garikoitz Aguirregabiria3,4, Javier Aizpurua3,4, Alfred Leitenstorfer1, and Daniele Buda1 — 1Department of Physics and Center of Applied Photonics, University of Konstanz, D-78457 Konstanz, Germany — 2Institut des Sciences Moléculaires d’Orsay, UMR 8214 CNRS-Université Paris-Sud, Bât. 520, 91405 Orsay Cedex, France — 3Material Physics Center CSIC-UPV/EHU, Paseo Manuel de Lardizabal 5, 20018, Donostia-San Sebastián, Spain — 4Donostia International Physics Center DIPC, Paseo Manuel de Lardizabal 5, 20018, Donostia-San Sebastián, Spain

We employ a pair of single-cycle near-infrared pulses to control coherent transfer of single electrons between the contacts of a plasmonic nanocircuit. As a result, attosecond and highly nonlinear phenomena occur at pl pulse energies.

Oral

Charge Carrier Dynamics in Lead Bromide Perovskites Probed by Femtosecond Broadband Deep-UV Spectroscopy — Thomas Rossi1, Lihe Wang1, Y.-H. Chiang2, P. Chen2, T.-F. Guo2, Malte Oppermann1, M.-C. Tsai2, and Maied Cherghi1 — 1Laboratory of Ultrafast Spectroscopy & Lausanne Centre of Ultrafast Science, Ecole Polytechnique Federale de Lausanne, SB-ISIC-LSU, Station 6, CH-1015 Lausanne, Switzerland — 2Department of Photonics, Advanced Optoelectronic Technology Centre, NCKU, Tainan 701, Taiwan

Charge carrier dynamics following band gap excitation of methylammonium lead bromide perovskites is investigated by femtosecond broadband deep-UV spectroscopy. Electron cooling time of ca. 270 fs is monitored along the M-R direction of the Brillouin zone.

Oral

Tabletop EUV Coherent Diffractive Imaging and Small Angle Scattering of Colloidal Crystals — Giulia Fulvia Mancini1,2,5, Robert Karl1, Elisabeth Shanblatt1, Charles Bevis1, Dennis Gardner1, Michael Tanaskalvaa1, Jennifer Russell1,6, Daniel Adams1, Henry Kapteyn1,7, John Badding1,5,6, Thomas Mallouk1,5,6, and Margaret Murnane1,7 — 1JILA, 440 UCB, University of Colorado, Boulder, CO 80309 USA — 2Laboratory for Ultraviolet Spectroscopy, Lausanne Center for Ultrafast Science (LACUS), Ecole Polytechnique Federale de Lausanne, CH-1015 Lausanne, Switzerland — 3Paul Scherrer Institut, WSLA/210, 5232 PSI Villigen, Switzerland. — 4Department of Chemistry, Penn State University, University Park, PA 16802, United States. — 5Department of Physics, Penn State University, University Park, PA 16802, United States. — 6Materials Research Institute, Penn State University, University Park, PA 16802, United States. — 7KMLabs Inc., 4775 Walnut Street, Suite 102, Boulder, CO 80301, United States.

We demonstrate full-field quantitative ptychographic imaging using tabletop high harmonics to visualize the extended structure of silica close-packed nanosphere multilayers with <20nm spatial resolution, and also extract small-angle EUV Bragg scattering order/disorder correlations.
WED.1.1 8:30
A broadband electro-optic light source for ultrafast science —
•David R. Carlson, Daniel D. Hickstein, Wei Zhang, Andrew Metcalf, Franklyn Quinlan, Scott A. Diddams, and Scott B. Papp — National Institute of Standards and Technology, Boulder, CO, USA

We report a 10-GHz electro-optic ultrafast source that produces stable few-cycle pulses from photonic waveguides without a mode-locked resonator. Octave-spanning supercontinuum generation is used to implement dual-comb spectroscopy across the near infrared at high speed.

WED.1.2 9:00
Few-cycle Pulse Driven Long-wave Infrared Frequency Combs —•Henry Timmers¹, Abijith Kowligy¹, Alex Lind¹,², Flavio C. Cruz³, Nima Nader³, Myles Silfies³, Thomas K. Allison³, Gabriel Ycas⁴, Peter G. Schunemann⁴, Scott B. Papp⁴, and Scott A. Diddams⁴ —¹Time and Frequency Division, National Institute of Standards and Technology, Boulder CO, USA —²Department of Physics, University of Colorado, Boulder CO, USA —³Applied Physics Division, National Institute of Standards and Technology, Boulder CO, USA —⁴Stony Brook University, Stony Brook NY, USA —⁵BAE Systems, Nashua NH, USA

We present a robust scheme for generating bright, super-octave infrared combs in the molecular fingerprint region using intra-pulse difference frequency generation in orientation-patterned GaP. We demonstrate high-resolution, dual-comb molecular spectroscopy utilizing this source.

WED.1.3 9:15
Phase-matched XUV frequency comb generation at 77 MHz —•Christoph M. Heyl¹,²,³, Gil Porat³, Stephen B. Schoun³, Craig Benko¹, Nadine Dörre¹,⁴, Kristian L. Corvin¹,⁵, and Jun Ye¹ —¹ILIA, NIST and the University of Colorado, 440 UCB, Boulder, CO 80309-0440, USA —²Department of Physics, Lund University, P. O. Box 118, SE-221 00 Lund, Sweden —³Now at: Helmholtz-Institute Jena, Fröbelstieg 3, 07743 Jena and Deutsches Elektronen-Synchrotron DESY, 22607 Hamburg, Germany —⁴University of Vienna, Faculty of Physics, VCQ & QuaNbios, Boltzmanngasse 5, A-1090 Vienna, Austria —⁵Department of Physics, Kansas State University, Manhattan, Kansas, USA

We discuss recent progress for power scaling of XUV frequency combs enabling phase-matched high harmonic generation at 77 MHz repetition rate. We demonstrate an average power of ~2 mW at photon energy of 12.7 eV.

WED.1.4 9:30
100 W-level carrier-envelope-phase stable thin-disk oscillator —•Sebastian Gröbmeier¹, Jonathan Brons¹, Marcus Seidel¹, Ferenc Krausz¹, and Oleg Pronin² —¹LS für Experimentalphysik - Laserphysik, LMU München, Am Coulombwall 1, 85748 Garching, Germany —²Max-Planck-Institut für Quantenoptik, Hans-Kopfermann-Str. 1, 85748 Garching, Germany

We present carrier-envelope-phase (CEP) stabilization of a Kerr-lens mode-locked thin-disk oscillator with an average output power of 105 W and intra-cavity peak-powers exceeding 200 MW representing the highest average power CEP stable laser today.

WED.1.5 9:45
600 W Ultrafast Thin-Disk Amplifier System —•Christian Grebing¹, Marcel Schultzze¹, Sandro Klingeibl¹, Christoph Wandt¹, Catherine Y. Trisset², Stephan Prinz³, Sabrina Bayer³, Knut Michel³, and Thomas Metzger¹ —¹TRUMPF Scientific Lasers GmbH + Co. KG, Feringastr. 10a, 85774 Unterföhring, Germany —²Munich University of Applied Sciences, Fakultät für angewandte Naturwissenschaften und Mechatronik, Lothstr. 54, 80335 München, Germany

A thin-disk regenerative amplifier with a compressed output power of 600 W is presented. At a wavelength of 1031 nm pulse energies up to 80 mJ are demonstrated at multi-kilohertz repetition rates with pulse durations of < 1.0 ps.

WED.1.6 10:00
Phasing methods of tiled-aperture coherent beam combining for high peak power lasers —•Chun Peng¹,², Xiaoyan Liang¹,³, Rencui Li¹,², Wenzhi Li¹,²,³, and Ruxin Li¹,²,³ —¹State Key Laboratory of High Field Laser Physics, Shanghai Institute of Optics and Fine Mechanics, Chinese Academy of Sciences, Shanghai 201800, China —²University of Chinese Academy of Sciences, Beijing 100049, China —³IFSA Collaborative Innovation Center, Shanghai Jiao Tong University, Shanghai 200240, China —⁴School of Physical Science and Technology, ShanghaiTech University, Shanghai 200031, China

We demonstrate two type phasing methods for tiled-aperture coherent beam combining for high-power lasers based on the near and far field measurement techniques respectively, a comparison is made.

10:15–10:45: EXHIBITION AND COFFEE BREAK
kindly sponsored by Light Conversion
Wednesday Sessions

**WED.2A: Dynamics in Solids III**
Chaired by Steven T. Cundiff, University of Michigan, Ann Arbor, MI, USA

Time: Wednesday, 10:45–12:30 Location: Festsaal

**WED.2A.1** 10:45
Combining time-resolved optical (TOX), electronic (trARPES) and structural (UED) probes on the class of rare earth triluturides R-Te3 — TIMM ROHWER1,2, EDBERT SIE1, ALFRED ZONG1, BYRON FREELON3, CHANGMIN LEE4, ANSHUL KOGAR5, YAOQING BIE1, PABLO JARILLO-HERRERO1, and NUN GEDIK1 — 1Department of Physics, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139, United States — 2Center for Free-Electron Laser Science, Deutsches Elektronen-Synchrotron DESY, Luruper Chaussee 149, 22761 Hamburg, Germany — 3Department of Physics, University of Louisville, Louisville, Kentucky 40208, United States

The combination of EUV based time-resolved Angle-Resolved-Photo-Electron-Spectroscopy (trARPES), Ultrafast-Electron-Diffraction (UED) and Transient-Optical-Spectroscopy (TOS) facilitates a comprehensive study and all-embracing analysis of correlated dynamics, exemplified on the system of Charge-Density-Waves (CDW’s) in rare earth triluturides (RIE3).

**WED.2A.2** 11:00
Probing Non-Equilibrium Conditions in Solids using Angle-Resolved Photoemission driven by a Femtosecond Enhance

Cavity — ARTHUR K. MILLS1,2, MENMXING NA1,2, SERGEY ZHIDANOVICH1,2, FABIO BOSCHINI1,2, MATTEO MICHIARDI1,2, ELIA RAZZOLI1,2, ANDREA DAMASCIELLI1,2, and DAVID J. JONES1,2 — 1University of British Columbia, Vancouver, Canada — 2Stewart Blusson Quantum Matter Institute, Vancouver, Canada — 3Max Planck Institute for Solid State Research, Stuttgart, Germany

Using a new femtosecond extreme ultraviolet source with a narrow linewidth we track electron dynamics at graphitic Brillouin zone edge. The full Brillouin zone of next-generation materials are now within reach for future studies.

**WED.2A.3** 11:15
Charge-density-wave inT-TiSe2: exciton-phonon separation by femtosecond valence band dynamics — HAMOON HEDAYAT1, DAVIDE BUGINI1, SARA KARBAEI3, SVEN FRIEDEMANN2, JASPER VAN WEZEL1, STEPHEN R CLARK1, CHARLES SAYERS2, ENRICO DA COMO1, GIULIO CERULLO1, CLAUDIA DALLERA1, and ETTORE CARPENE5 — 1Dipartimento di Fisica, Politecnico di Milano, 20133 Milan, Italy — 2HH Wills Physics Laboratory, University of Bristol, BS8 1TL Bristol UK — 3Institute for Theoretical Physics, Institute of Physics, University of Amsterdam, 1090 GL Amsterdam, The Netherlands — 4Department of Physics and Centre for Photonics and Photonic Materials, University of Bath, BA2 7AY Bath, UK — 5Dipartimento di Fisica, Politecnico di Milano, 20133 Milan, Italy

**WED.2B: Cluster and Gasphase Dynamics**
Chaired by Claudio Cirelli, Paul Scherrer Institute, Villigen, Switzerland

Time: Wednesday, 10:45–12:30 Location: Spiegelsaal

**WED.2B.1** 10:45
Ultrafast Mapping of Relaxation Dynamics of Ethylene Cation — MATTEO LUCCHINI1,2, MARIO MURARI1,2, GIACINTO D. LUCARELLI1,2, FABIO FRASSERTO1, LUCA POLETT01, and MAURO NISOLI1,2 — 1Department of Physics, Politecnico di Milano, 20133 Milano, Italy — 2Institute for Photonics and Nanotechnologies, IFN-CNR, 20133 Milano, Italy — 3Institute for Photonics and Nanotechnologies, IFN-CNR, 35131 Padova, Italy

The complex ultrafast molecular relaxation dynamics of ethylene, initiated by tunable vacuum-ultraviolet $\sim$10-fs pulses, was measured. Exploiting state selectivity, an unprecedented time-energy mapping of the process was demonstrated on a few-femtosecond temporal scale.

**WED.2B.2** 11:00
Evaporation of an Anisotropic Nanoplasma — CAMILA BACCHELLI1,2, ADAM S. CHATTERLEY1, FLORIAN LACKNER1, C.D. PEMMARAJU1, RIC. M.P. TANYAG1, CHARLES BERNANDO1, DEEPAK VERMA1, SEAN O’CONNELL1, MAXIMILIAN BUCHER2, KEN R. FERGUSON2, TAIS GORKHOVER3,4, RYAN N. COFFER4, GIACOMO COSOLVICH4, DIPANWITA RAY5, TIMUR OSPOV6, DANIEL M. NEUMARK1,2, CHRISTOPH BOSTEDT1,2, ANDREY E. VILESOV1,3, and OLIVER GESSNER1 — 1Chemical Sciences Division, Lawrence Berkeley National Laboratory, Berkeley, California 94720, USA — 2Department of Chemistry, University of California Berkeley, California 94720, USA — 3Department of Chemistry, University of Southern California, Los Angeles, California 90089, USA — 4Department of Physics and Astronomy, University of Southern California, Los Angeles, California 90089, USA — 5Argonne National Laboratory, 9700 South Cass Avenue B109, Lemont, IL 60439, USA — 6Linac Coherent Light Source, LCLS, SLAC National Accelerator Laboratory, 2575 Sand Hill Road, Menlo Park, California 94025, USA — 7Institute of Optics and Atomic Physics, Technical University of Berlin, Hardenbergstraße 36, 10623 Berlin, Germany — 8Department of Physics and Astronomy, Northwestern University, 2154 Sheridan Road, Evanston, IL 60208, USA

Intense laser induced plasma dynamics in sub-micron scale helium droplets are monitored by femtosecond time-resolved X-ray coherent diffractive imaging. Anisotropic surface softening and strongly anisotropic shrinking of the plasma core are observed.

**WED.2B.3** 11:15
Coupled nuclear-electronic dynamics in photoionization of H2 — LAURA CATTANEO1, JOHANNA VOS1, ROGER YULIO BELLO1, ALICIA PALACIOS2, SEBASTIAN HEUSER1, LUCA PEDRELLI1, MATTEO LUCCHINI1, CLAUDIO CIRELLI1,2, FERNANDO MARTIN1, and URSULA KELLER1 — 1Physics Department, ETH Zurich, 8093 Zurich, Switzerland, EU — 2Departamento de Quimica, Módulo 13, Universidad Autónoma de Madrid, 28049 Madrid, Spain, EU — 3Empa - Swiss Federal Laboratories for Materials Science & Technology, 8600 Dübendorf, Switzerland, EU

In this study we investigate the dissociative photoionization of molecular hydrogen H2, addressing the influence of autoionizing
We investigate the driving mechanism leading to charge-density-wave transition in 1T-TiSe$_2$ single crystals. Our results show that both exciton instability and phonons cooperate to develop the charge ordered phase below 202 K.

Oral

**Observation of Counterion Effects and Dimensionality Reduction in Single-Crystal (EDO-TTF)$_2$SbF$_6$ with Ultrafast Electron Diffraction**

—Lai Chung Li$^{1,2}$, Yifeng Jiang$^{1,2}$, Henrike M. Mueller-Werkmeister$^3$, Cheng Lu$^3$, Gustavo Moriena$^{1,2}$, Manabu Ishikawa$^4$, Yoshiaki Nakano$^4$, Hidetsugu Yamochi$^4$, and R. J. Dwayne Miller$^{1,2}$ — 1University of Toronto, Toronto, Canada — 2Max Planck Institute for the Structure and Dynamics of Matter, Hamburg, Germany — 3University Postdam, Postdam, Germany — 4Kyoto University, Kyoto, Japan

Femtosecond electron diffraction is used to resolve structural dynamics in single-crystal (EDO-TTF)$_2$SbF$_6$, (X = P, Sb). The retarded and lower-dimensional dynamics of the latter illustrate the dominant role of counterion motion in stabilizing electron transfer.

Oral

**Coherent control of an electron wavefunction in space, time and momentum via the non-local interference of semi-infinite light fields and plasmon polaritons**

—Giovanni Maria Vanacore$^1$, Ivan Madan$^2$, Gabriele Berruto$^1$, Enrico Pomarico$^1$, Kanpeng Wang$^2$, Raymond J. Lamb$^2$, Damien McGrouther$^3$, Ido Kaminer$^3$, Brett Barwick$^4$, F. Javier Garcia de Abajo$^5$, and Fabrizio Carbone$^6$ — 1Institute of Physics, Laboratory for Ultrafast Microscopy and Electron Scattering (LUMES), Ecole Polytechnique Federale de Lausanne (EPFL), Station 6, CH-1015 Lausanne, Switzerland — 2Institute of Quantum Electronics, ETH Zurich, ETH Zurich, Switzerland — 3School of Physics and Astronomy, University of Glasgow, Glasgow G12 8QQ, UK — 4Ripon College, 300 W. Seward St., Ripon, WI 54971, United States — 5ICFO-Institut de Ciencies Fotoniques, The Barcelona Institute of Science and Technology, 08860 Castelldefels (Barcelona), Spain. ICREA-Institució Catalana de Recerca i Estudis Avanzats, Passeig Lluis Companys 23, 08010 Barcelona, Spain

We experimentally demonstrate coherent manipulation of an electron wavefunction on the attosecond timescales using a properly synthesized electromagnetic field distribution, and show that using vortex plasmons orbital angular momentum can be transferred to the electrons.

Oral

**Real-Time Observation of Polaritonic Transport Using Ultrafast Microscopy**

— Georgi Rozenman, Katherine Akulov, Adina Golombek, and Tal Schwartz — School of Chemistry and Tel Aviv University Center for Light-Matter Interaction, Tel Aviv University, Tel Aviv, Israel

Using pump-probe microscopy we directly measure transport in organic strongly-coupled cavities for the first time. We show that strong coupling gives rise to micron-scale transport of polaritons and find that their propagation is surprisingly slow.

Oral

**Coherent vibrational wave packet dynamics inside superfluid helium nanodroplets**

— Bernhard Thaler, Pascal Heim, Sascha Ranftl, Miriam Meyer, Leonhard Treiber, Stefan Cesnik, Wolfgang E. Ernst, and Markus Koch — Graz University of Technology, Institute of Experimental Physics, Graz, Austria

The wave packet dynamics of indium dimers inside helium droplets, as observed with time-resolved photoelectron spectroscopy, indicate surprisingly low decoherence and represent a demonstration of femtochemistry inside superfluid helium nanodroplets.

Oral

**Ultrafast Quantum Control of Ionization Dynamics**

— Konrad Hütten$^{1,2}$, Michael Mittermair$^{1,2}$, Sebastian Stock$^{3,4}$, Randolph Beerwerth$^{5,4}$, Vahe Shirvanyants$^{5,6}$, Johann Riemensberger$^{7,8}$, Andreas Dünser$^1$, Rupert Heider$^1$, Martin S. Wagner$^1$, Alexander Guggemos$^1$, Stephan Fritzschke$^{1,9}$, Nikolay M. Kabachnik$^{7,8}$, Reinhard Kienberger$^{1,2}$, and Birgitta Hendry$^{1,5,9}$ — 1Physics Department E11, Technical University of Munich, 85748 Garching, Germany — 2Max Planck Institute of Quantum Optics, 85748 Garching, Germany — 3Helmholtz-Institut Jena, 07743 Jena, Germany — 4Theoretisch-Physikalisches Institut, Friedrich Schiller University Jena, 07745 Jena, Germany — 5Abbe Center of Photonics, Friedrich Schiller University Jena, 07745 Jena, Germany — 6European XFEL GmbH, 28269 Schenefeld Hamburg, Germany — 7Skobeltsyn Institute of Nuclear Physics, Lomonosov Moscow State University, Moscow 119991, Russia — 8International Physics Center (DIPC), E-20018 San Sebastian/Donostia, Spain — 9Institute of Applied Physics, Friedrich Schiller University Jena, 07745 Jena, Germany

The unprecedented combination of transient absorption and ion mass spectroscopy with attosecond resolution is used to study and control the complex multidimensional excitation and decay cascade of an ultrafast Auger process in krypton.

Oral

**Photo-induced Dynamics in Bromoform Molecules Studied by Femtosecond XUV Transient Absorption Spectroscopy**

— Florian Lackner$^{1,2,3}$, Adam S. Chatterley$^{1,2}$, Benjamin W. Toulson$^{1,2}$, Daniel M. Neumark$^{1,2}$, Stephen R. Leone$^{1,2,3}$, and Oliver Gessner$^1$ — 1Chemical Sciences Division, Lawrence Berkeley National Laboratory, Berkeley, CA, USA — 2Department of Chemistry, University of California, Berkeley, CA, USA — 3Institute of Experimental Physics, Graz University of Technology, Graz, Austria — 4Department of Physics, University of California, Berkeley, CA, USA

Ultrafast dissociation dynamics in bromoform molecules initiated by UV (263 nm) excitation and by strong-field ionization are explored using femtosecond XUV transient absorption spectroscopy.
Oral WED.2A.7 12:15
Picosecond cooperative spin-state switching of iron-triazole nanoparticles —  •Marco Reinhard1, Kristjan Kunnus1, Elisa Blasi2, Kathryn Ledbetter1, Diana Bregenholt-Zederko2, Kasper Skov Kjaer3, Sergey Korodnov1, Kryong Hong1, Lin Li1, Roberto Alonso-Mori4, Tim Brandt von Driel5, Silke Nelson6, Michael Kozina7, Dimosthenis Sokaras8, Olaf Borkiewicz9, Kristoffer Haldrup9, Maciej Lorenc9, Marco Cammarata10, Eric Collet11, Amy Cordoness-Hahn12, and Kelly Gaffney1,4,6, — •Stanford PULSE Institute, SLAC National Accelerator Laboratory, Menlo Park, CA 94025, USA — •2Department of Physics, Technical University of Denmark, 2800 Kongens Lyngby, Denmark — •1Linac Coherent Light Source, SLAC National Accelerator Laboratory, menlo Park, CA 94025, USA — •1X-ray Science Division, Argonne National Laboratory, Lemont, IL 60439, USA — •1Institute of Physics, University of Rennes, 35042 Rennes, France — •1Stanford Synchrotron Radiation Lightsource, SLAC National Accelerator Laboratory, Menlo Park, CA, 94025, USA

Femtosecond X-ray studies of UV-excited iron-triazole nanoparticles reveal ~200 fs molecular-scale followed by sub-100 ps cooperative spin state switching with up to four converted molecular centers per absorbed photon.

WED.PO: EXHIBITION, COFFEE BREAK & POSTER SESSION II

Time: Wednesday, 14:00–15:30

Poster WED.PO.1 14:00
Coherent wavepackets in the Fenna-Matthews-Olson complex are robust to excitonic–structure perturbations caused by mutagenesis —  •Margherita Mairu1, Evgeny Ostromou1, Rafael Saer2, Robert Blankenship2, and Gregory Scholes3 — •1Princeton University, Princeton, New Jersey, United States — •2Washington University, St. Louis, Missouri,United States

The photosynthetic FMO complex is probed by femtosecond pump-probe spectroscopy and compared with a series of genetically modified mutants with distinct excitonic interactions. These experiments allow us to identify vibrational contributions to the coherence.

Poster WED.PO.2 14:00
Ultrafast dynamics in zinc chlorin aggregates for artificial photosynthesis —  •Tongchao Shi1,2, Juan Du1, Zhengzheng Liu1,2, Zeyu Zhang1, and Yuxin Leng1,3 — •1State Key Laboratory of High Field Laser Physics, Shanghai Institute of Optics and Fine Mechanics, Chinese Academy of Sciences, Shanghai 201800, China — •2University of Chinese Academy of Sciences, Beijing 100049, China — •3School of Physical Science and Technology, ShanghaiTech University, Shanghai 200031, China

A layer-structured zinc chlorin aggregates for artificial photosynthesis were studied by 7.1fs real-time vibrational spectroscopy. And the ultrafast dynamics of the excitation and its interaction with molecular vibrations were obtained.

Poster WED.PO.3 14:00
Cyanylated cysteines as infrared labels to unravel the vibrational dynamics along the photocycle of the photo-switchable protein PYP by mid infrared pump-probe spectroscopy —  •Julian M. Schmidt-Engler1, Larissa Blankenburg1, Bar...
Dissipative quantum dynamics simulations reveal a branching of charge separation dynamics in Drosophila Crytochrome due to subtle balanced energetics within the enzyme. In silico mutations of charged amino acids provide control over charge transfer directionality.

Poster  WED.PO.6  14:00
Excitation Energy Transfer and Equilibration Processes in LHClI studied by Multidimensional Electronic Spectroscopy — Thanh Nhut Do³, Adriana Huerta-Viga³, Cheng Zhang¹, Parveen Akhtar¹, Pawel J. Nowakowski¹, Muham­mad Faizal Khu­sa­ideaen¹, Petar H. Lam­­brey¹, and Ho­we­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­­…
At room temperature, we obtain an optical-to-THz conversion efficiency of lithium niobate excited by chirped 30 fs femtosecond laser pulses. High-energy THz pulses with 0.2 mJ have been demonstrated in condensed matter physics, Institute of Physics, Chinese Academy of Sciences, Beijing 100190, China. We present the generation of a single isolated 30 fs electron pulse by the optical gating approach. Then we theoretically demonstrate the feasibility of using this technique to generate single isolated electron pulse.

Efficient generation of 0.2 mJ THz pulses in lithium niobate at room temperature driven by chirped 30 fs Tasaphire laser pulses — Xiao-Ju Wu, Jing-Long Ma, Bao-Long Zhang, Shu-Su Chai, De-Yin Kong, Xuan Wang, Cun-Jun Ruan, Jun-Gang Miao, and Yu-Tong Li — School of Electronic and Information Engineering, Beihang University, Beijing 100101, China. We present the generation of single isolated 30 fs electron pulses from lithium niobate excited by chirped 30 fs femtosecond laser pulses. At room temperature, we obtain an optical-to-THz conversion efficiency of 0.3%.

Two-Dimensional Electronic Spectroscopy in a Co-Linear Geometry with Optical Readout — Patanjali Kambhampati, Hellen Seiler, Samuel Palato, Colin Sonnichsen, and Harry Baker — McGill University, Montreal, Canada. Two-Dimensional Electronic Spectroscopy is demonstrated in a fully co-linear geometry. This approach enables both polarization selectivity and observation of a wide variety of signals based upon phase cycling.

Semiconductor lasers optically pumped in the tunneling excitation regime — Richard Hollinger, Pavel Malevich, Valentina Shumakov, Skirmantas Ališauskas, Dishiti Gupta, Lukas Trefflich, Robert Röder, Audrius Pugžlys, Andrius Baltuška, Carsten Ronning, Christian Spielmann, and Daniil Kartashov — Institute of Optics and Quantum Electronics, Abbe Center of Photonics, Friedrich Schiller University, Max-Wien-Platz 1, 07743 Jena, Germany. We report on experimental results of semiconductor nanowire lasers under nonlinear pumping with intense ultrashort laser pulses. Tuning the pumping wavelength from near- to mid-infrared we observe the transition from multi-photon absorption to tunneling excitation.

Towards Broadband Two-Dimensional Electronic Spectroscopy with ~8 fs phase-locked pulses at 400 nm — Damianos Agathangelou, Youssef El-Khoury, Johanna Brazard, Olivier Créguet, Stefano Haacke, Giulio Cerullo, and Jérémie Léonard — IPCMS, Strasbourg, France. We introduce a two-dimensional spectroscopy setup based on a pair of near-UV-blue (360 - 430 nm), 8.4 fs, phase-locked, collinear excitation pulses and a nearly collinear UV-Vis supercontinuum probe pulse.

Robust Enhancement of High Harmonic Generation via Atto-second Control of Ionization — Barry Bruner, Michael Krueger, Oren Pedatza, Gal Orenstein, Dobon Azoury, and Nirit Dudovich — Department of Physics of Complex Systems, Weizmann Institute of Science, Rehovot 76100 Israel. We demonstrate up to two orders of magnitude enhancements in high harmonic generation efficiency via sub-cycle control and scaling of the ionization rate in a two colour laser field.

High energy fiber laser source at 1750 nm with variable repetition rate for imaging applications — Andreas Wenneker, Dietter Wandt, Jean-Bernard Lecourt, Didier Lekime, Yves Hernandez, Jörg Neumann, and Dietmar Kracht — Laser Zentrum Hannover e.V., Laser Development Department, Hollerithallee 8, 30419 Hannover, Germany. We present a novel ultrashort pulse fiber laser source operating at a center wavelength of 1750 nm which generates 22 nJ of pulse energy at variable repetition rate with a pulse duration of 220 fs.

Generation of Short Deep-UV Pulses in Transparent Solids with a Noncollinear Beam Geometry — Jan Reislöhner, Christoph Leithold, Jesús Delgado Aguilón, and Adrian N. Pfeiffer — Institute of Optics and Quantum Electronics, Abbe Center of Photonics, Friedrich Schiller University, Max-Wien-Platz 1, 07743 Jena, Germany. Using two noncollinear femtosecond pulses, deep-UV pulses are generated from bulk dielectrics with durations < 3 fs at selected emission angles. Angle-resolved spectra of the deep-UV light are used to unravel the light-matter interaction.

High-order Harmonic source spanning up to the Oxygen K-edge based on filamentation pulse compression — Cédric Schmidt, Yoann Pertot, Tadas Balciunas, Kristina Zinchenko, Mary Matthew, Hans Jacob Wörner, and Jean-Pierre Wolf — GAP, Université de Genève, 1227 Carouge, Switzerland. We present a high-order harmonic generation setup extending beyond the oxygen K absorption edge. The 1 kHz repetition rate, high temporal resolution enabled by the short driving pulse duration and bright high-order harmonics generated in helium make this an attractive source for molecular-dynamics studies.

Single shot temporal characterization of XUV FEL Pulses — Rosen Ivanov, Jia Liu, Günter Brenner, Ivette Bermudez, and Stefan Düsterer — Deutsches Elektronen-Synchrotron — DESY, Notkestr. 85, 22607 Hamburg, Germany. We report on experimental results of semiconductor nanowire lasers under nonlinear pumping with intense ultrashort laser pulses. Tuning the pumping wavelength from near- to mid-infrared we observe the transition from multi-photon absorption to tunneling excitation.
Wednesday Sessions

Terahertz-field-driven streaking is a powerful tool for measuring on a single-shot base free-electron laser (FEL) pulses providing pulse duration and arrival time information with around 10 fs resolution for each single FEL pulse.

Poster

**WED.PO.26 14:00**

**Bright self-guided high harmonic generation for single-shot spectroscopy in the water window** — **• Vincent Cardin**, Bruno E. Schmidt1, Nicolas Thibé1, Samuel Beaugieu1, Vincent Wauthy1, Matteo Negro1, Caterina Vozzi2, Valer Tosa2, and François Légaré1 — 1 Institut National de la Recherche Scientifique, Varennes, Canada — 2 few-cycle Inc., Montreal, Canada — 3 FASTLITE, Valbonne, France — 4 Université de Strasbourg - CELIA, Talence, France — 5 Institute for Photonics and Nanotechnologies CNR-IFN, Milan, Italy — 6 INCDFIM, Cluj-Napoca, Romania

We provide evidences that self-guided propagation of multi-mJ infrared pulses in a high-pressure gas cell provides good conditions to achieve bright and well collimated high harmonics with photon energies covering the entire water window.

Poster

**WED.PO.27 14:00**

**Generation of 31-mJ mid-infrared femtosecond pulses at 3.3 μm by a DC-OPA** — **Yuxi Fu1, Kotaro Nishimura1,2, Bing Xue1, Akira Suda1, Katsumi Midorikawa1, and Eiji Takahashi1** — 1 RIKEN Center for Advanced Photonics, RIKEN, 2-1 Hirosawa, Wako, Saitama 351-0198, Japan — 2 Tokyo University of Science, 2641 Yamazaki, Noda-shi, Chiba-ken 278-8510, Japan

We report the generation of 31-mJ mid-infrared pulses at 3.3 μm with duration of 70 fs, by a dual-chirped optical parametric amplification (DC-OPA) scheme. We will further increase the pulse energy to obtain TW-scale, few-cycle mid-infrared pulses.

Poster

**WED.PO.28 14:00**

**Development of an Optical Fibre-Driven Low-Energy Electron Gun with Sub-Picosecond Resolution** — **• Chwon Lee1, Günther Kassier1, and R. J. Dwayne Miller1** — 1 Max Planck Institute for the Structure and Dynamics of Matter, Hamburg, Germany — 2 Departments of Chemistry and Physics, University of Toronto, Ontario, Canada

The wave guiding feature of the optical fibre is used to construct a novel type of electron gun to realize single-shot low-energy electron diffraction experiments with sub-picosecond resolution for studying irreversible samples.

Poster

**WED.PO.29 14:00**

**New fully OPCPA petawatt class beamline for Vulcan laser facility** — **• Pedro Oliveira, Marco Galimberti, Alexios Boyle, Ian Musgrave, Dave Pepler, Waseem Shaikh, Trevor Winstone, and Cristina Hernandez-Gomez** — Central Laser Facility, Science and Technology Facilities Council, Didcot, UK

The Vulcan laser facility is being upgraded with a new beam line that is based fully on OPCPA. This laser system will be at the PW level with a repetition rate of 5 min.

Poster

**WED.PO.30 14:00**

**15 W, few-cycle and ultra-stable mid-IR OPCPA for HHG and spectroscopy applications** — **• Nicolas Thibé1, Raman Makhnik1, Balint Kiss1, Clément Perchaud1, Sébastien Jarosch1, Pierre Bizouard1, Vittorio di Pietro1, Eric Cormier2, Karoly Osvay2, and Nicolas Forget3** — 1 FASTLITE, Valbonne, France — 2 ELI-HU Non-Profit Ltd, Szeged, Hungary — 3 Imperial College London, London, United Kingdom

We demonstrate an optical parametric chirped-pulse amplifier delivering 4-cycle (39-fs) pulses centered around 3.2 μm at 100-kHz with an average power of 15-W and a single-shot CEP noise of 65 mrad over 8h.

Poster

**WED.PO.31 14:00**

**Broadband Adiabatic and Pulse-Shaped SHG with a Ti:Sapphire Oscillator** — **Assaf Levanon, Assaf Dahan, Achiya Nagler, Erga Lifshitz, Eyal Bahar, Michael Meijen, and Haim Suchowski** — School of Physics and Astronomy, Tel Aviv University, 69978 Tel Aviv, Israel

We experimentally demonstrate an efficient broadband second-harmonic generation (SHG) using an adiabatic aperiodically poled KTP crystal. We show a pulse-shaping capability where a spectral phase of absolute value allows a tunable pump-probe.

Poster

**WED.PO.32 14:00**

**Extreme THz Fields from Mid-Infrared Two-Color Laser Filaments** — **• Anastasios D. Kouloukidis1,2, Claudia Gollner1, Valentina Shumakova1, Vladimir Yu. Fedorov1,4, Audrius Pužžlys1,3, Andrius Baltuška1,3, and Styllanos Tzortzakis1,2,6** — 1 Institute of Electronic Structure and Laser (IESL), Foundation for Research and Technology - Hellas (FORTH), Heraklion, Greece — 2 Science Program, Texas A&M University at Qatar, Doha, Qatar — 3 Photonics Institute, TU Wien, Vienna, Austria — 4 P. N. Lebedev Physical Institute of the Russian Academy of Sciences, Moscow, Russia — 5 Center for Physical Sciences & Technology, Vilnius, Lithuania — 6 Department of Materials Science and Technology, University of Crete, Heraklion, Greece

We report intense THz fields from two-color mid-infrared (3.9 μm) femtosecond laser filaments. The obtained conversion efficiency approaches the percent level, while theoretical estimations project THz electric and magnetic fields to extreme values.

Poster

**WED.PO.33 14:00**

**Generation of High-flux Soft X-Ray High Harmonics Driven by Loosely Focused TW-class Infrared Pulses** — **Kotaro Nishimura1,2, Yuxi Fu1, Akira Suda1, Katsumi Midorikawa1, and Eiji J. Takahashi1** — 1 Attosecond Science Research Team, RIKEN Center for Advanced Photonics, 2-1 Hirosawa, Wako, Saitama 351-0198, Japan — 2 Department of Physics, Tokyo University of Science, 2641 Yamazaki, Noda, Chiba 278-8510, Japan

We developed an experimental strategy for generating high-flux soft x-ray high-order harmonics (HHs) driven by loosely focused high-energy infrared femtosecond pulses. Strong HHs up to 240 eV region were observed in the experiment.

Poster

**WED.PO.34 14:00**

**Arbitrary beam generation by 4D Pulse Shaping** — **• Wei Liu, Joseph Robinson, Alan Fry, and Sergio Cabejo** — SLAC National Accelerator Laboratory and Stanford University

We report on a novel ultrafast laser architecture capable of generating 4D arbitrarily distributed beams based on an array of coherently combined fibers, each containing femtosecond pulses with controlled intensity, waveform, and polarization vector distribution.

Poster

**WED.PO.35 14:00**

**Dual Self-Diffraction Dispersion-scan for Measuring Spatially Inhomogeneous Ultrashort Pulses** — **• Miguel Canhota1, Rosa Wegand2, and Helder Crespo3** — 1 IFIMUP-IN and Departamento de Física e Astronomia, Faculdade de Ciências, Universidade do Porto, R. do Campo Alegre 687, 4169-007 Porto, Portugal — 2 Departamento de Optica, Fac. de Ciencias Fisicas, Avda. Complutense s/n, Universidad Complutense de Madrid, 28040, Madrid, Spain
We develop a self-diffraction dispersion-scan method that simultaneously measures two distinct spatial portions of an ultrashort light pulse and apply it to the temporal characterization of 400-nm broadband ultraviolet pulses generated by multiple-plate continuous-wave (CPW) lasers.

**Poster**

**WED.PO.36 14:00**

**Intense molybdenum Kα X-ray source driven by 10 TW femtosecond laser pulses at 100 Hz**

— Amélie Ferré, Yassmina Azamoum, Laurent Charmasson, Raphael Clady, Matthieu Gambari, Olivier Utéza, and Marc Sentis — Aix Marseille Université, CNRS, LP3 UMR 7341, 13288, Marseille, France

We develop molybdenum Kα X-ray secondary source (17.4 keV) using a 10 TW – 27 fs – 100 Hz laser. We demonstrate Kα photon flux of 6.2 x 10^10 ph/s/str, which is the highest performance using this approach.

**Poster**

**WED.PO.37 14:00**

**THz doubler at FLASH: double pulses for pump-probe experiments at X-ray FELs**

— Ekaterina Zapolnova, Torsten Golz, Rui Pan, Karsten Klose, Siegfried Schreiber, and Nikola Stoianovic — Deutsches Elektronen-Synchrotron (DESY), Hamburg, Germany

Double electron bunches timed for temporal overlap of THz and XUV pulses at the pump probe experiment provide a solution to large difference in optical paths of the THz and XUV beamlines at FLASH FEL.

**Poster**

**WED.PO.38 14:00**

**Intense tunable XUV source at high repetition rate >100kHz**

— Antoine Comby1, Laura Ines Gonzalez2, D. Descamps3, S. Petit4, Florent Guichard5, Ioann Zaouter6, and Yann Mairese7 — Université de Bordeaux - CNRS - CEA, CELIA, UMR5107, F33405 Talence, France — 1Amplitude Technologies, 91090 Lisses, France — 2Amplitude Systemes, 33600 Pessac, France

We report the development of a tunable XUV source at 166 kHz with a conversion efficiency of up to 7.2 x 10^{-5}. This remarkable efficiency allows up to 3.7x10^{12} photons/s after a focusing monochromator.

**Poster**

**WED.PO.39 14:00**

**Strong dc precursors of laser pulses ionizing electro-optic crystals**

— Maxim V. Tsarev1 and Michael I. Barkunov2 — 1Max-Planck-Institute of Quantum Optics, Garching, Germany — 2University of Nizhny Novgorod, Nizhny Novgorod, Russia

We found that optical rectification of a high-intensity ultrashort laser pulse in an electro-optic crystal can produce a terahertz wave with a strong quasistatic electromagnetic precursor propagating ahead of the laser pulse.

**Poster**

**WED.PO.40 14:00**

**Demonstration of a tilted-pulse-front pumped planar parallel slab/terahertz source**

— Payto S. Nugraharon1,2, Gergo Krasznai1,2, Csaba Lombarb1,2, Gyorgy Toth1, Laszlo Palfalvi1, Gabor Almas1,2, Jozsef A. Fulop1,2, and Janos Hebling1,2,3 — 1Szentgothai Research Centre, University of Pecs, Pecs, Hungary — 2Institute of Physics of Pecs, Pecs, Hungary — 3MTA-PTE High-Field Terahertz Research Group, Pecs, Hungary

THz pulse generation in a nonlinear echelon slab structure is demonstrated. The setup uses a plane-parallel nonlinear optical crystal slab, which produces good-quality, symmetric THz beam and enables scalability to high pulse energy.

**Poster**

**WED.PO.41 14:00**

**Low-noise femtosecond Cherenkov fiber laser, continuously tunable across the entire red-green-blue spectral range**

— Xiaomin Liu1, Jesper Lægsgaard2, Roman Iogevroby3, Ask Svane4, E. Ömer İlday4,5, Haohua Tu6, Stephen A. Boppard, and Dmitry Turchinovich6,7 — 1Max Planck Institute for Polymer Research, Ackermannweg 10, 55128 Mainz, Germany — 2DTU Fotonik, Technical University of Denmark, 2800 Kgs. Lynghby, Denmark — 3National Research Tomsk Polytechnic University, Institute of Power Engineering, 30 Lenin Avenue, 634050 Tomsk, Russia — 4Department of Physics, Bilkent University, 06800 Ankara, Turkey — 5Department of Electrical and Electronics Engineering, Bilkent University, 06800 Ankara, Turkey — 6Biophotons Imaging Laboratory, University of Illinois at Urbana-Champaign, Urbana, Illinois 61801, USA — 7Fakultät für Physik, Universität Duisburg-Essen, Lotharstraße 1, 47048 Duisburg, Germany

Low-noise Cherenkov wave conversion in a tapered photonic crystal fiber turns a standard, fixed-wavelength femtosecond laser into an extremely widely-tunable source. Here we show the continuous laser tunability across the entire red–green–blue range.

**Poster**

**WED.PO.42 14:00**

**Generation and Complete Temporal Characterization of 5-fs EUV Pulses**

— Matteo Lucchini1,2, Giacinto Lucarelli1,2, Mario Murari1,2, Andrea Trabattoni1,2, Nicola Fabris1,2, Fabio Frassetto1, Sandro De Silvestri1,2, Luca Poletto1,2, and Mauro Nisoli1,2 — 1Department of Physics, Politecnico di Milano, 20133 Milano, Italy — 2Institute for Photonics and Nanotechnologies, IFN-CNR, 20133 Milano, Italy — 3Center for Free-Electron Laser Science (CFEL), DESY, 22607 Hamburg, Germany — 4Institute for Photonics and Nanotechnologies, IFN-CNR, 35131 Padova, Italy — 5Department of Information Engineering, University of Padova, 35131 Padova, Italy

Extreme-ultraviolet pulses as short as 5 fs, produced by high-order harmonic generation and selected by a time-delay compensated monochromator, were fully reconstructed thanks to an advanced ptychographic technique, while most commonly used reconstruction methods fail.

**Poster**

**WED.PO.43 14:00**

**Resonantly enhanced THz emission from atoms irradiated by subpicosecond laser pulses**

— Carsten Breier1, Michael Hofmann1, Ayhan Demircan3, Uwe Morgen4, Olga Kosareva5, Andrei Savelyev6, Anton Husakou5, Misha Ivanov6, and Ibar Barushkin3,5 — 1Weierstrass Institute, Berlin, Germany — 2Virtuino AG, Berlin, Germany — 3Institute for Quantum Optics, Hannover, Germany — 4Hannover Centre for Optical Technologies, Hannover, Germany — 5Physics Faculty, Lomonosov Moscow State University, Moscow, Russia — 6Max Born Institute, Berlin, Germany

We theoretically demonstrate that resonantly enhanced multiphoton ionization induces a sub-cycle ionization dynamics which leads to a corresponding increase in the THz yield of atoms irradiated by strong subpicosecond laser pulses.

**Poster**

**WED.PO.44 14:00**

**A 200 kHz Few-Cycle OPCPA Based HHG Source for 3D Momentum Electron-Ion Coincidence Spectroscopy**

— Sara Mikaelsson, Yu-Chen Cheng, Anna Hart, Chen Guo, Miguel Miranda, Jan Vogelsang, Mathieu Gisselbrecht, Anne L'Huillier, and Cord L. Arnold — 1Department of Physics, Lund University, Lund, Sweden

We efficiently generate high order harmonics from few-cycle pulses with only a few-μJ pulse energy. In a first application,
we perform small-signal coincidence measurements at variable XUV-IR delay, exploiting the laser’s 200 kHz repetition rate.

**Poster**

**WED.PO.45 14:00**

A beamline for attosecond UV pump - XUV probe experiments — **Mara Galli**1,2, Vincent Wanle1,3, Erik Peter Manssson1, François Légaré1, Fabio Frassetto1, Luca Poletto1, Mauro Nisoli1,2, and Francesca Calegari1,4,5 — 1Institute of Photonics and Nanotechnologies—Consiglio Nazionale delle Ricerche, Piazza Leonardo da Vinci 32, 20133 Milano, Italy — 2Department of Physics, Politecnico di Milano, Piazza Leonardo da Vinci 32, 20133 Milano, Italy — 3Institut National de la Recherche Scientifique, Centre Énergie Matériaux et Télécommunications, 1650 Blvd. Lionel-Boulet, Varennes, JX312, Canada — 4Center for Free-Electron Laser Science, DESY, Notkestr. 85, 22607 Hamburg, Germany — 5Institute for Photonics and Nanotechnologies CNR-IFN, Via Trasea 7, 35131 Padova, Italy — 6Department of Physics, University of Hamburg, Jungiusstr. 9, 20355 Hamburg, Germany

We designed and commissioned an attosecond beamline to study with unprecedented time resolution the UV photo-induced electronic dynamics in bio-chemically relevant molecules. For this purpose, sub-2fs UV pulses are combined with XUV isolated attosecond pulses.

**Poster**

**WED.PO.46 14:00**

Efficient Generation of Broadband MIR Radiation by Difference-Frequency Generation in LiGaS2 — **Bo-Han Chen**1,2, Tamas Nagy1, and Peter Baun1,2 — 1Ludwig-Maximilians-Universität München, Am Coulombwall 1, 85748 Garching, Germany — 2Max-Planck-Institute of Quantum Optics, Hans-Kopfermann-Str. 1, 85748 Garching, Germany — 3Max Born Institute for Nonlinear Optics and Short Pulse Spectroscopy, Max-Born-Str. 2A, 12489 Berlin, Germany

We report a surprisingly broadband and efficient middle-infrared (MIR) pulse generation in LiGaS2 (Langasite, LGS) by invoking a simultaneous interplay of intra-pulse difference frequency generation, self-phase-modulation and dispersion.

**Poster**

**WED.PO.47 14:00**

33-fold pulse compression down to 1.5 cycles in a 6-m-long hollow-core fiber — **Young-Gyu Jeong**1, Riccardo Piccoli1, Denis Perachou1,2, Vincent Cardin1,2, Michael Chini1, Steffen Hädrich1, Jens Limpert1,2, Roberto Morandotti1, François Légaré1, Bruno E. Schmidt2, and Luca Razzari1 — 1InRS-EMT, Varennes, Canada — 2few-cycle Inc., Montreal, Canada — 3Department of Physics and CEROL, University of Central Florida, Orlando, USA — 4Active Fiber Systems GmbH, Jena, Germany — 5Institute of Applied Physics, Abbe Center of Photonics, Friedrich-Schiller-University Jena, Germany — 6Fraunhofer Institute for Applied Optics and Precision Engineering, Jena, Germany

We demonstrate 33-fold pulse compression employing a 6m long hollow-core fiber and chirped mirrors. 1mJ, 170fs pulses at 1030nm are compressed to 5.1fs (1.5 optical cycles) with 70% efficiency.

**Poster**

**WED.PO.48 14:00**

Generation of multi-mW, two-octave passively-stable infrared frequency comb — **Jinwei Zhang**1, Ka Fa Mak2, Nathalie Nagl1, Marcus Seidel1, Dominik Bauer1, Dirk Sutter1, Vladimir Pervak1, Ferenc Krausz1,2, and Oleg Pronin1 — 1Max-Planck-Institute of Quantum Optics, Hans-Kopfermann-Str. 1, 85748 Garching, Germany — 2Ludwig-Maximilians-University Munich, Am Coulombwall 1, 85748 Garching, Germany — 3TRUMPF Laser GmbH, Aichhalder Straße 39, D-78713 Schramberg, Germany

We report the generation of a two-octave infrared continuum spanning from 500 to 2250 cm-1 at over 24 mW of average power by difference frequency generation. The generation is based on a first femtosecond Ho:YAG thin-disk oscillator.

**Poster**

**WED.PO.49 14:00**

Extreme Ultraviolet Opto-optical Modulation — **Neven Ibradovic1, Emma R. Simpson1, Seth Camp1, Anna Olofsson1, Samuel Bengtsson1, Kenneth J. Schafer2, Mette B. Gaarde1, and Johan Mauritzson1 — 1Department of Physics, Lund University, PO Box 118, SE-221 00 Lund, Sweden — 2Department of Physics and Astronomy, Louisiana State University, Baton Rouge, Louisiana 70803-4001, USA

We probe and control the phase of a coherently excited ensemble of atoms using opto-optical modulation in the extreme ultraviolet, using an extreme ultraviolet pump, infrared probe configuration.

**Poster**

**WED.PO.50 14:00**

Millijoule-Level Sub-Cycle Pulses from Two Channels of a Parallel Parametric Waveform Synthesizer — **Fabian Scheiber1,2, Giulio Maria Rossi1,2, Roland E. Mainz1,2, Yudong Yang1,2, Giovanni Cirmi1,2, and Franz X. Kärtner1,2 — 1Center for Free-Electron Laser Science, Notkestrasse 85, 22607 Hamburg, Germany — 2Physics Department and The Hamburger Centre for Ultrafast Imaging, University of Hamburg, Luruper Chaussee 149, 22761 Hamburg, Germany

We report on an optical synthesis of two compressed channels from our parametric waveform synthesizer, leading to a 0.6 mJ 4.4 fs pulse (3.6 fs transform limited) with a central wavelength of 1.8 μm, corresponding to 0.74-cycle.

**Poster**

**WED.PO.51 14:00**

Femtosecond pulse generation from an Yb:YAG ceramic regenerative amplifier — **János Huyán1,2, Martin Smrk1, Taijke Miura1, David Vojta1,2, Ondřej Sležák1, Arkira Endo1, Miroslav Čech1, and Tomáš Molec1 — 1HILASE center, Institute of Physics ASCR, V.V.I., Dolní Březany, Czech Republic — 2Czech Technical University, Faculty of Nuclear Sciences and Physical Engineering, Prague 1, Czech Republic

We report on femtosecond regenerative Yb:YAG (Y3Ga2Al3O12) ceramic amplifier delivering 405 fs pulses at a wavelength of 1030 nm, 1.1 W of average power, 8 microjoule of pulse energy, and repetition rate of 100 kHz.

**Poster**

**WED.PO.52 14:00**

IR Peak Power & Average Power scaling via Fourier domain OPA (FOPA) — **Bruno E. Schmidt1, Vincent Gruson2, Philippe Lassonde3, Guilhot Ernotte3, Heide Ibrahim3, Arvid Håge4, Torsten Mans5, Lou Di Mauro5, Paul Corkum5, Hans Jakob Wörnkr6, and François Légaré — 1few-cycle Inc., Montreal, Canada — 2InRS-EMT, Varennes, Canada — 3Amphos GmbH, Herzogenrath, Germany — 4Department of Physics, The Ohio State University, Columbus, USA — 5University of Ottawa & NRC, Ottawa, Canada — 6ETH, Zürich, Switzerland

Taking advantage of pulse shortening upon amplification, we demonstrate 2.5TW pulses (30mJ, 2 cycle, 1.8μm) based on TiSa pumping, while for boosting average power we utilize a 500W Yb platform for pump and seed pulses.
Wednesday Sessions

Poster WED.PO.53 14:00
Isolated Terawatt Attosecond Hard X-ray Pulse Generation by Single Current Spike without Delay Units in XFELs — CHI HYUN SHIM1, YONG WOON PARC2, SANDEEP KUMAR3, INSOO KO1,2, and DONG EON KIM4,5 — 1Department of Physics, Pohang University of Science and Technology, Pohang, 37673, Korea — 2Pohang Accelerator Laboratory, Pohang University of Science and Technology, Pohang, 37673, Korea — 3Department of Physics, Ulsan National Institute of Science and Technology, Ulsan, 44919, Korea — 4Department of Physics, Center for Attosecond Science and Technology, Pohang University of Science and Technology, Pohang, 37673, Korea — 5Max Planck POSTECH/Korea Res. Init., Pohang, 37673, Korea

Isolated TW-level as X-ray pulse that is >1.0 TW and ~36 as at 12.4 keV can be generated by using properly chosen single current spike without any delay units in XFELs’ undulator line.

Poster WED.PO.54 14:00
Quasi-Phase-Matched High Harmonic Generation in structured Plasmas — MICHAEL WÖSTMANN, LUKAS SPLITTHOFF, and HELMY TANCHARIS — Physikalisches Institut, Westfälische Wilhelms-Universität, Münster, Germany

Quasi-phase-matching is enabled by applying spatially structured plasmas. Combined with an optimized spacing between the individual plumes quasi-phase matching is achieved. The harmonic yield is increased by a factor of 100.

Poster WED.PO.55 14:00
Direct measurement of intense sub-4-fs pulses in a gas target by third-harmonic dispersion-scan — HELDER CRESPO-1,2, MIGUEL CANHOTA1,2, TOBIAS WITTING1,2, and JOHN TISCH3 — 1IFIMUP-IN and Departamento de Física e Astronomia, Faculdade de Ciências, Universidade do Porto, Porto, Portugal — 2Blackett Laboratory, Imperial College, London, UK — 3Max-Born-Institute for Nonlinear Optics and Short Pulse Spectroscopy, Berlin, Germany

We demonstrate on-target temporal characterization of sub-4-fs pulses by third-harmonic dispersion-scan, using a minimal in-line setup where a gas target optimized for high-harmonic generation doubles as nonlinear medium, obtaining excellent agreement with independent SEA-F-SPIDER measurements.

Poster WED.PO.56 14:00
Model study of Josephson plasma soliton propagation in high Tc superconductor — DONGHOON KIM and J.D. LEE — Daegu Gyeongbuk Institute of Science & Technology, Daegu, 42988, Republic of Korea

In this study, we proposed a model Hamiltonian of the intrinsic Josephson junction realized by high Tc superconductor and investigated a propagation of Josephson plasma soliton by the optical excitation.

Poster WED.PO.57 14:00
Theoretical Study of the Ultrashort Dynamics in Graphene after fs-Laser Excitation — SERGEJ KRYLOW, EEUWE S. ZHILSTRA, and MARTIN E. GARCIA — Theoretical Physics II, University of Kassel, Heinrich-Plett-Str. 40, 34132 Kassel, Germany

The hot electrons of ultrafast excited graphene strongly couple to a few optical phonons. We analyze and simulate the time-evolution of the subsequent thermalization processes. Three different timescales can be extracted.

Poster WED.PO.58 14:00
Terahertz driven amplification of coherent optical phonons in GaAs coupled to a plasmonic split-ring resonator — MICHAEL WOERNER1, CARMINE SOMMA1, KLAUS REIMANN1, THOMAS ELSAESSER1, IGAL BRENER2, JOHN L. RENO2, YUANMU YANG1, and PETER Q. LUI3 — 1Max-Born-Institut für Nichtlineare Optik und Kurzzeitpektroskopie, 12489 Berlin, Germany — 2Center for Integrated Nanotechnologies, Sandia National Laboratories, Albuquerque, New Mexico 87185, USA — 3Department of Electrical Engineering, The State University of New York at Buffalo, Buffalo New York 14260, USA

Two-dimensional terahertz spectroscopy on a GaAs nanofilm covered by field-enhancing split-ring resonators shows signatures of coherent optical phonon amplification. Amplification is due to stimulated phonon emission by a terahertz-driven electron current.

Poster WED.PO.59 14:00
Antenna-enhanced high harmonic generation in a wide-bandgap semiconductor ZnO — KOTARO IMASAKA, TOMOHIRO KAJI, TSUTOMU SHIMURA, and SATOSHI ASHIHARA — Institute of Industrial Science, The University of Tokyo, 4-6-1, Komaba, Meguro-ku, Tokyo, 153-8505, Japan

We demonstrate high harmonic generation into the deep-UV range in a ZnO crystal with resonant nanoantennas. The presence and the absence of even-order harmonics indicate that the spectral selection rule precisely reflects the crystal symmetry.

Poster WED.PO.60 14:00
Ultrafast optical response of plasmonic structures beyond the perturbative regime: evidence of universal saturation dynamics — MYCHEL G. SILVA1,2, DANIELLE C.T. FERREIRA1,2, CRISTIAN MANZONI1, LUCIA GANZER1, LIVIA SIMAN1, CLAUDELINE R. CHAVES1, LUIZ O. LADEIRA1, GIULIO CERULLO2,3, STEFANO LONGHI1, SANDRO DE SILVESTR11,2, GIUSEPPE DELLA VALLE2,3, and ANA M. DE PAULA1 — 1Departamento de Física, Universidade Federal de Minas Gerais, 31270-901 Belo Horizonte-MG, Brazil — 2Dipartimento di Fisica, Politecnico di Milano, Piazza Leonardo da Vinci 32, 20133 Milano, Italy — 3Istituto di Fotonica e Nanotecnologie, Consiglio Nazionale delle Ricerche, Piazza Leonardo da Vinci 32, 20133 Milano, Italy — 4Department of Biointerface-IICS, Universidade Federal da Bahia, 40110-100 Salvador-BA, Brazil

The transient optical response of gold nanorods is investigated beyond the perturbative regime. Ultrafast pump-probe spectroscopy and semiclassical modeling of hot electrons reveal a universal mechanism presiding over the saturation of nonlinear plasmonic effects.

Poster WED.PO.61 14:00
Broadband Coherent Optical Response of Localized Surface Plasmon Resonances with Deep Sub-wavelength Resolution — URI ARIELI, MICHAEL MEJERN, ASSAF LEVANON, and HAID SUCHOWSKI — Raymond and Beverly Sackler School of Physics and Astronomy, Tel Aviv University, Tel Aviv, Israel

We investigate the optical response of localized surface plasmon resonances with a scattering-Scanning Nearfield Microscope and broadband (650-1050nm) femtosecond laser, yielding a spatial resolution of 40nm and spectral resolution of 50cm-1.

Poster WED.PO.62 14:00
Population inversion in laser-driven N2 — YOYUAN ZHANG, ERIK LÖSTEDT, and KAORU YAMANOUCHI — Department of Chemistry, School of Science, The University of Tokyo, Tokyo, Japan
The mechanism of the efficient population inversion between the electronically excited B state and the ground X state in N₂⁺ generated from an intense laser field is interpreted by the quasistationary Floquet approach.

Poster  WED.PO.63  14:00
Ultrafast electronic decay of core excited HCl molecules studied with THz streaking — Katharina Weng¹, Marek Wieland², Sophie Walter³, Arne Baumann², Anastasios Dimitriou⁴, Mark Prandolini⁵, Oliver Schepp⁶, Ivette Bermudez Machías⁷, Malec Sempel³ and Thorsten Schumacher⁵ — Institut für Experimentalphysik, Universität Hamburg, Luruper Chaussee 149, Germany — ²Deutsches Elektron Synchrotron DESY, Hamburg, Notkestrasse 85, 22607, Germany
The evolution of coupled electronic and nuclear dynamics of the core excited HCl molecules is studied directly in the time domain combining x-ray electron spectroscopy with the light field streaking technique

Poster  WED.PO.64  14:00
Femtosecond response of a quantum solvent to impurity photoexcitation — Bernhard Thaler, Sascha Ranftl, Pascal Heim, Stefan Cesnik, Miriam Meyer, Leonard Treiber, Wolfgang E. Ernst, and Markus Koch — Graz University of Technology, Institute of Experimental Physics, Graz, Austria
By observing and simulating the photoexcitation dynamics of a single indium atom inside a helium nanodroplet, we demonstrate the feasibility and interpretability of femtosecond chemistry experiments in this superfluid quantum solvent.

Poster  WED.PO.65  14:00
Femtosecond XUV-IR dynamics of the methyl iodide cation — G. Rettsma¹, M.L. Murillo-Sánchez², R. de Naëla³, M.E. Corrales³, S. Maraggi Poullain⁴, J. Gonzalez-Váquez⁵, M.J.J. Vrakking⁶, L. Bañares⁶, and O. Kornilov⁷ — ¹Max Born Institute for Nonlinear Optics and Short Pulse Spectroscopy, Berlin, Germany — ²Departamento de Química Física (Unidad Asociada I+D+i al CSIC), Facultad de Ciencias Químicas, Universidad Complutense de Madrid, Madrid, Spain — ³Instituto de Química Física Rocasolano, CSIC, Madrid, Spain — ⁴Departamento de Química, Facultad de Ciencias, Universidad Autónoma de Madrid, Madrid, Spain — ⁵Institute for Advanced Research in Chemical Sciences (IAdChem), Facultad de Ciencias, Universidad Autónoma de Madrid, Madrid, Spain
Wavelength-selected laser pulses obtained from high harmonic generation are an excellent tool to study the dynamics of cations state-by-state. We demonstrate this by pump-probe experiments on CH₃I molecules and unravel both resonant and non-resonant dynamics.

Poster  WED.PO.66  14:00
Single-shot molecular orbital tomography — Chunyang Zhai, Xiaofan Zhang, Xiaosong Zhu, Lixin He, Yinfu Zhang, Baoning Wang, Qingbin Zhang, Pengfei Lan, and Peixiang Lu — Wuhan National Laboratory for Optoelectronics and School of Physics, Huazhong University of Science and Technology, Wuhan 430074, China
We report a single-shot molecular orbital tomography scheme with orthogonal two-color (OTC) fields. This enables the tomographic imaging of molecular orbitals with single-shot measurement, owing to the two-dimensional manipulation of electron motions in OTC fields.

Poster  WED.PO.67  14:00
Second-harmonic generations in a plasmonic two-wire transmission-line — Tzu-Yu Chen¹,⁵, Julian Obermeier⁵, Fan-Cheng Lin⁴, Jer-Shing Huang³, Thorsten Schumacher⁵, Markus Lippitz², and Chen-Bin Huang¹,³ — ¹Institute of Photonics Technologies, National Tsing Hua University, Hsinchu, Taiwan — ²International Intercollegiate PhD Program, National Tsing Hua University, Hsinchu, Taiwan — ³Department of Physics, University of Bayreuth, Bayreuth, Germany — ⁴Department of Chemistry, National Tsing Hua University, Hsinchu, Taiwan — ⁵Leibniz Institute of Photonic Technology, Jena, Germany
We demonstrate second-harmonic generation (SHG) in a plasmonic two-wire transmission-line which is in material and geometry fully symmetric. The anti-symmetric waveguide mode allows emission of the surface nonlinear polarization independently of the fundamental wave's mode.

Poster  WED.PO.68  14:00
A New Method to Calculate Ultrafast Electron Dynamics in Molecules Based on Matrix Product States — LARS-HENDRIK FRAYM and DANIELA PFANNKUCHE — I. Institut für Theoretische Physik, Uni Hamburg
We propose a new method to describe electron dynamics in molecules on the scale of femtoseconds. It is based on factorizing the electronic wave function into matrix products in the mathematically proven optimal way.

Poster  WED.PO.69  14:00
Asymmetry Flip in Photoelectron Angular Distribution of Rare Gas Atoms in Intense Circularly-polarized Few-cycle Laser Fields — Shinichi Fukahori¹, Kaoru Yamanouchi³, and Gerhard G. Paulus¹ — ¹Department of Chemistry, School of Science, The University of Tokyo, Tokyo, Japan — ²Institut für Optik und Quantenelektronik, Friedrich-Schiller-Universität, Jena, Germany
An analytical formula representing the photoelectron kinetic energy, at which the ejection direction of photoelectrons generated by an intense circularly-polarized few-cycle laser pulse flips, was derived and was used for determining the laser pulse duration.

Poster  WED.PO.70  14:00
Highly efficient end-station for space-, time- and spin-resolved photoemission spectroscopy at free electron lasers and high harmonic generation sources. — D. Kutnyakho²,¹, F. Pressacco², G. Mercurio², A. Benüz², L. Wenthaus², H. Meyer², S. Gieschen², K. Bühlmann², S. Däster², R. Gott³, D. Curcio³, K. Volckaert³, M. Bianchi³, Ch. Sanders³, J. Miwa³, S. Ulstrup³, A. Oelsner³, C. Tüsche³, Y. Chen³, S.Y. Agustsson⁴, D. Vasilyev⁴, K. Medjanc⁴, G. Brenner¹, D. Dziarzhytsk¹,¹, H. Redlin¹, J. Demes¹, H.J. Elmers², Ph. Hofmann¹, G. Schönheise¹,², Y. Acremann², and W. Wurth¹,² — ¹DESY Photon Science, Hamburg, Germany — ²Physics Department and CFEL, University of Hamburg, Hamburg, Germany — ³Department of Physics, ETH Zürich, Zürich, Switzerland — ⁴Aarhus University, Aarhus, Denmark — ⁵Surface Concept GmbH, Mainz, Germany — ⁶Forschungszentrum Jülich GmbH, Peter Grünberg Institut (PGI-6), Jülich, Germany — ⁷Fakultät für Physik, Universität Duisburg-Essen, Duisburg, Germany — ⁸Institute of Physics, Johannes Gutenberg-University Mainz, Mainz, Germany
Time-of-flight momentum microscopy combined with ultrashort probe pulses from the free electron laser or from a high harmonic generation source is an ideal approach for studying ultrafast electron and lattice dynamics.
Wednesday Sessions

Poster

**WED.PO.71 14:00**
Fourier Transform Vibrational Spectroscopy of D$_2$ by Few-Cycle Near-Infrared Laser Pulses — *Toshiaki Ando, Atsushi Iwasaki, and Kaoru Yamanouchi* — Department of Chemistry, School of Science, The University of Tokyo, Japan

By strong-field Fourier transform spectroscopy using intense pump and probe few-cycle laser pulses, the vibrational level energies of D$_2$ were determined with high precision by taking advantage of the dressed-state formation by the probe pulse.

Poster

**WED.PO.72 14:00**
Differences in the ultrafast melting of bismuth and antimony — *S. W. Epf$, M. Hada$, Y. Zhong$, Y. Kuma&$, K. Motomura$, S. Mizote$, T. Ono$, S. Owada$, D. Axford$, S. Bakhtiarzadeh$, H. Fukuzawa$, Y. Hayashi$, T. Katayama$, A. Markt$, H. M. Müller-Werkmeister$, R. L. Owen$, D. A. Sherrell$, K. Tono$, K. Ueda$, F. Westermeier*, and R. J. D. Miller$^1,6,8$ — *1 Max Planck Institute for the Structure and Dynamics of Matter, 22761 Hamburg, Germany — 2 Graduate School of Natural Science and Technology, Okayama University, Okayama 700-8530, Japan — 3 Institute of Multidisciplinary Research for Advanced Materials, Tohoku University, Sendai 980-8577, Japan — 4 RIKEN Spring-8 Center, 1-1-1 Kouzo, Sayo-cho, Sayo-gun, Hyogo 679-5184, Japan — 5 Diamond Light Source, Harwell Science and Innovation Campus, Didcot OX11 0DE, United Kingdom — 6 The Hamburg Centre for Ultrafast Imaging, Luruper Chaussee 149, 22761 Hamburg, Germany — 7 Japan Synchrotron Radiation Research Institute, 1-1-1 Kouzo, Sayo-cho, Sayo-gun, Hyogo 679-5198, Japan — 8 Departments of Physics and Chemistry, University of Toronto, Toronto, Ontario M5S 1A7, Canada

We developed a tool for time-zero determination between optical- and free-electron-laser-pulses exploiting the ultrafast melting of the bismuth crystal lattice. Investigating antimony, we find a surprisingly slow melting under similar optical excitation conditions.

Poster

**WED.PO.73 14:00**
Attosecond transient absorption spectroscopy and electron spectroscopy for noble gas atoms: A TDCIS approach — *Daria Kolbasova$, V. S. R. Son$, Zoltan Jur&$, and Robin Santra$^1,2$ — *1 Center for Free-Electron Laser Science, DESY, Hamburg, Germany — 2 University of Hamburg, Hamburg, Germany

High-intensity FEL-induced photoelectron streaking and attosecond transient absorption spectroscopy are studied in the noble gas atoms using the TDCIS method.

Poster

**WED.PO.74 14:00**
Multi-Dimensional Coherent Spectroscopy of CdSe Colloidal Quantum Dots at Cryogenic Temperatures — *Albert Liu*, Diogo B. Almeida$, Wan Ki Bae$, Lazaro A. Padilha$, and Steven T. Cundiff$^1,2$ — *1 Applied Physics Program, University of Michigan, Ann Arbor, MI, USA — 2 Department of Physics, University of Michigan, Ann Arbor, MI, USA — 3 Photo-Electronic Hybrid Research Center, Korea Institute of Science and Technology, Seoul, Korea — 4 Instituto de Física "Gleb Wataghin", Universidade Estadual de Campinas, Campinas, Sao Paulo, Brazil

One-quantum and zero-quantum multi-dimensional coherent spectroscopy are used to study CdSe colloidal quantum dots at cryogenic temperatures. Each technique reveals unique aspects of the electron-phonon coupling dynamics in the material.

Poster

**WED.PO.75 14:00**
Encapsulation Narrows Excitonic Homogeneous Linewidth of Exfoliated MoSe$_2$, Monolayer — *Eric W. Martin, Jason Horng, Hanaa G. Ruth, Eunice Paik, Michael-Hein Wentzel, Hui Deng, and Steven T. Cundiff* — Department of Physics, University of Michigan, Ann Arbor, USA

We use collinear multidimensional coherent spectroscopy to measure van der Waals structures with a nearly diffraction-limited spot size. Encapsulation by boron nitride narrows the homogeneous and inhomogeneous linewidths of excitonic resonances in MoSe$_2$.

Poster

**WED.PO.76 14:00**
Absolute strong-field ionization probabilities of ultracold alkali atoms — *Philippe Wessels$, Bernhard Ruff$, Tobias Kroker$, Andrey K. Kazansky$, Nikolay M. Karachink$, Klaus Sengstock$, Markus Drescher$, and Juliette Simonet* — *1 The Hamburg Centre for Ultrafast Imaging, Luruper Chaussee 149, 22761 Hamburg, Germany — 2 Center for Optical Quantum Technologies, University of Hamburg, Luruper Chaussee 149, 22761 Hamburg, Germany — 3 Departamento de Fisica de Materiales, UPV/EHU, 20018 San Sebastian/Donostia, Spain — 4 Ikerbasque, Basque Foundation for Science, 48011 Bilbao, Spain — 5 Donostia International Physics Center (DIPC), 20018 San Sebastian/Donostia, Spain — 6 Skobeltsyn Institute of Nuclear Physics, Lomonosov Moscow State University, Moscow 119991, Russia

We report on measurements of absolute strong-field ionization probabilities of ultracold rubidium atoms at Keldysh parameter near unity. The experimental data are in perfect quantitative agreement with ab-initio theory without any free parameters.

Poster

**WED.PO.77 14:00**
Ultrafast x-ray-driven phenomena in nanocrystals: development and application of powerful simulation tools — *Malik Muhammad Abdullah* — Center for Free-Electron Laser Science, Deutsches Elektronen-Synchrotron, Notkestrasse 85, 22607 Hamburg, Germany — The Hamburg Centre for Ultrafast Imaging, Luruper Chaussee 149, 22761 Hamburg, Germany — Department of Physics, University of Hamburg, Jungiusstrasse 9, 20355 Hamburg, Germany

We investigate the radiation damage dynamics of nanocrystals at high x-ray intensity, by using time-resolved scattering patterns. We present dynamics simulations for biologically relevant molecules using XMDYN extended to nanocrystals and scattering simulation with XSSINC.

Poster

**WED.PO.78 14:00**
Investigation of terahertz generation from various liquids — *Anton Tschpkin$, Sergey Putilin$, Svyatoslav Stumpf$, Semen Smirnov$, Yuwen E$, Maksim Melnik$, Evgeniya Ponomareva$, Victor Bespalov$, Sergey Kozlov$, and Xi-Cheng Zhang$^1,2$ — *1 ITMO University, Saint-Petersburg, Russia — 2 University of Rochester, Rochester, USA

We present experimental measurement and numerical simulation of terahertz radiation on the duration of optical excitation pulse and the thickness of the various liquids.

Poster

**WED.PO.79 14:00**
Hot-electrons cooling in encapsulated graphene via coupling to hyperbolic phonons — *Eva A. A. Pogna$, Klaas-Jan Tielrooij$, Niels C. H. Hesp$, Alessandro Principi$, Marc Lundeberg$, Luca Banzer$, Mathieu Massicotte$, Peter Schmidt$, Diana Davydovskaya$, Ilya Goykhman$, Giancarlo Soavi$, Antonio Lombardo$, Christoph Stampfer$, Andrea C. Ferrari$, Marco Polini$, Frank H. L. Koppens*
and Giulio Cerullo — 1Dipartimento di Fisica, Politecnico di Milano, Milano 20133 — 2ICFO, The Barcelona Institute of Science and Technology, ES 08860 Castelldefels, Spain — 3Radboud University, Institute for Molecules and Materials, NL 6525 Nijmegen, Netherland — 4JARA-FIT 2nd Institute of Physics, RWTH Aachen University, GE 52074 Aachen, Germany 5. Cambridge Graphene Centre, University of Cambridge, Cambridge, UK — 5Cambridge Graphene Centre, University of Cambridge, Cambridge, UK — 6Istituto Italiano di Tecnologia, Graphene labs, Via Morego 30, IT 16163 Genova, Italy

We report on a study of the cooling dynamics of hot electrons in high-quality encapsulated graphene. The relaxation dynamics is rationalized in terms of efficient coupling to the hyperbolic phonon modes of the encapsulant.

Poster

Many-body Correlation and Interaction in Atomic Vapors Probed by Optical Two-dimensional Coherent Spectroscopy — H. Li1, Shaogang Yu1,2,3, Michael Titze1, and Xiaojun Liu1,2,3 — 1Department of Physics, Florida International University, Miami, Florida 33199, USA — 2State Key Laboratory of Magnetic Resonance and Atomic and Molecular Physics, Wuhan Institute of Physics and Mathematics, Chinese Academy of Sciences, Wuhan 430071, China — 3University of Chinese Academy of Sciences, Beijing 100049, China

Optical two-dimensional coherence spectra are obtained on atomic vapors. The results reveal dipole-dipole interactions between atoms with the mean separation at the order of micrometer. Many-body correlations up to four atoms have also been observed.

Poster

Ultrafast Hot-carrier Transport in Hybrid Perovskite Visualized by Ultrafast Time-resolved Microscopy — JyoYoung Sung1,2, LiMeng Ni1, Philipp Kukura1, and Akshay Rao1 — 1Optoelectronics Group, Cavendish Laboratory, JJ Thomson Ave, Cambridge CB3 0HE, UK — 2Physical and Theoretical Chemistry Laboratory, University of Oxford, South Parks Road, OX1 3QZ, Oxford, UK

Ultrafast hot carrier transport process in hybrid organic-inorganic metal halide perovskite at thermally non-equilibrium state are directly obtained by performing focused pump and wide-field probe femtosecond transient absorption microscopy.

Poster

Multiscale temporal probing of elemental ultrafast magnetization dynamics in Permalloy using high order harmonics — Marie Barthélémy, Ahmed Maghraoui, Gilles Versini, Mircea Vomir, and Jean-Yves Bigot — CNRS – Strasbourg University, IPCMS UMR7504, Strasbourg, France

Chemically selective magnetization dynamics is probed in Permalloy with High order Harmonics over a large temporal scale. It is shown that the ratio between effective exchange interaction constants of each element can be retrieved experimentally.

Poster

Ultrafast Taunomerization Dynamics in Single Porphycene Molecules — Lukasz Piatkowski1, Czeslaw Radzewicz1, Gonzalo Angulo1, and Jacek Waluk1,2 — 1Institute of Physical Chemistry of the Polish Academy of Sciences, Warsaw, Poland — 2Institute of Experimental Physics, University of Warsaw, Warsaw, Poland — 3Faculty of Mathematics and Science, Cardinal Stefan Wyszyński University, Warsaw, Poland

We used a combination of steady state and time-resolved fluorescence microscopy to probe the ultrafast tautomerization reaction dynamics in porphycenes at a single molecule level.

Poster

Ultrafast Magnetization Dynamics Probed by Lorentz Microscopy — Marcel Möller1, Nara Rubiano da Silva1, John H. Gaida1, Armin Feist2, Henning Ulbrich3, Sascha Schäfer4, and Claus Ropers1 — 14th Physical Institute, University of Göttingen, Göttingen, Germany — 21st Physical Institute, University of Göttingen, Göttingen, Germany — 3Institute of Physics, University of Oldenburg, Oldenburg, Germany

We present ultrafast magnetic imaging combining high spatial and temporal resolution with Lorentz transmission electron microscopy. In a perovskite nanoscale, we track femtosecond magnetization dynamics and the gyrotropic motion of a magnetic vortex.

Poster

Phase sensitive pump-probe technique with arcsecond resolution discriminates between exciton and free carrier dynamics in PbS/CdS quantum dots — Mirco Kolarczyk1, Christian Ulbrich1, Pieti Geiregat2, Yunpeng Zhu2, Laxmi Kishore Sagar2, Akshay Singh2, Bastian Herzog2, Alexander Achtstein1, XiaoQin Li1, Dries van Thourhout3, Zeger Hens2, Ulrike Woggon3, and Nina Osschumikon1 — 1Institut für Optik und Atomeck Physik, Technische Universität Berlin, Berlin, Germany — 2Department of Inorganic and Physical Chemistry, Ghent University, Ghent, Belgium — 3Department of Information Technology, Ghent University, Ghent, Belgium — 4Physics Department, University of Texas, Austin, Texas, USA

Combining amplitude modulation with phase-sensitive heterodyne detection, we resolve transmission and phase changes of a probe beam in the order of 10^-5. This allows us to disentangle Auger processes and biexciton decay in quantum dots.

Poster

Highly Coherent Femtosecond Electron Pulses for Ultrafast Transmission Electron Microscopy — Nora Bach1, Armin Feist1, Till Domröse2, Thomas Danz2, Marcel Möller1, Nara Rubiano da Silva1, Katharina Priebe1, Christopher Rathje2, Sascha Schäfer3, and Claus Ropers1 — 14th Physical Institute – Solids and Nanostructures, University of Göttingen, Friedrich-Hund-Platz 1, D-37077 Göttingen, Germany — 2Institute of Physics, University of Oldenburg, Carl-von-Ossietzky-Straße 9-11, 26129 Oldenburg, Germany

We describe the implementation and detailed characterization of a laser-triggered field-emitter electron source integrated into a modified transmission electron microscope. Highly coherent electron pulses enable high resolution ultrafast electron imaging and diffraction.

Poster

Towards a 10-fs Hyperspectral Spectroscopy Source with Arbitrable Pulse Shaping Based on Adiabatic Frequency Conversion — Dylan A. Heberle, Noah R. Femmens, Xiaoyue Ding, Weizhong Chang, and Jeffrey Moses — School of Applied and Engineering Physics, Cornell University, Ithaca, New York 14853, USA

We introduce a 10-fs hyperspectral source architecture for facilitating nonlinear spectroscopy with multi-color sequences of arbitrarily shaped 10-fs UV/Vis, near-IR, and mid-IR pulses. Design principles and initial experimental results are provided.
Ultrafast reversal of the ferroelectric polarization — **R.J. Dwayne Miller** — The Max Planck Institute for the Structure and Dynamics of Matter, Hamburg, Germany & Departments of Chemistry and Physics, University of Toronto, M5S 3H6, Ontario, Canada

Atomically resolved reaction dynamics have revealed the key modes driving chemistry and the enormous reduction in dimensionality in the barrier crossing region that makes chemistry a transferable concept.

Multi-mJ Terahertz Generation in Periodically Poled Lithium-Niobate by Pulse Recycling with Dispersion Compensation. — **Lu Wang**, **Arta Fallahi**, **Koustiban Ravi**, and **Franz Kaertner** — Center for Free Electron Laser Science (CFEL), Deutsches Elektronen-Synchrotron (DESY) and Department of Physics, University of Hamburg, Notkestraße 85, 22607 Hamburg, Germany — **Research Laboratory of Electronics and the Department of Electrical Engineering and Computer Science, Massachusetts Institute of Technology (MIT), Cambridge, Massachusetts 02139, USA** — **Physics Department and The Hamburg Centre for Ultrafast Imaging, University of Hamburg, Luruper Chaussee 149, 22761 Hamburg, Germany**

We propose a design for high efficiency narrow band terahertz generation using multiple stages with dispersion compensation and quartz out coupler using Brewster incident angle. Terahertz efficiency of a few percent could be achieved.

Sub-8 optical cycle, 4-12 μm tunable, μJ-level pulse generation via a BaGa₃GeSe₆-based, 1.96 μm pumped OPA at 100 kHz — **Matthias Baudisch**, **Marcus Beutler**, **Martin Gebhardt**, **Christian Gaida**, **Fabian Stutzki**, **Steffen Hädrich**, **Robert Herda**, **Valery Badikov**, **Dmitri Badikov**, **Valentin Petrov**, **Armin Zach**, **Jens Limpert**, and **Ingo Rimke** — **APE Angewandte Physik & Elektronik GmbH, Haus N, Plauener Str. 163-165, 13053 Berlin, Germany** — **Institute of Applied Physics, Abbe Center of Photonics, Friedrich-Schiller-Universität Jena, Albert-Einstein-Str. 15, 07745 Jena, Germany** — **Helmholtz-Institute Jena, Fröbelstieg 3, 07743 Jena, Germany** — **Active Fiber Systems GmbH, Wildenbruchstraße 15, 07743 Jena, Germany** — **TOPTICA Photonics AG (Germany), Lochhamer Schlag 19, 82156 Gräfelfing, Germany** — **High Technologies Laboratory, Kuban State University, 149 Stavropoliska Str., 350040 Krasnodar, Russia** — **Max-Born-Institute for Nonlinear Optics and Ultrafast Spectroscopy, Max-Born-Str. 2A, 12489 Berlin, Germany** — **Fraunhofer Institute for Applied Optics and Precision Engineering, Albert-Einstein-Str. 7, 07745 Jena, Germany**

We present a novel, BaGa₃GeSe₆-based, femtosecond OPA system driven by a CPA Ti:H̶̄̄̄:fiber-laser at 100 kHz. The system delivers mid-to-long-infrared tunable, 1-μJ energy level idler pulses, with sub-160-fs pulse durations and 140-240 cm⁻¹ spectral bandwidths.

Generation of Narrowband, High-intensity, Carrier-envelope Phase-stable Pulses Tunable Between 4 and 18 THz — **BiaoLong Liu**, **Michael Först**, **Hubertus Bromberger**, **Andrea Cartella**, **Thomas Gebert**, and **Andrea Cavalleri** — **Max Planck Institute for the Structure and Dynamics of Matter, Hamburg, Germany** — **Department of Physics, Oxford University, Clarendon Laboratory, Parks Road, Oxford, United Kingdom**

We demonstrate the generation of narrowband (<1 THz) high-energy (~2 μJ) carrier-envelope phase-stable pulses, tunable between 4 and 18 THz as achieved by difference-frequency mixing between chirped near-infrared pulses in organic DSTMS.
Oral WED.3A.3 16:15
Optically induced transient enhancement of a structural order parameter — Michael Porer¹, Michael Fechner², Elisabeth M. Bothschafter¹, Laurent Retting¹, Awadesi Narayani¹, Milan Radovic¹, Matteo Savoini⁴, Vincent Esposito¹, Jochen Rittmann⁵, Martin Kubli³, Teresa Kubacka¹, Tim Huber¹, Martin Neugebauer¹, Elsa Abreu⁶, Sebastian Grübel⁶, Paul Beaud⁵, Gerhard Ingold⁴, Gabriel Lantz⁵, Sergio Parchenkov⁴, Sanghoon Song⁴, Takahiro Satoh⁵, Ulrich Aschauer⁶, Nicola Spaldin⁵, Steve L. Johnson⁴, and Urs Stauber — Swiss Light Source, Paul Scherrer Institute, 5232 Villigen-PSI, Switzerland — 1Materials Theory, ETH Zurich, 8093 Zurich, Switzerland — 2Max Planck Institute for the Structure and Dynamics of Matter, CPEL, 22761 Hamburg, Germany — 3Institute for Quantum Electronics, ETH Zürich, 8093 Zurich, Switzerland — 4SwissFEL, Paul Scherrer Institute, 5232 Villigen-PSI, Switzerland — 5LCIS, SLAC National Accelerator Laboratory, Menlo Park, California 94025, USA — 6Dept. of Chemistry and Biochemistry, University of Bern, 3012 Bern, Switzerland

We photexcite SrTiO₃ and EuTiO₃ in their purely soft-mode-driven structurally distorted phase and track the structural order parameter via ultrashort x-rays. We observe a rapid decay for SrTiO₃ and an intriguing transient enhancement for EuTiO₃.

Oral WED.3A.4 16:30
Observation of THz-induced molecular orientation in water — Peter Zalden², Liwei Song¹, Xiaojun Wu¹,², Haoyu Huang³, Frederike Ahir³, Oliver D. Mücke³,⁴, Joscha Reichert³,¹, Michael Thorwart³,¹, Pankaj K. Mishra¹,³, Ralph Welsch¹, Robin Šantara³,¹,², Franz X. Kärtner³,¹, and Christian Bressler³,¹ — ¹Centre for Ultrafast Imaging CUI, University of Hamburg, 22761 Hamburg, Germany — ²European XFEL, Holzkoppel 4, 22869 Schenefeld, Germany — ³Free-Electron Laser Science CFEL, Deutsches Elektronen-Synchrotron, 22607 Hamburg, Germany — ⁴State Key Lab. of High Field Laser Physics, Shanghai Institute of Optics and Fine Mechanics, 201800 Shanghai, China — ⁵Department of Physics, University of Hamburg, Jungiusstr. 9, 20355 Hamburg, Germany — ⁶I. Institut für Theoretische Physik, Universität Hamburg, Jungiusstr. 9, 20355 Hamburg, Germany — ⁷School of Electronic and Information Engineering, University of Science and Technology, Beijing 100091, China

Water dynamics is studied by excitation with intense single-cycle pulses of 0.25 THz center frequency. An optical probe reveals a transient, negative-signed Kerr effect, which is shown to result from an orientation of water’s dipole moments.

Oral WED.3A.5 16:45
Strong-field physics in the molecular frame — Andrea Trabattoni¹,², Sebastian Trapp³,¹,², Umberto De Giovannini¹,³, Jean-François Olivieri², José Wiese³, Terry Mullins¹, Jolijn Onylei², Sang-Kil Son³,², Babigio Frusteri², Angelo Rubio⁴,²,⁷, and Jochen Köppér¹,²,⁵,⁷ — ¹Center for Free-Electron Laser Science, Deutsches Elektronen-Synchrotron DESY, Notkestraße 85, 22607 Hamburg, Germany — ²The Hamburg Center for Ultrafast Imaging, Universität Hamburg, Luruper Chaussee 149, 22761 Hamburg, Germany — ³Max Planck Institute for the Structure and Dynamics of Matter and Center for Free-Electron Laser Science, Hamburg 22761 Hamburg, Germany — ⁴Dipartimento di Fisica e Chimica, Universita degli Studi di Palermo, Via Archirafi 36, 1-90123, Palermo, Italy — ⁵Department of Chemistry, Universität Hamburg, Martin-Luther-Platz 6, 20146 Hamburg, Germany — ⁶Center for Computational Quantum Physics (CCQ), The Flatiron Institute, 162 Fifth Avenue, New York NY 10010 — ²Department

Oral WED.3B.4 16:15
Direct Time-Domain Shaping of High-Energy Femtosecond Pulses at THz Burst Frequencies — Tobias Flörty¹, Edgar Kaekees¹, Ignas Austrauskas¹, Tadas Balčiūnas¹, Audrius Pugžlys¹,²,²,²,²,²,³, Andrius Balčiuška¹,³, Daniil Kartashov³, Alexander Mitrofanov³, Andrey Fedotov³, Dmitri Sidorov-Bryukov⁴, and Alexei M. Zheltikov⁴,³,⁵,⁶ — ¹Photonics Institute, TU Wien, Gusshausstrasse 27-38, A-1040 Vienna, Austria — ²Center for Physical Sciences & Technology, Savanoriu Ave. 23 LT-02300 Vilnius, Lithuania — ³Friedrich-Schiller University Jena, Max-Wien Platz 1, 07743 Jena, Germany — ⁴Physics Department, M.V. Lomonosov Moscow State University, 119992 Moscow, Russia — ⁵Russian Quantum Center, ul. Novaya 100, Skolkovo, Moscow Region, 143025 Russia — ⁶Department of Physics and Astronomy, Texas A&M University, College Station TX, 77843–4242, USA

We demonstrate generation of fully controllable fs multimillijoule pulse bursts with the energy handling, throughput efficiency and frequency resolution substantially exceeding spatial-light-modulator and interferometric techniques. A proof-of-concept experiment coherently controls nitrogen-ion emission via multiple-pulse excitation.

Oral WED.3B.5 16:30
Millijoule Few-Cycle 5 μm Source at 1 kHz Repetition Rate for Generating Broadband Pulses from the Mid- to Far-Infrared — Giulia Foplini, Klaus Reimann, Michael Woerner, Lorenz von Graevenitz, Martin Bock, Uwe Griebner, and Thomas Elsaesser — Max-Born-Institut für Nichtlineare Optik und Kurzzeitspektroskopie, Berlin, Germany

We present a novel few-cycle 5 μm source delivering 75 fs pulses with 1.2 mJ energy at a 1 kHz repetition rate and its first applications for broadband pulse generation from the mid- to far-infrared.

Oral WED.3B.6 16:45
Segmented Terahertz device for ultrashort electron acceleration, compression, focusing and streaking — Dongfang Zhang¹,², Arty Fallahi¹, Michael Hemmer³, Xiaojun Wu¹, Moerin Pakhari¹,², Yi Hua¹, Huseyn Cankaya¹, Anne-Laure Calendron¹, Luis E. Zapata¹, Nicholas H. Matlis¹, and Franz X. Kärtner¹,²,³ — ¹Deutsches Elektronen-Synchrotron, Hamburg, Germany — ²University of Hamburg, Hamburg, Germany — ³Research Laboratory of Electronics, MIT, Massachusetts, USA

We present a novel THz based device (STEAM) capable of performing multiple high-field operations of electron acceleration, compression, focusing and streaking.
Laser-aligned carbonyl-sulfide molecules were strong-field ionized by using mid-infrared light. Investigating the strong-field effects in the molecular frame allowed to add novel facets to the understanding of the intrinsic nature of strong-field physics.

Oral  WED.3A.6  17:00

**Intense-Terahertz-Pulse Enhancement of Hot-Carrier Photoluminescence in GaAs** — David Purschke¹, MengXing Na¹, Andrew Longman¹, Lyubov Titova², and Frank Hegmann¹

¹University of Alberta, Edmonton, Canada — ²Worcester Polytechnic Institute, Worcester, United States

We demonstrate enhancement of hot-carrier photoluminescence (PL) with intense terahertz pulses in GaAs. Using a simple model, we show that both PL enhancement as well as near-band-gap PL quenching arise from terahertz-induced carrier heating.

Oral  WED.3B.7  17:00

**Multidimensional Terahertz Control of Electron Pulses** — Dominik Ehrberger¹, Andrey Ryabov¹,², and Peter Baum¹,²

¹Universität Hamburg, Luruper Chaussee 149, 22761 Hamburg, Germany — ²Universität Hamburg, Dauenseestr. 4, 22761 Hamburg, Germany

We report the all-optical compression and streaking of ultrashort electron pulses for microscopy & diffraction by THz radiation. We also demonstrate multidimensional control in space and time, exemplified by the generation of tilted electron pulses.

18:30–22:00: HARBOUR TOUR AND CONFERENCE BANQUET

kindly sponsored by Coherent Inc.
THU.1: Exciton Dynamics

Chaired by Tobias Brixner, University of Würzburg, Würzburg, Germany

Time: Thursday, 8:30–10:15

Invited

Ultrafast Coherent Exciton Dynamics in a Series of Cofacial Perylene Bisimide Stacks — DONGHO KIM — Department of Chemistry and Spectroscopy Laboratory for Functional π-Electronic Systems, Yonsei University, Seoul 03722, Korea

With broadband fluorescence upconversion and transient absorption techniques, we investigated Frenkel exciton and excimer formation dynamics in perylene bisimide dimer, tetramer, and extended-oligomer aggregates and excimer-mediated symmetry-breaking charge-separation dynamics in a perylene bisimide dimer cyclophane.

Oral


We use sub-10 fs transient absorption microscopy to study exciton transport in cyanine J-aggregates. Our observations provide direct evidence for ultralong-range energy migration. Intriguingly, the speed of transport is suggestive of ballistic motion.

Ultrafast bi-excitonic dynamics and annihilation in molecular and mesoscopic systems — PAVEL MALEVICH, CONSTANTIN HESHMATPOUR, CRAIG LINCOLN, HARALD CSEYMANN, MAXIMILIAN SCHRECK, and JÜRGEN HAUER — Photonic Institute, Vienna University of Technology, Gusshausstrasse 27-29, 1040, Vienna, Austria — Institut fuer Organische Chemie, Universität Wuerzburg, Am Hubland, D-97074, Wuerzburg, Germany — Professur fur Dynamische Spektroskopien, Fakultät für Chemie, Technische Universität Müenchen, Lichtenbergstr. 4, D-85748, Garching b. Müenchen, Germany

We present 5th and 3rd order 2D spectra of a squaraine trimer. Slowly decaying (τ = 0.8 ps) and intensity dependent features unique to the 5th order signal are attributed to exciton-exciton annihilation.

Oral

Two-dimensional Electronic Spectroscopy reveals Ultrafast Dynamics at a Conical Intersection in an Organic Photovoltaic Material — EPHRAIM SOMMER, ANTONIETTA DE SIO, ELENA MENA-OSTERTIZ, PETER BÄGERLE, and CHRISTOPH LIENAU — Institut für Physik, Carl von Ossietzky Universität, Oldenburg, Germany — Institut für organische Chemie II und neue Materialien, Universität Ulm, Germany

Two-dimensional electronic spectroscopy with sub-10-fs time resolution reveals signatures of vibronic coupling and wavepacket motion through a conical intersection in the initial charge separation dynamics of an acceptor-donor-acceptor oligomer thin film for organic solar cells.

Oral

Correlation between optical and transport properties in organic semiconductors — BENJAMIN STADTMÜLLER, SEBASTIAN EMMERICH, DOMINIK JUNGKNECHT, NORMAN HAAG, CHRISTINA SCHOTT, STEFFEN EICH, MARKUS ROLLINGER, MAHALINGAM MANIJA, MARTIN AESCHLIMMANN, MIRKO CINCHETTI, and STEFAN MATHIAS — Department of Physics and Research Center OPTIMAS, University of Kaiserslautern, 67663 Kaiserslautern, Germany — Graduate School of Excellence Materials Science in Mainz, Erwin-Schrödinger-Straße 46, 67663 Kaiserslautern, Germany — Experimentelle Physik VI, Technische Universität Darmstadt, 44221 Darmstadt, Germany — Physikalisches Institut, Georg-August-Universität Göttingen, Friedrich-Hund-Platz 1, 37077 Göttingen, Germany

Using time-resolved photoemission, we investigate the correlation between optical and transport properties of organic semiconductors on fs timescales. Optical excitation leads to exciton formation which strongly modifies the energy level alignment of the transport levels.

10:15–10:45: EXHIBITION AND COFFEE BREAK
THU.2A: New Methods in Spectroscopy
Chaired by Francesca Calegari, CFEL and DESY, Hamburg, Germany
Time: Thursday, 10:45–12:30 Location: Festsaal

Invited
THU.2A.1 10:45
Free space laser telecommunication through fog and clouds — Thomas Probst1, Guillaume Schimmel1, Denis Mongin1, Jérôme Kasparian1,2, and Jean-Pierre Wolf1 — 1Groupe de Physique Appliquée, Université de Genève, Chemin de Pinchat 22, CH-1211, Genève 4, Switzerland — 2Institut des Sciences de l'environnement, Université de Genève, Boulevard Carl-Vogt 66, CH-1205, Genève, Switzerland

We present a disruptive approach to allow free space laser telecommunication through fog and clouds, by making use of the opto-mechanical displacement of water droplets induced by the shockwave of high peak power femtosecond laser filaments.

Oral
THU.2A.2 11:15
Photonic Time-Stretch Spectroscopy for Broadband Stimulated Raman Scattering — Francesco Saltarelli, Vikas Kumar, Daniele Viola, Francesco Crisafi, Fabrizio Preda, Giulio Cerrullo, and Dario Polli — CNR-IFN and Dipartimento di Fisica, Politecnico di Milano, Pza L. da Vinci 32, 20133 Milano, Italy

We introduce a novel approach to broadband stimulated Raman scattering based on photonic time-stretch. An optical fiber stretches the broadband femtosecond Stokes pulse to ≥15 ns, mapping frequency to time and allowing high-frequency single-shot spectrum detection.

Oral
THU.2A.3 11:30
All-Optical Switching and Real-Time Spectroscopy of Soliton Molecules in a Few-Cycle Laser Oscillator — Felix Kurz1, Daniel Solli2, Bahram Jalali3, Claus Ropers1, and Georg Herrmann1 — 1IV. Physical Institute, Goettingen, Germany — 2Department of Electrical Engineering, UCLA, Los Angeles — 3Institute of Physics, Bayreuth, Germany

Bound states of femtosecond solitons are generated and controlled in a commercial Kerr-lens mode-locked oscillator. Using real-time time-stretch interferometry, we resolve the resonance of

THU.2B: High Harmonic Generation in Condensed Phase
Chaired by Henry Kapteyn, University of Colorado, Boulder, CO, USA
Time: Thursday, 10:45–12:30 Location: Spiegelsaal

Oral
THU.2B.1 11:00
Experimental verification of selection rules for circularly polarized high harmonics from a solid — Narui Kato, Peiyu Xia, Faming Lu, Noruhisa Ishii, Teruto Kanai, and Jiro Ishitani — The Institute for Solid State Physics, the University of Tokyo, Kashiwa, Chiba, Japan

We experimentally verify selection rules for circularly polarized high harmonics from solids by using single-color circularly polarized mid-infrared pulses. Our result offers a novel way to produce circularly polarized, coherent short-wavelength light.

Oral
THU.2B.2 11:15
Polarization states of high-harmonics generated in silicon from elliptical drivers — Nicolas Klemke1,2, Nicolas Tancogne-Dejean1,2, Giulio M. Rossi1,2, Yudong Yang1,2, Rolando E. Mainz1,2, Giuseppe Di Sciacca1, Angel Rubio2,4, Franz X. Kärner1,3, and Oliver D. Müller1,5 — 1Center for Free-Electron Laser Science, CFEL, Deutsches Elektronen-Synchrotron DESY, Hamburg, Germany — 2Physics Department, University of Hamburg, Hamburg, Germany — 3Max Planck Institute for the Structure and Dynamics of Matter, Hamburg, Germany — 4European Theoretical Spectroscopy Facility ETSF — 5The Hamburg Centre for Ultrafast Imaging CUI, Hamburg, Germany

The polarization states of high-harmonics generated in silicon with elliptical excitation is studied. Circularly polarized harmonics are demonstrated with both circular and non-circular excitation, determined by crystal symmetry and dynamical response of the system.

Oral
THU.2B.3 11:30
High-Harmonic Generation Controlled by Valley-Polarization in Transition Metal Dichalcogenide Monolayers — Naotaka Yoshikawa1, Kohei Nagai1, Yuhei Takaguchi1, Shogo Sasaki1, Yasutomo Miyata1, and Koichiro Tanaka1,2 — 1Department of Physics, Kyoto University, Oiwake-cho, Kitashirakawa, Sakyo, Kyoto, 606-8502 Japan — 2Department of Physics, Tokyo Metropolitan University, Hachioji, Tokyo 192-0397, Japan — 3Institute for Integrated Cell-Material Sciences (iCeMS), Kyoto University, Yoshida-honnmachi, Sakyo, Kyoto, 606-8501 Japan

Enhancement of even orders of high-harmonic generation is confirmed around the band-nesting absorption band that shows valley-polarization in transition metal dichalcogenide monolayers. Driving in anisotropic k-space keeps valley-polarization should give enhancement and polarization selection rule.

Oral
THU.2B.4 11:30
Amplification of high-order harmonics in semiconductor waveguides — Dominik Franz1, Shatha Kaassaman1, David Gauthier1, Rana Nicolae1, Willem Bout1, Jean-Thomas Gomes2,3, Laure Lavoue2,3, Dmitry Gaponov2,3, Nicolas Ducros1,2, Sébastien Fvrier1,2, and Hamed Mere1 — 1LIDYL, CEA, CNRS, Université Paris-Saclay, CEA Saclay, 91191 Gif sur Yvette, France — 2Novae, ZA du Moulin Cheyroux, 87700 Aixe-sur-Vienne, France — 3Univ. Limoges, CNRS, XLIM, UMR 7252, 87000 Limoges, France
vibrating soliton molecules and demonstrate all-optical switching between stable doublet states.

Oral THU.2A.4 11:45

Antenna-enhancements of molecular vibrational responses in ultrafast infrared spectroscopy — Ikki Morichika, Atsunori Sakurai, and Satoshi Asahiara — Institute of Industrial Science, The University of Tokyo, 4-6-1, Komaba, Meguro-ku, Tokyo, 153-8505, Japan

We demonstrate surface-enhanced ultrafast vibrational spectroscopy by employing periodic arrays of infrared-resonant gold nanoantennas. Furthermore, we analytically formulate and evaluate the linear/nonlinear signal enhancements using a coupled-dipole model.

Oral THU.2A.5 12:00

Direct imaging of ultrafast electron dynamics by X-ray sum frequency generation — Jeremy Rouxel, Markus Kowalewski, Kochise Bennett, and Shaul Mukamel — Department of Chemistry and Department of Physics and Astronomy, University of California, Irvine, CA 92697, USA

We present a nonlinear X-ray technique which provides a spatial electron density image of valence electron excitations. The technique combines a visible pump and an X-ray pulse and yields snapshots of the transition charge densities.

Oral THU.2A.6 12:15

Infrared pre–excitation grants isotopomer–specific photochemistry — Daniela Kern-Michler1, Carsten Neumann1, Nicole Mielke1, Luuk van Wilderen1, Matthias Reinfelds1, Jan von Cosel1, Fabrizio Santoro1, Alexander Heckel2, Irene Burghardt3, and Jens Breitenbeck1 — 1Institute of Biophysics, Goethe-University Frankfurt, Frankfurt am Main, Germany — 2Institute of Organic Chemistry and Chemical Biology, Goethe-University Frankfurt, Frankfurt am Main, Germany — 3Institute of Physical and Theoretical Chemistry, Goethe-University Frankfurt, Frankfurt am Main — 4Consiglio Nazionale delle Ricerche, Istituto di Chimica dei Composti Organico Metallico, UOS di Pisa, Pisa, Italy

Species-selective photochemistry is often hampered by overlapping UV-Vis spectra. We overcome this long standing problem by combined vibrational and electronic excitation as demonstrated by isotopomer selection. The influence of various factors on selectivity is discussed.

We report on amplification of non-perturbative harmonics in semiconductor waveguides by several orders of magnitude. Harmonic amplification is achieved by field enhancement of the fundamental beam in nanocones, which yields a dramatic increase in intensity.

Oral THU.2B.5 12:00

Efficient Terahertz Harmonics Generation in Single Layer Graphene — Hassan A. Hafez1,2, Sergey Kovalev1, Jan-Christoph Deinert1, Zoltan Mics2, Bertram Green3, Niles Arm3, Min Chen1, Semyon Germanaskiy3, Zhe Wang1, Klaas-Jan Tielen2, Zhaoyang Liu2, Zongping Chen2, Akimitsu Naita3, Klaus Müller2, Mischa Bonn2, Michael Geneser1, and Dmitry Turchinovich1,2 — 1Fakultät für Physik, Universität Duisburg-Essen, Duisburg, Germany — 2Max-Planck-Institut für Polymerforschung, Mainz, Germany — 3Helmholtz-Zentrum Dresden-Rossendorf, Dresden, Germany — 4ICFO-Institut de Ciencies Fotoniques, Barcelona, Spain

We report on highly efficient terahertz harmonics generation by hot Dirac fermions in single layer graphene under ambient conditions. The corresponding nonlinear coefficients substantially exceed that of typical solids by many orders of magnitude.

Oral THU.2B.6 12:00

Band-resolved double photoemission spectroscopy on correlated electrons in solids using high-order harmonics at megahertz repetition rates — Cheng-Tien Chang1,2, Andreas Trützheller1,2, Michael Huth2, Robin Kamrla1,2, Frank O. Schumann2, and Wolf Widdra1,2 — 1Institute of Physics, Martin-Luther-Universität Halle-Wittenberg, Halle (Saale), Germany — 2Max-Planck-Institut für Mikrostrukturphysik, Halle (Saale), Germany

By using high-order harmonics at megahertz repetition rates, correlated electron pairs in the valence bands of Ag and Cu are resolved by double photoemission spectroscopy.

Oral THU.2B.7 12:15

Extreme-Ultraviolet High-order Harmonic Generation in Liquids — Tran Trung Liu, Zhong Yin, Arohi Jain, Thomas Gaumütz, Yvonn Pertot, Jun Ma, and Hans Jakob Werner — Laboratorium für Physikalische Chemie, ETH Zürich, Vladimir-Prolog-Weg 2, 8093 Zürich Switzerland

We report the first observation of extreme-ultraviolet HHG from the bulk of liquids, i.e. water and the three most common alcohols. The emitted radiation is shown to be a promising probe of the electronic properties of liquids.
Thursday Sessions

**THU.3A: 2D Materials**

**Time:** Thursday, 14:00–15:45  
**Location:** Festsaal

**Oral**  
**THU.3A.1** 14:00  
Ultrafast dynamics across the topological phase transition in the Weyl semimetal MoTe2 — **Alberto Crepaldi**, Gabriela Ates, Gianmarco Gatti, Silvan Roth, Andrea Sterzi, Giulia Manzoni, Michele Zacchigna, Cephe Cacho, Emma Springate, Philippe Bignon, Helmut Berger, Arnaud Magrez, Ivan Vobornik, Kai Rossnagel, Fulvio Parmigiani, Oleg Yazyev, and Marco Grioni 1

**THU.3A.2** 14:15  
Time-domain observation of ultrafast exciton formation in monolayer MoS2 — **Chiara Trovatello**, Stefano Dal Conte, Nick Boris, Kaiyuan Yao, Francesco Scottoni, Ilka Krieger, Lucia Ganzer, Rocio Borrego Varillas, P. James Schuck, and Giulio Cerullo 1

**Oral**  
**THU.3A.3** 14:30  
Ultrafast manipulation of the structure of WTe2 via terahertz frequency light pulses — **Ebdert Sie**, Clara Nyby, Suii Park, Matthias Hoffmann, Benjamin Ofori-Oka, Nathan Finney, Daniel Rhodes, Renkai Li, Jie Yang, Xiaozhe Shen, James Hone, Luis Balicas, Tony Heinz, Xihe Wang, and Aaron Lindenberg 1 Stanford University / SLAC National Accelerator Laboratory, Menlo Park, CA, USA 2Columbia University, New York, NY, USA 3High Magnetic Field Laboratory, Tallahassee, FL, USA

**THU.3B: Photochemistry**

**Chaired by Philip Wernet, Helmholtz-Zentrum Berlin für Materialien und Energie GmbH, Germany**

**Oral**  
**THU.3B.1** 14:00  
Ultrafast Dynamics of Hydrated Excess Protons in CH3CN:H2O Mixtures — **Fabian Dahms**, Achintya Kundu, Ehud Pines 1, Benjamin P. Fingerhut 2, Erik T. J. Nibbering 3, and Thomas Elsaesser 1 1Max Born Institut für Nichtlineare Optik und Kurzzeitpektroskopie, Berlin, Germany 2Ben Gurion University of the Negev, Beer-Sheva, Israel

We have investigated by time-resolved ARPES the evolution of the ultrafast electron dynamics across the topological phase transition of the Weyl semimetal MoTe2, bearing evidence of the Weyl point formation.

**Oral**  
**THU.3B.2** 14:15  
Ultrafast Proton Transport in Water-Methanol Mixtures — **Maria Ekimova**, Felix Hoffmann, Gül Berçoğlu-Neff 2, Aidan Raphael, Erik T. J. Nibbering 1, and Daniel Sebastiani 3 1Max Born Institut für Nichtlineare Optik und Kurzzeitpektroskopie, Berlin, Germany 2Institut für Chemie, Martin-Luther-Universität Halle-Wittenberg, Halle (Saale), Germany

Femtosecond UV/IR pump-probe experiments and ab initio molecular dynamics calculations of 7-hydroxyquinoline in water-methanol mixtures demonstrate an unexpectedly dominant OH−/CH3O− transport pathway but consistent with a solvent-dependent photoacidity free energy-reactivity correlation behaviour.

**Oral**  
**THU.3B.3** 14:30  
UV-photochemistry of the biologically relevant thiol group and the disulfide bond: Evolution of early photoproducts from pico-second X-ray absorption spectroscopy at the sulfur K-Edge — **Miguel Ochmann**, Abid Hussain, Inga von Ahnen 1, Amy Cordones 2, Kibyong Hong 1, Jae Huyk Lee 2, Rory Ma 1, Katrin Adamczyk 1, Tae Kyu Kim 1, Robert W. Schoenlein 2, Oriol Vendrell 3, and Nils Huse 1 1Department of Physics, University of Hamburg and Center of Free Electron Laser Science, Hamburg, Germany 2Ultrafast X-ray Science Lab, Chemical Sciences Division, Lawrence Berkeley National Laboratory, Berkeley, CA, USA 3Department of Chemistry and Chemistry Institute of Functional Materials, Pusan National University, Busan, South Korea 4Center for Free-Electron Laser Science, DESY, Hamburg, Germany

We report on the biologically relevant sulfur-containing thiol group and the disulfide bond using pico-second X-ray absorption spectroscopy at the sulfur K-edge, providing unique elementspecific insight into their 267 nm UV-induced photochemistry using model compounds.
Oral THU.3A.4 14:45
Intravalley spin scattering dynamics in WS2 — •ZILOG LONG WANG1, ALEJANDRO MOLINA-SANCHEZ2, PATRICK ALTMANN1, DAVIDE SANGALLI3, DOMENICO DE FAZIO4, GIANNCARLO SOAVI1, UGO SASSI1, FEDERICO BOTTEGONI1, FRANCO CICCICCI1, MARCO FINAZZI1, LUDGER WIRTZ1, ANDREA C. FERRARI1, ANDREA MARINI1, GIULIO CERULLO1,2, and STEFANO DAL CONTE1,2 — 1Dipartimento di Fisica, Politecnico di Milano, Piazza L. da Vinci 32, I-20133 Milano, Italy — 2Institute of Materials Science (ICMUV), University of Valencia, Catedrático Beltrán 2, E-46980, Spain, Spain — 3Istituto di Struttura della Materia (ISM), CNR, Via Salaria Km 29.3, I-00016 Monterotondo Stazione, Italy — 4Cambridge Graphene Centre, University of Cambridge, 9 JJ Thomson Avenue, Cambridge CB3 0FA, United Kingdom — 5Université du Luxembourg, 162 A, avenue de la Faïencerie, L-1511 Luxembourg — 6IFN-CNR, Piazza L. da Vinci 32, I-20133 Milano, Italy
We use helicity-resolved transient absorption spectroscopy to track intravalley scattering dynamics in monolayer WS2. We find that spin-polarized carriers scatter from upper to lower conduction band by reversing their spin orientation on a sub-ps timescale.

Oral THU.3A.5 15:00
Lightwave control of the valley pseudospin in a monolayer of tungsten diselenide — •CHRISTOPH P. SCHMID1, FABIAN LANGER1, STEFAN SCHLAUDERER1, MARTIN GMITRA1, JAROSLAV FABIAN1, PHILIPP NAGLER1, CHRISTIAN SCHÜLLER1, TOBIAS KORN1, PETER G. HAWKINS2, JOHANNES T. STEINER2, ULRICH HUTTNER2, STEFAN W. KOCH3, MACKILLO KIRA1, and RUPERT HUBER1 — 1University of Regensburg, 93040 Regensburg, Germany — 2University of Marburg, 35032 Marburg, Germany — 3University of Michigan, Ann Arbor, Michigan 48109, USA
Intense multi-THz waveforms drive coherent intervalley transport of photogenerated electron–hole pairs in monolayer tungsten diselenide, which enables a subcycle switching of the valley pseudospin and paves the way towards valleytronics at optical cycle scales.

Oral THU.3A.6 15:15
The influence of oxygen adsorption on THz phot conductivity in MoS2 laminate — •GUOHONG MA — Department of Physics, Shanghai University, Shanghai, China
Optical pump THz probe spectroscopy was used to study THz phot conductivity of MoS2 laminate in N2, air and O2. In contrast to a negative phot conductivity in N2, the positive phot conductivity is observed in air and O2 due to the oxygen passivation.

Oral THU.3A.7 15:30
Extreme Ultraviolet Core-Exciton Dynamics in Two-dimensional Molybdenum Disulfide — •MICHAEL ZÜRCH1, HUNG-TZU CHANG1, ALEXANDER GUGGENMOS2, DIANA Y. QIU2,3, ROMAIN GENEUX4, YEN-CHANG CHEN4,5, XUAN WEI4, CHANG-MING JIANG6,7, YUFENG LIANG6,7, FELIPE H. DA JORNADA1,2, ADAM SCHWARTZBERG1, DAVID PRENDERGAST1, VINCENT C. TUNG4, STEVEN G. LOUE2,3, DANIEL M. NEUMARK1,2, and STEPHEN R. LEONE1,2,3 — 1Department of Chemistry, University of California, Berkeley, CA-94720, USA — 2Department of Physics, University of California, Berkeley, CA-94720, USA — 3Materials Sciences Division, Lawrence Berkeley National Laboratory, Berkeley, CA-94720, USA — 4Molecular Foundry, Lawrence Berkeley National Laboratory, Berkeley, CA-94720, USA — 5School of Engineering, University of California, Berkeley, CA-94720, USA — 6Department of Physics, University of Colorado, Boulder, CO, USA. — 7Department of Physics, California Institute of Technology, Pasadena, CA, USA

Oral THU.3A.8 15:45
Ultrafast Stimulated Raman Study of the Complete Reactive Potential Energy Surface of a Photomolecular Rotor — •CHRISTOPHER HALL1, STEPHEN MEECH1, WESLEY BROWN2, and BEN FERINGA1 — 1University of East Anglia, Norwich, UK — 2University of Groningen, Groningen, The Netherlands
Femtosecond Stimulated Raman Spectroscopy (FSRS) reports on structure and dynamics of excited states. Here we record FSRS for a photomolecular motor in its stable and metastable states, and thus map the entire excited state PES.

Oral THU.3A.9 15:55
Ultrafast Dynamics of Highly Constrained Azobenzene Macrocycles — •CHAYDAV SLOVÁK1, CHONG YANG1, LUCAS SCHWIEGHAUSER1, ANDREAS HEINDE1, HERMANN WEGNER3, ANDREAS DREW2, and JOSEP WACHTVERITZ1 — 1Institute of Physical and Theoretical Chemistry, Goethe University, Frankfurt am Main, Germany — 2Interdisciplinary Center for Scientific Computing (IWR), University of Heidelberg, Germany — 3Institute of Organic Chemistry, Justus-Liebig University Giessen, Giessen, Germany
The ultrafast photoisomerization of model azobenzene macrocycles was studied by transient absorption spectroscopy. Our results reveal a strong dependence of the dynamics and the overall molecular properties on the geometric constraints and the intramolecular strain.

Oral THU.3A.10 16:05
How Efficiently Can Carbonic Acid Protonate Biological Bases? — •DANIEL AMINOV1, DINA PINES1, PHILIP M. KIEFER2, SNEHASIS DASCHAKRABORTY3, JAMES T. HYNES1,2, and EHUD PINES1 — 1Ben-Gurion University of the Negev, Beer-Sheva, Israel — 2University of Colorado, Boulder, CO, USA. — 3Ecole Normale Supérieure-PSL Research University, Paris, France
We demonstrate the ability of intact carbonic acid — previously considered too unstable to be a viable protonating agent — to protonate bases under physiological-like conditions with high efficiency by using both experimental and theoretical methods.

Oral THU.3A.11 16:15
Relaxation of Excited Free OH at the Air/Water Interface Revealed by Time-Resolved Heterodyne-Detected Vibrational Sum Frequency Generation — •SATOSHI NIIHONYANGAKI1, KEN-ICHI INOUE1, and TAHITI TAHARA1,2 — 1Molecular Spectroscopy Laboratory, RIKEN, 2-1 Hirosawa, Wako, Saitama 351-0198, Japan — 2Ultrafast Spectroscopy Research Team, RIKEN Center for Advanced Photonics, 2-1 Hirosawa, Wako, Saitama 351-0198, Japan
Femtosecond time-resolved interface-selective nonlinear spectroscopy unveils ultrafast dynamics of water at the outermost surface. Absence of isotope effect on the vibrational lifetime suggests that the excited free OH at the surface relaxes through reorientation exclusively.
We report the direct observation of relatively long-lived core-excitons in two-dimensional transition-metal dichalcogenide MoS$_2$ initiated by an attosecond extreme ultraviolet pulse. We observe coherences between the core-exciton states in addition to ultrafast valence dynamics.

**THU.PO: EXHIBITION, COFFEE BREAK & POSTER SESSION III**

**Time:** Thursday, 15:45–17:15  
**Location:** Grand Foyer

**Poster**  
**THU.PO.1 15:45**  
**Coherent Rotational Control of Asymmetric Molecular Rotors by Optical Pulses and Terahertz Fields**  
**— RAN DAMARI$^{1,2}$, SHMESHON KALLUSH$^{1}$, and SHARLY FLEISCHER$^{1,2}$**  
$^1$Department of Chemical Physics, Tel-Aviv University, Tel Aviv 6997801, Israel  
$^2$Tel-Aviv University Center for Light-Matter-Interaction, Tel Aviv 6997801, Israel  

We experimentally and theoretically the interaction of Asymmetric-top molecules with optical and terahertz pulses that provide two complementary rotational handles for controlling the rotational dynamics of molecules in the gas phase.

**Poster**  
**THU.PO.2 15:45**  
**The Ramifications of Coherent Radiative Decay on Periodically Orienting Molecular ensembles**  
**— RAN DAMARI$^{1,2}$, DINA ROSENBERG$^{1,2}$, and SHARLY FLEISCHER$^{1,2}$**  
$^1$Department of Chemical Physics, Tel-Aviv University, Tel Aviv 6997801, Israel  
$^2$Tel-Aviv University Center for Light-Matter-Interaction, Tel Aviv 6997801, Israel  

We experimentally show that field-free rotational dynamics induced by terahertz fields decay faster than by optical pulses. This is attributed to coherent radiative emission of terahertz-oriented ensembles that is lacking in optically-aligned ensembles.

**Poster**  
**THU.PO.3 15:45**  
**Effect of the hole states in time-resolved dynamical Franz-Keldysh effect**  
**— TOMOHITO OTOBE**  
National Institutes for Quantum and Radiological Science and Technology, KPSI, Kyoto, Japan  

Time-resolved dynamical Franz-Keldysh effect with the hole created in the valence band is presented. The hole generates the odd-harmonic modulation with respect to the pulse laser frequency.

**Poster**  
**THU.PO.4 15:45**  
**CEP-sensitive control of multiphoton ionization using shaper-generated variable frequency ratio bichromatic fields**  
**— STEFANIE KERBSTADT, DOMINIK PENGEL, LARS ENGELERT, TIM BAYER, and MATTHIAS WOLLENHAUPT**  
Carl von Ossietzky University, Oldenburg, Germany  

We demonstrate CEP-control of asymmetries in the multiphoton-ionization of xenon atoms using bichromatic fields of specifically tailored frequency ratio, generated by supercontinuum polarization shaping. CEP-sensitivity arises from the interference of continuum states with opposite parity.

**Poster**  
**THU.PO.5 15:45**  
**Probing molecular unidirectional rotation with high order harmonic generation**  
**— LIXIN HE, PENGFEI LAN, BAONING WANG, FENG WANG, WEI CAO, QINGBING ZHANG, XIAOSONG ZHU, and PEIXIANG LU**  
$^1$School of Physics and Wuhan National Laboratory for Optoelectronics, Huazhong University of Science and Technology, Wuhan 430074, China  
$^2$Laboratory of Optical Information Technology, Wuhan Institute of Technology, Wuhan 430205, China

We propose an angular high-harmonic spectroscopy method to probe the molecular unidirectional rotation. From the measured time-dependent angular distributions of harmonics, the spatiotemporal evolution of the molecular rotational wave packet is directly visualized.

**Poster**  
**THU.PO.6 15:45**  
**Frustrated Double Ionization of Argon Atoms in Strong Laser Fields**  
**— SEYEDREZA LARIMAN, SONIA ERATTUPUZHA, ANDRIS BALTSUASKA, MARKUS KITZLER, and XINHUA XIE**  
Photonics Institute, Technische Universität Wien, Vienna, Austria  

We report coincidence measurements of frustrated double ionization of argon atoms with a reaction microscope. Experimental results show electron trapping process during double ionization has a clear transition from the nonsequential to the sequential regime.

**Poster**  
**THU.PO.7 15:45**  
**Ultrafast Plasmon-plasmon Coupling Probed by Strong-field Photoemission**  
**— SZUZSANNA PÁPA, JUDIT BUDÁI, ISTVÁN MÁRTON, PIOTR WRÓBEL, TOMASZ STEFANIUK, SZUZSANNA MÁRTON, PÉTER RÁCS, and PÉTER DOMBII**  
"Lendület" Ultrafast Nanoptics Group, Wigner Research Centre for Physics, 1121 Budapest, Hungary  
$^1$ELI-ALPS Research Institute, ELI-HU Nonprofit Kft., 6720 Szeged, Hungary  
$^2$Department of Optics and Quantum Electronics, University of Szeged, 6720 Szeged, Hungary  
$^3$Faculty of Physics, University of Warsaw, 02-093 Warsaw, Poland  
$^4$Department of Experimental Physics, University of Pécs, 7624 Pécs, Hungary

Coupling of propagating and localized plasmons is studied on different nanostructured Ag films by direct photoelectron near-field probing. Contributions from propagating and localized plasmon modes and fundamental mechanisms of localization are revealed.

**Poster**  
**THU.PO.8 15:45**  
**Ionization Enhancement by Charge Rearrangement at High X-ray Intensity**  
**— LUDGER INHESTER, KOTA HANASAKI, KOU DAI TOYOTA, YAJIANG HAO, OBIOL VENDRELL, SANG-KIL SON, and ROBIN SANTRA**  
$^1$Center for Free-Electron Laser Science, DESY  
$^2$The Hamburg Centre for Ul-
Ultrafast Imaging — 1Department of Chemistry, Graduate School of Science, Tohoku University, Sendai — 2Department of Physics, University of Science and Technology Beijing — 3Department of Physics and Astronomy, Aarhus University — 4Department of Physics, University of Hamburg
We simulated the multi-photon multi-ionization dynamics of an iodomethane molecule, CH₃I, exposed to ultraintense and ultra-short x-ray pulses. The strong ionization causes electronic charge rearrangement in the molecule that leads to an enhanced total charge.

Poster

THU.PO.9 15:45

withdrawn

Poster

THU.PO.10 15:45

Theoretical Framework for Classification and Prediction of Ultrafast and Strong-Field Phenomena in Solids — Stanislav Kruchinin1,2, Ferenc Krausz3,4, and Vladimir Yakovlev5,2 — 1University of Vienna, Faculty of Physics and Center for Computational Materials Sciences, Sensengasse 8/12, 1090 Vienna, Austria — 2Max Planck Institute of Quantum Optics, Hans-Kopfermann-Str. 1, 85748 Garching, Germany — 3Ludwig Maximilian University of Munich, Am Coulombwall 1, 85748 Garching, Germany
We study characteristic frequencies and timescales describing coherent electronic dynamics and decoherence phenomena in solids interacting with ultrashort laser pulses. Our analysis resulted in the system of dimensionless adiabaticity parameters and derivation of master equation applicable on arbitrary short timescales.

Poster

THU.PO.11 15:45

Ultrafast Spin Crossover in a Single Crystal — Ryan L. Field1,2, Lai Chung Liu1,2, Yifeng Jiang1,2, Wojciech Gawelda3, Cheng Lu2, and R. J. Dwayne Miller1,2 — 1Department of Chemistry and Physics, University of Toronto, Toronto, Canada — 2Center for Free Electron Laser Science, Max Planck Institute for the Structure and Dynamics of Matter, Hamburg, Germany — 3European XFEL, Schenefeld, Germany
Femtosecond spectroscopy and electron diffraction are used to characterize spin crossover in single crystal iron(II)-tris(bipyridine)-bis(hexafluorophosphate). The high-spin lifetime is reduced compared to in solution. Associated nuclear displacements appear to be governed by typical thermalization dynamics.

Poster

THU.PO.12 15:45

Nonequilibrium Dirac electron dynamics in SiC graphene probed by sub-10-fs angle-resolved photoemission spectroscopy — Katsuya Oguri1, Kento Tome2, Hiroki Mashiko1, Yoshiaki Sekine1, Keiko Kato1, Hiroki Hirino3,4, Akira Suda1, and Hideki Gotoh5 — NTT Basic Research Laboratories, NTT Corporation, 3-1 Morinosato Wakamiya, Atsugi, Kanagawa 243-0198, Japan — 2Faculty of Science and Technology, Tokyo University of Science, 2641 Yamazaki, Noda, Chiba 278-8510, Japan — 3School of Science and Technology, Kwansei Gakuin University, 2-1 Gakuen, Sanda, Hyogo 669-1337, Japan
Dynamical Dirac electrons are directly investigated with time-resolved ARPES based on the 27th harmonics with 8-fs duration. Transient energy- and momentum-electron distributions reveal characteristic decay process from the initial nonequilibrium to the following quasi-equilibrium state.

Poster

THU.PO.13 15:45

First Principle Electrons Dynamics Simulation Study of High Intensity Laser Irradiation on Crystal Systems: Photon Energy Dependent Energy Transfer — Atsushi Yamada and Kazuhiro Yabana — Center for Computational Sciences, University of Tsukuba, 1-1-1 Tennodai, Tsukuba, Ibaraki 305-8577, Japan
Photon energy dependent energy transfer process from high intensity laser field to solid materials, Si, diamond and α-quartz, obtained by real-time realistic simulation (TDDFT) has been presented together with analysis of nonlinear behaviours.

Poster

THU.PO.14 15:45

First-principles method for propagation of ultrashort pulsed light in thin films — Shunsuke Yama1, Masashi Noda2, Katsuyuki Nobusada3, and Kazuhiro Yabana — 1Center for Computational Sciences, University of Tsukuba, Tsukuba, Japan — 2Institute for Molecular Science, Okazaki, Japan
We develop a first-principles method for calculating propagation of intense and ultrashort pulsed light in thin films solving Maxwell and time-dependent Kohn-Sham equations simultaneously. The method is applied to silicon thin films.

Poster

THU.PO.15 15:45

Ultrafast nano-acoustics: controlling the quality factor of a single nanoresonator by tuning its morphology — Fabio Medeghini1, Aurélien Crut2, Marco Gandolfi2,3,4, Francesco Rossella5, Paolo Maioli1, Fabrice Vallières2, Francesco Banfi1, and Natalia Del Fatt1 — 1FemtanoNanoptics, group Univ Lyon, Université Claude Bernard Lyon 1, CNRS, Institut Lumière Matière, F-69662 Villeurbanne, France — 2Interdisciplinary Laboratories for Advanced Materials Physics (I-LAMP), Università Cattolica del Sacro Cuore, Brescia I-25121, Italy — 3Dipartimento di Matematica e Fisica, Università Cattolica del Sacro Cuore, Brescia I-25121, Italy — 4Laboratory of Soft Matter and Biophysics, Department of Physics and Astronomy, KU Leuven, Celestijnenlaan 200D, B-3001 Heverlee, Leuven, Belgium — 5NEST, Scuola Normale Superiore and Istituto Nanoscienze-CNR, Piazza S. Silvestro 12, 5-16124 Pisa, Italy
Acoustic damping of lithographed gold nanodisk vibrations was investigated using single-particle time-resolved spectroscopy. A strong influence of morphology (diameter/height ratio) on their mechanical quality factors was demonstrated, and its physical origin unveiled by numerical modeling.

Poster

THU.PO.16 15:45

Ultrafast dynamics of carriers and phonons in quantum-confined topological insulators Bi₂TeX — Mateusz Weck1,2, Bartosz Wilk1, Katarzyna Balin1, Vincent Juvé2, Gwenaëlle Vaudel2, Alain Bulou3, Brice Arnaud2, Jacek Szade1, and Pascal Ruello2 — 1A. Chelkowski Institute of Physics, SMCEBI, 75Pullu Pichoty 1A, Chorzow, Poland — 2Institut des Molecules et Matéraux du Mans UMR CNRS 6283, 72085 Le Mans, France
Reduced to few nanometers topological insulators exhibit strong modification of the electronic structure and dynamics of charges and electron phonon coupling. We present complete investigation of this phenomena by ultrafast pump-probe spectroscopy.

Poster

THU.PO.17 15:45

Attosecond-Streaking Spectroscopy on a Liquid-Water Microjet — Arshi Jain1,2, Rupert Heider2, Martin Wagner3, Thomas Gaumnitz2, Andreas Duenning2, Michael Mittermair2, Inga Jordán3, Jun Ma1, Johann Riemschneider2, Wolfgram Helme2, Reinhard Kienberger2, and Hans Jakob Wörner1 — 1Laboratorium für Physikalische Chemie, ETH Zürich, Vladimir-Prelog-Weg 2, CH-8093 Zürich, Switzerland — 2Physik-Department, Technische Universität München, James-Franck-Str. 1, D-85748, Garching, Deutschland
Attosecond-streaking experiments on gas- and liquid-phase water employing the liquid microjet are presented. The streaking traces are used to extract delays between the inner- and outer-valence bands, giving access to photoionization dynamics, transport and scattering processes in water.

**Poster**  
THU.PO.18 15:45  
**Transient Fano Resonance in Topological Insulators Observed by Coherent Phonon Spectroscopy** — [Richarj Mondal](#), Akira Araida, Yuta Saito, Paul Fons, Alexander V. Kolobov, Junji Tominaga, and Muneaki Hase  
1Division of Applied Physics, Faculty of Pure and Applied Sciences, University of Tsukuba, Tsukuba, Japan  
3Nanoelectronics Research Institute, National Institute of Advanced Industrial Science and Technology, Tsukuba, Japan  
We report upon observation of a transient Fano resonance, a quantum interference between coherent phonon and Dirac-fermions, that persisted for up to 1 picosecond in the topological insulator Sb2Te3 investigated using coherent phonon spectroscopy.

**Poster**  
THU.PO.19 15:45  
**NIR-assisted stabilization of adenine following ionization by XUV attosecond pulses** — Erik Månsso, Mara Galli, Vincent Vinchi, Simone Latini, Umberto De Giovanni, Mattea Carmen Castrovilli, Fabio Frassetto, Luca Poletto, Jason Greenwood, Francois Legare, Mauro Nisoli, Angel Rubio, and Francesca Calegari  
1Center for Free-Electron Laser Science, DESY, Notkestr. 85, 22607 Hamburg, Germany  
2Dipartimento di Fisica, Politecnico di Milano, Piazza L. da Vinci 32, 20133 Milano, Italy  
3Institut National de la Recherche Scientifique, 1650 Blvd. Lionel Boulet, 3X1S2, Varennes (Qc), Canada  
We used intense ultrashort laser pulses combined with time-resolved photoelectron spectroscopy to investigate coherent phonon spectroscopy

**Poster**  
THU.PO.20 15:45  
**Probing strain wave in graphite using time-resolved X-ray diffraction** — Xiaocui Wang, Amelie Jarnac, Carl Ekström, Asa Bengtsson, Matthias Burza, Fabien Dochich, Henriek Enquist, Andrius Jurgilaitis, Martin Pedersen, Carlito Ponseca, Chien-Ming Tu, Michael Wulfraat, and Jörgen Larsson  
1Department of Physics, Lund University, P.O. Box 118, SE-221 00 Lund, Sweden  
2MAX IV Laboratory, Lund University, P.O. Box 118, SE-221 00 Lund, Sweden  
3Univ. Bordeaux, CNRS, CEA, CELIA (Centre Lasers Intenses et Applications), UMR 5107, F-33400 Talence, France  
We used intense ultrashort laser pulses to generate 9.4% strain waves in graphite and characterized the strain wave using time-resolved X-ray diffraction in order to reveal the phase transformation mechanism from graphite to diamond.

**Poster**  
THU.PO.21 15:45  
**Ultrafast Optics with Slow Electrons: Numerical Study** — Nahid Talebi and Christoph Lienau  
1Max Planck Institute for Solid State Research, Stuttgart, Germany  
2Institute of Physics and Center of Interface Science, Carl von Ossietzky University, Oldenburg, Germany  
We study the interaction of swift electrons with laser and solids using a self-consistent numerical approach, and specifically show that low-energy electrons can be used to map the time-resolved response of a Fermi gas.

**Poster**  
THU.PO.22 15:45  
**VUV-induced dynamics of deuterated ethylene measured with time-resolved photoelectron spectroscopy with interferometric contrast** — Oliver Schepp, Arne Baumann, Marek Wieland, and Markus Drescher  
1Institut für Experimentalphysik, Universität Hamburg, Luruper Chaussee 149, 22761 Hamburg — 2The Hamburg Centre for Ultrafast Imaging (CUI), Luruper Chaussee 149, 22761 Hamburg — 3Center for Free-Electron Laser Science, Luruper Chaussee 149, 22761 Hamburg  
The ultrafast relaxation dynamics of deuterated ethylene via \( \pi^* \) excitation is studied using sub-20-fs vacuum ultraviolet pulses combined with time-resolved photoelectron spectroscopy. A collinear geometry enables interferometric contrast for the measured pump-probe signal.

**Poster**  
THU.PO.23 15:45  
**Ultrafast Spin Injection into Gold** — Kevin Bühmann, Rafael Gort, Simon Däster, Andreas Vaterlaus, and Yves Acremann  
1Laboratory for Solid State Physics, ETH Zürich, Switzerland  
The ultrafast demagnetization of a ferromagnet allows for generating femtosecond spin current pulses. By spin and time resolved photoelectron spectroscopy we directly observe spin injection into a gold film.

**Poster**  
THU.PO.24 15:45  
**Femtosecond CARS (fs-CARS) for temperature and concentration measurements on combustion species using a dual output OPCA** — Yang Ran, Marita Kerstan, Andreas Tünnermann, Stefan Nolte, and Roland Ackermann  
1Institute of Applied Physics, Abbey Center of Photonics, Albert-Einstein-Straße 15, 07745 Jena, Germany  
2Fraunhofer Institute for Applied Optics and Engineering (IOF), Albert-Einstein-Straße 7, 07745 Jena, Germany  
Abstract: Using two beam femtosecond coherent anti-Stokes Raman scattering (fs-CARS), temperature and concentration measurements are performed on relevant combustion species such as H2, N2, CO, and CO2.

**Poster**  
THU.PO.25 15:45  
**Fundamental mechanisms for the non-perturbative high harmonic generation in graphene.** — Óscar Zurbón, Antonio Picón, Carlos Hernández-García, and Luis Plaja  
1Grupo de Investigación en Aplicaciones del Laser y Fotónica, Departamento de Física Aplicada, University of Salamanca, E-37008, Salamanca, Spain  
2Departamento de Química, C-9, Universidad Autónoma de Madrid, E-28049 Madrid, Spain  
We present calculations of the response of graphene to ultrashort intense fields. A saddle-point analysis determines the main mechanism of the harmonic emission, whose excitation step is different from finite gap solids and atoms.

**Poster**  
THU.PO.26 15:45  
**Optically stimulated third harmonic generation** — Christian Stock, Kaloyan Zlatanov, and Thomas Halffmann  
1Institut für Angewandte Physik, Technische Universität Darmstadt, Hochschulstraße 6, D-64289 Darmstadt, Germany  
We present strong enhancements of third harmonic generation by optical stimulation in a microscopy setup. The effect is most pronounced at low laser intensity and weak nonlinear susceptibilities, making it suitable in harmonic microscopy.
**Thursday Sessions**

**Poster**

**THU.PO.27 15:45**

Coherent Multidimensional Spectroscopy on High-Temperature Cuprate Superconductors — Fabio Novelli1, Jonathan Tollerud1, Dharmalingam Prabhakaran2, and Jeffrey Davis1 — Centre for Quantum and Optical Science and Department of Physics, Swinburne University of Technology, Hawthorn 3122, Victoria, Australia — 2Department of Physics, University of Oxford, Oxford OX1 3PU, UK

Two-dimensional spectra of LSCO, a high-temperature cuprate superconductor, reveal low-energy, zero-quantum coherences that persist for >500 fs. The corresponding linewidth (~5meV) is substantially narrower than the distribution of states measured, which stretches from 20–60meV.

**Poster**

**THU.PO.28 15:45**

High-resolution mass spectrometry and velocity map imaging for ultrafast electron dynamics in complex biomolecules — Erik P. Månsson1, Vincent Wanie2,3, Mara Galli2,4, Mattea C. Castrovilli1, Fabio Frassetto5, Luca Poletto6, Mauro Nisoli2,4, and Francesca Calegari1,2 — 1Center for Free-Electron Laser Science, Deutsches Elektronen-Synchrotron, Notkestr. 85, 22607 Hamburg, Germany — 2Institute for Photonics and Nanotechnologies, National Research Council, Pza Leonardo da Vinci 32, 20133 Milano, Italy

We present a design combining a velocity map imaging electron spectrometer with a reflector mass spectrometer. Together with femtosecond and attosecond pump-probe methods it will enable studies of ultrafast dynamics in large molecular systems.

**Poster**

**THU.PO.29 15:45**

Time-Dependent Ab Initio Wavefunction-Based Methods for Intense Laser-Driven Multielectron Dynamics — Takeshi Sato, Yuki Orimo, Himadri Pathak, and Kenichi Ishikawa — The University of Tokyo, Tokyo, Japan

We have formulated time-dependent wavefunction-based methods for ab initio descriptions of multielectron dynamics in intense laser fields. This report describes the methodology development and their applications to correlated electron dynamics in atoms.

**Poster**

**THU.PO.30 15:45**

Finding the Ionization Limit for Pump-Probe SFX Experiments — Antoine Sarracin1, Olivier Pare-Labrosse1, Anling Kuo1, Ryan Field1, and R. J. Dwayne Miller1,2 — 1Department of Physics & Chemistry, University of Toronto, Toronto, Canada — 2Department of Biochemistry, University of Toronto, Toronto, Canada — 3 Atomically Resolved Dynamics, Max-Planck-Institute for the Structure and Dynamics of Matter, Hamburg, Germany

Fluence dependent transient absorption measurements are performed on carboxymyoglobin and other previously studied systems at XFELs in order to reveal the threshold for nonlinear effects and determine the peak power limits for time-resolved SFX experiments.

**Poster**

**THU.PO.31 15:45**

Differential transient transmission spectroscopy to directly monitor charge separation dynamics at lead halide perovskite interfaces — Kunie Ishioka1, Bobby G. Barker Jr., Masatoshi Yanagida1, Yasuhiro Shira1, and Kenjiro Miyano1 — 1RCAMC, National Institute for Materials Science, Tsukuba, Japan — 2Department of Chemistry and Biochemistry, University of South Carolina, Columbia, USA — 3GREEN, National Institute for Materials Science, Tsukuba, Japan

Differential transient transmission spectroscopy using strongly absorbed pump light enables to separate the charge injection dynamics at the heterointerface of lead halide perovskite and carrier transport layer from the recombination and transport within the perovskite.

**Poster**

**THU.PO.32 15:45**

Coherent hole transfer in non-fullerene OPV blends — Ruifang Wang1, Chunfeng Zhang1, and Min Xiao1 — Nanjing University, China — 1University of Arkansas, USA

We study the ultrafast hole transfer process in the OPV blends with non-fullerene acceptor utilizing two-dimensional electronic spectroscopy. The results show coherent vibronic coupling plays a critical role in ultrafast hole transfer process.

**Poster**

**THU.PO.33 15:45**

High-harmonic generation in solids driven by sub-cycle mid-infrared pulses from laser filamentation — Hideo Shira1, Fumitosh Kuma1,2, Yutaka Nomura1,2, and Takao Fujii1,2 — 1Institute for Molecular Science — 2The Graduate University for Advanced Studies (SOKENDAI)

Sub-cycle mid-infrared pulses from two-color filamentation have been applied for high harmonic generation in crystalline silicon membrane. The high harmonic spectrum reaches the ultraviolet region, beyond the direct band gap of silicon.

**Poster**

**THU.PO.34 15:45**

Energy relaxation dynamics in MoS2 revealed by ultrafast transient absorption microscopy — Hope M Breitscher1, Jooyoung Sung1, Alexandre Chemin1, Philipp Kukura1, and Arshay Rao2 — 1 Cavendish Laboratory, University of Cambridge, Cambridge, United Kingdom — 2Physical and Theoretical Chemistry Laboratory, Oxford University, Oxford United Kingdom

Many-body effects play a significant role in dynamics of monolayer MoS2. We use super-resolved, transient absorption microscopy to study how carrier concentration impacts ultrafast carrier dynamics and diffusion lengths of monolayer MoS2.

**Poster**

**THU.PO.35 15:45**

Ultrafast spectroscopy of lattice-charge carrier interactions in bismuth-based perovskites — Lissa Eyre1, Robert Hoye1, Tudor Thomas1, Pablo Dogcam1, Hannah Joyce1, and Felix Deschler1 — 1 Cavendish Laboratory, Cambridge University, JJ Thomson Ave, Cambridge, CB3 0HE, United Kingdom — 2School of Electrical and Electronic Engineering, Merz Court, Newcastle University, Newcastle upon Tyne, NE1 7RU, United Kingdom — 3Department of Engineering, Cambridge University, 9 JJ Thomson Ave, Cambridge, CB3 0FA, United Kingdom

The coupling between photoexcited charge carriers and lattice vibrations in various lead-free perovskites has been probed using ultrafast transient absorption, Raman and THz spectroscopy, revealing important design criteria for efficient next-generation solar cells.
Thursday Sessions

Poster

THU.PO.36 15:45
Femtosecond Acoustics for Sub-Atomic-Resolution Imaging of Interface — CHI-KUANG SUN1, CHI-KIANG SHEN2, MENG-YU WENG2, HUI-YUAN CHEN3, and JINN-KONG SHEU4 — 1Graduate Institute of Photonics and Optoelectronics and Department of Electrical Engineering, National Taiwan University, Taipei 10617, Taiwan — 2Institute of Electro-Optical Science and Engineering and Advanced Optoelectronic Technology Center, National Cheng Kung University, Tainan 70101, Taiwan

Taking advantage of the slow sound velocity in materials, here we show that femtosecond-time-resolved acoustic imaging is capable to noninvasively monitor in situ an interface and sub-surface area under atmospheric conditions with sub-atomic layer sensitivity.

Poster

THU.PO.37 15:45
withdrawn

Poster

THU.PO.38 15:45
Nonlinear Spectral Focusing for High Contrast Pump–Probe Coherent Raman Microscopy — TERAUMA ITO, KOTA MATSUURA, and KAZUHIKO MISAWA — Tokyo University of Agriculture and Technology, Tokyo, Japan

Spectral focusing with asymmetric pulses enables a highly-sensitive, high-contrast pump–probe coherent Raman imaging with improved spectral resolution. We demonstrate this new approach by imaging the transport of anesthetic molecules from water to fatty acid microdroplets.

Poster

THU.PO.39 15:45
High-order Harmonic Field Retrieval in Ethylene — VARUN MAHISHA1, JAN TROSS2, VINOD KUMARAPPA2, MICHAEL SPANER1, CATERINA VOZZI3, CARLOS TRAILERO3, and SALVATORE STAGIRA3 — 1Department of Physics, University of Ottawa, Ottawa, Ontario, Canada — 2Department of Physics, Kansas State University, Manhattan, KS, USA — 3Dipartimento di Fisica, Politecnico di Milano and IFN-CNR, Milano, Italy

The XUV field emitted by impulsively aligned ethylene molecules during high-order harmonic generation is retrieved as a function of molecular orientation. The results can be ascribed to multielectron contributions to the harmonic emission.

Poster

THU.PO.40 15:45
Beamline for attosecond time-resolved transient-absorption spectroscopy in the water window — KRISTINA ZINCHENKO, FERNANDO ARDANA-LAMAS, YOANN PERTOT, MARTIN HUPPERT, and HANS JAKOB WÖRNER — Laboratory for physical chemistry, ETH Zürich, Vladimir-Prelog-Weg 2, CH-8093 Zurich, Switzerland

We present the first results from our transient-absorption experimental setup which delivers soft X-rays attosecond pulses with photon energies extending to more than 350 eV generated by an intense few-cycle laser pulse centered at 1.8 μm.

Poster

THU.PO.41 15:45
Single Shot XUV Nanomaging Using an Intense Femtosecond Soft X-ray Laser — MICHAEL ZÜRCH1,2,3, FREDRIK TUTJTE1, TOBIAS HELK1, JULIAN GAUTIER1, FABIAN TISSANDIER2, JEAN-PHILIPPE GODDET4, ALEXANDER GUGGENMOS5,6, ULF KLEINEBERG5,6, STEPHANE SEBRAN5, and CHRISTIAN SPIELMANN1,2 — 1Institute of Optics and Quantum Electronics, Abbe Center of Photonics, Jena University, 07743 Jena, Germany — 2Helmholtz Institute Jena, 07743 Jena, Germany — 3Department of Chemistry, University of California, Berkeley, CA 94720, USA — 4LOA, ENSTA, CNRS, Ecole Polytechnique, Université Paris-Saclay, F-91762 Palaiseau cedex, France — 5Ludwig-Maximilians-Universität München, Am Coulomboval 1, 85748, Garching, Germany — 6Max-Planck-Institut für Quantenoptik, Hans-Kopfermann-Str. 1, 85748, Garching, Germany

We report the direct wavefront characterization of an intense ultrashort high-harmonic-seeded soft X-ray laser (λ = 32.8 nm) depending on the arrival time of the seed pulses by high-resolution ptychographic imaging and subsequently perform single-shot nanoscale imaging.

Poster

THU.PO.42 15:45
A versatile setup for multi-dimensional spectroscopy in the XUV — PATRICK RUPPRECHT, LENNART AUFLIEGER, THOMAS DING, MARC REHOLZ, CARINA DA COSTA CASTANHEIRA, ALEXANDER MAGUNGA, CHRISTIAN OTT, and THOMAS PFEIFER — Max Planck Institute for Nuclear Physics, Heidelberg, Germany

We present a setup for multi-dimensional, multi-color experiments including extreme ultraviolet (XUV) pulses. Using a four-split-and-delay mirror at grazing incidence in combination with a high-resolution XUV spectrometer enables experiments with different XUV light sources.

Poster

THU.PO.43 15:45
Single-Shot Broadband Femtosecond Circular Dichroism in the Deep-UV — MALTE OPPERMANN, BENJAMIN BAUER, THOMAS ROSSI, FRANK VAN MOURIK, and MAJED CHEGGUI — Laboratory of Ultrafast Spectroscopy and Lausanne Centre for Ultrafast Science, EPFL, Lausanne, Switzerland

We report the first single-shot broadband femtosecond circular dichroism spectrometer in the deep-UV (250–370 nm). Artefact-free static and transient CD spectra of enantiopure [Ru(bpy)3]2+ are successfully recorded at noise levels < 10−7 OD.

Poster

THU.PO.44 15:45
High-order Harmonic Generation in Femtosecond Laser-Micromachined Devices — ANNA GABRIELLA CIROLLO, REBECA MARTINEZ VAZQUEZ, GABRIELE CIRRI, DAVIDE FACCIÀLÀ, MATTEO NEGRO, MICHELE DEVETTA, DIOMO PEREIRA LOPES, ADITYA PUSALA, CATERINA VOZZI, ROBERTO OSSELLA, and SALVATORE STAGIRA — Politecnico di Milano and Istituto di Fotonica e Nanotecnologie CNR, Milano, Italy

We demonstrate the generation of high-order harmonics in a fused-silica chip produced by femtosecond laser micromachining. This achievement paves the way for the miniaturization of HHG applications from large-scale laboratories to microstructures.

Poster

THU.PO.45 15:45
withdrawn

Poster

THU.PO.46 15:45
SwissFEL Alvra: An X-ray Experimental Station for Ultrafast Chemistry and Biology — CHRISTOPHER MLNE, CLAUDIO CIRELLA, DABARD GASHI, DOMINIQUE HAUENSTEIN, TADEJ HUMAR, GREGOR KNOPP, PETER RADI, and JOERG SCHNEIDER — Paul Scherrer Institute, Villigen-PSI, Switzerland

The SwissFEL X-ray free electron laser has successfully completed its first pilot experiments. Here we describe the Alvra experimental station, which is designed for ultrafast chemistry and biology using different X-ray techniques.

Poster

THU.PO.47 15:45
Rotational Echo Spectroscopy: Rephasing the Centrifugal Distortion of Rotating Gas Molecules — DINA ROSENBERG1,2, RAN DAMARI1,2, SHIMSHON KALLUSH3,4, and SHARLY FLEISCHER1,2

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— 1Department of Chemical Physics, Tel-Aviv University, Tel Aviv 6997801, Israel — 2Tel-Aviv University center for Light-Matter-Interaction, Tel Aviv, 6997801 Israel — 3Department of Physics and Optical Engineering, ORT Braude College, P.O. Box 78, 21982 Karmiel, Israel — 4The Fritz Haber Research Center and The Institute of Chemistry, The Hebrew University, Jerusalem 91904, Israel

We utilize two time-delayed laser pulses to induce alignment echoes in a gas of symmetric-top molecules and observe the rephasing evolution of the centrifugal distortion effects using time-resolved optical birefringence measurements.

**Poster**

**THU.PO.48 15:45**

**Time-Resolved High-Harmonic Spectroscopy of Ultrafast Ring-Opening of 1,3-Cyclohexadiene** — KeisuK Kaneshima, Yuki Ninota, and Taro Sekikawa — Hokkaido University, Sapporo, Japan

Ultrafast ring-opening reaction of 1,3-cyclohexadiene was probed via time-resolved high-harmonic spectroscopy (TR-HHS). The present results show that TR-HHS can track both the electronic and the nuclear dynamics, and is useful for unveiling ultrafast photo-chemical reactions.

**Poster**

**THU.PO.49 15:45**

**Ultrafast mid-infrared spectroscopy discovers an unprecedented CO2-transition metal binding mode in liquid solution** — Steffen Straub, Jörg Lindner, and Peter Vöhringer — Institute for Physical and Theoretical Chemistry, University of Bonn, 53115 Bonn, Germany

Fs-UV/mid-infrared spectroscopy was used to photolyze aqueous ferroxoolate thereby generating a primary ferrous complex within 500 fs that carries a carbon dioxide radical anion ligand, i.e. the reductively activated and highly reactive form of CO2

**Poster**

**THU.PO.50 15:45**

**Direct Observation of Photoionization Dynamics in Solution Phase Induced by Femtosecond Two-Photon Excitation** — Masafumi Koga, Yusuuke Yanoda, Hikaru Sotome, and Hiroshi Mitasaka — Division of Frontier Materials Science, Graduate School of Engineering Science, Osaka University, Osaka, Japan

Femtosecond double-pulse excitation was applied to direct detection of ionization dynamics of a phenylendiamine derivative in polar solvents. Temporal evolution of transient absorption spectra, it was revealed that solvation process played crucial roles in photoionization.

**Poster**

**THU.PO.51 15:45**

**Excited State Vibrational Coherence in aBinuclear Metal Adduct: Wave Packet Phase Dependent Molecular Fragmentation Under Variation of Ligand Size** — Sebastian V. Kruppa1, Florian Bäppler2, Christof Holzer1, Rolf Diller1, Wim Klopper1, and Christoph Riehn1,4 — 1Department of Chemistry University of Kaiserslautern, Kaiserslautern, Germany — 2Department of Physics University of Kaiserslautern, Kaiserslautern, Germany — 3Institute of Physical Chemistry Karlsruhe Institute of Technology, Karlsruhe, Germany — 4Landesforschungszentrum OPTIMAS, Kaiserslautern, Germany

Ultrafast vibrational coherence with metal-metal stretching mode character, is observed for phosphate-bridged d10-d10 complexes of different size containing the binuclear [Ag2Cl]+ chromophore in an ion trap. Fragmentation pathways are governed by the wave packet’s phase.

**Poster**

**THU.PO.52 15:45**

**Photoinduced Electronic Dynamics of Nitric Oxide from Roussin’s Red Ester Probed by Time-Resolved Infrared Spectroscopy** — Hojeong Yoon, Seongchul Park, Cheongha Lim, and Minho Lim — Department of Chemistry, Pusan National University, Busan 46241, Republic of Korea

To explore nitric oxide (NO)-donating capability of Roussin’s red ester (RRE), photodissociation of NO from RRE and its subsequent reaction dynamics were probed by monitoring the N–O stretching mode after excitation with a 400-nm photon.

**Poster**

**THU.PO.53 15:45**

**Symmetry-Breaking Charge Transfer of 9,9’-Bianthracene Revealed by Experiment and Theory** — Changmin Lee1, So Hyeong Sohn1, Taecheon Lyu1, Cheol Ho Cho2, and Taima Joo1 — 1Department of Chemistry, Pohang University of Science and Technology (POSTECH), Pohang 37673, Korea — 2Department of Chemistry, Kyungpook National University, Daegu 41566, Korea

Symmetry-breaking charge transfer reaction of 9,9′-bianthracene is driven exclusively by the rotational fluctuation of solvents, not including the inertial component in the solvation dynamics. Torsional motion and bond shortening during the reaction were observed.

**Poster**

**THU.PO.54 15:45**

**Coherent Bond Formation Dynamics of Dicyanoaurate in the First Excited Singlet State** — So Hyeong Sohn, Changmin Lee, Taecheon Lyu, and Taima Joo — Department of Chemistry, Pohang University of Science and Technology (POSTECH), Pohang, South Korea

Time-resolved fluorescence of [Au(CN)2–]3 in water reveals a coherent vibration of 74 cm–1. A massive non-Condon effect, proved unambiguously by time-resolved fluorescence spectra, demonstrates that the wave packet motion arises from the coherent bond formation.

**Poster**

**THU.PO.55 15:45**

**Chain-Length-Dependent Exciton Dynamics in Linear Oligothiophenes Studied by Ultrafast Time-Resolved Raman Spectroscopy** — Wooseok Kim1, Shin Yea Tahara2, Hikaru Kuramochi3, Satoshi Takeuchi4, Tahei Tahara3, and Dongho Kim1 — 1Department of Chemistry and Spectroscopy Laboratory for Functional π–Electronic Systems, Yonsei University, Seoul 03722, Korea — 2Molecular Spectroscopy Laboratory, RIKEN, 2-1 Hirosawa, Wako 351-0198, Japan — 3Ultrafast Spectroscopy Research Team, RIKEN Center for Advanced Photonics (RAP), 2-1 Hirosawa, Wako 351-0198, Japan

By using ultrafast near-infrared femtosecond stimulated Raman spectroscopy, we studied chain-length-dependent exciton dynamics in a series of linear oligothiophenes by focusing on vibrational specificity.

**Poster**

**THU.PO.56 15:45**

**Photodynamics of Fe Complexes: Variation with Number of NHC Functions** — Aleksij Friedrich1, Peter Zimmer2, Matthias Bauer3, and Stefan Lochbrunner1 — 1Institute of Physics, University of Rostock, Rostock, Germany — 2Department Chemie, Universität Paderborn, Paderborn, Germany

Ultrafast spectroscopy on a series of Fe(II) complexes finds an increase of the MLCT lifetime with increasing number of N-heterocyclic carbene (NHC) donor functions revealing a promising route for the design of Fe photosensitizers.
Thursday Sessions

**Poster**

**THU.PO.57  15:45**

**High sensitivity fluorescence up-conversion spectroscopy of 3MLCT emission of metallo-organic complexes — Li Liu², Damianos Agathangelou¹, Hiaqiong Ning¹, Thomas Roland¹, Olivier Creque¹, Thibaud Duchanois¹, Marc Beley², Jérémie Léonard¹, Philippe Gros², and Stefan Haacke¹** — ¹Université de Strasbourg CNRS, UMR 7504, Institut de Physique et Chimie des Matériaux de Strasbourg, 67034 Strasbourg, France — ²Université de Lorraine — CNRS, UMR 7053, SRSMC, 54506 Vandoeuvre-lès-Nancy, France

We demonstrate the implementation of a broadband fluorescence up-conversion set-up with high signal-to-noise ratio (SNR) and dynamic range allowing for the detection of weak luminescence of 3MLCT states in Fe(II) NHC complexes.

**Poster**

**THU.PO.58  15:45**

**Switch of Dimensionality of Exciton Diffusion in Aggregates — Stephan Wolter³, Frank Würthner³, Oliver Kühn¹, and Stefan Lochbrunner¹** — ¹Institut für Physik, Universität Rostock, Rostock, Germany — ²Institut für Organische Chemie and Center for Nanosystems Chemistry, Universität Würzburg, Würzburg, Germany

The ultrafast exciton dynamics in J-aggregates of a perylene bisimide dye is investigated for temperatures down to 77 K revealing at low temperatures a decrease of the exciton mobility and a change in the dimensionality.

**Poster**

**THU.PO.59  15:45**

**Direct Measurement of Intramolecular Electron Transfer in a Series of Artificial Photosynthesis Processes — Ken Onda¹, Khi Ohokubo², Yasuomi Yamazaki², Kazuhide Koike³, Seiichi Tanaka², and Osamu Ishizaki²** — ¹Kyushu University, Fukuoka, Japan — ²Tokyo Institute of Technology, Tokyo, Japan — ³AIST, Tsukuba, Japan

We have directly determined the intramolecular electron transfer rates and revealed its mechanism in supramolecular complexes in the course of CO2 photoeduction processes by time-resolved infrared spectroscopic measurements in a wide temporal range.

**Poster**

**THU.PO.60  15:45**

**Challenges in XUV photochemistry simulations: a case study on ultrafast fragmentation dynamics of the benzene radical cation — Sophia Bazzi², Ralph Welsch¹, Okiol Vendrell³, and Robin Santra¹,²,⁴,⁵** — ¹Center for Free-Electron Laser Science, DESY, Notkestrasse 85, 22607 Hamburg, Germany — ²Department of Chemistry, University of Hamburg, Grindelallee 117, 20146 Hamburg, Germany — ³Department of Physics and Astronomy, Aarhus University, Ny Munkegade 120, 8000 Aarhus C, Denmark — ⁴Department of Physics, University of Hamburg, Jungiusstrasse 9, 20355 Hamburg, Germany — ⁵The Hamburg Centre for Ultrafast Imaging, Luruper Chaussee 149, 22761 Hamburg, Germany

We address two fundamental aspects of the ultrafast XUV photochemistry of benzene using ab initio classical trajectory calculations: the time-resolved relaxation of the electronic excited states and the time-resolved state-specific fragmentation dynamics.

**Poster**

**THU.PO.61  15:45**

**Ultrafast Proton/Deuterium Dynamics in Solid Oxide Observed with Infrared Pump-Probe Spectroscopy — Atsunori Sakurai and Satoshi Ashihara** — Institute of Industrial Science, The University of Tokyo, 4-6-1 Komaba, Meguro, Tokyo 153-8505, Japan

We performed pump-probe spectroscopy on OD-stretching mode in KTaO3 to explore how a proton/deuterion interacts with the surroundings. We identified the potential anharmonicity and phonon modes which interact with a proton/deuteron, considering the temperature effect.

**Poster**

**THU.PO.62  15:45**

**Ultrafast Photolysis of o-Nitrophenol Studied by Time-Resolved Photoelectron Spectroscopy — Yuki Nitta¹, Oliver Schalk², Keikuke Kaneshima¹, and Tarō Sekikawa¹** — ¹Hokkaido University, Sapporo, Japan — ²Stockholm University, Stockholm, Sweden

The formation of nitrous acid (HONO) through photolysis of o-nitrophenol was captured in real time by time-resolved photoelectron spectroscopy using single-order high harmonic probe pulses. HONO is released 250 fs after photoexcitation.

**Poster**

**THU.PO.63  15:45**

**Simulation of time-dependent ionization processes in acetylene — Thomas Schnappinger¹, Christian Burger¹,²,³ Attila Tuń-Noom¹, Har Xu¹,²,³, Phililpp Rosenberger¹,²,³ Nida Hareem¹,²,³, Robert Moshomaker⁴, Robert Sang¹,²,³ Boris Bergues¹,²,³, Igor Litvinyuk¹,²,³, Matthias Klings¹,²,³, and Regina de Vivie-Riedlé¹** — ¹Department of Chemistry, Ludwig-Maximilians-Universität München, D-81377 Munich, Germany — ²Department of Physics, Ludwig-Maximilians-Universität München, D-85748 Garching, Germany — ³Max Planck Institute of Quantum Optics, D-85748 Garching, Germany — ⁴Australian Attosecond Science Facility, Griffith University, Nathan, Queensland 4111, Australia — ⁵Centre for Quantum Dynamics, Griffith University, Nathan, Queensland 4111, Australia — ⁶Max Planck Institute of Nuclear Physics, D-69117 Heidelberg, Germany

Different ionization processes were observed for acetylene ions in a time-resolved reaction microscopy experiment with a pair of few-cycle pulses. Dynamics simulations and ab-initio calculations of ionization rates reveal the underlying mechanisms.

**Poster**

**THU.PO.64  15:45**

**UV-Induced DNA Self-Repair Mechanism Traced With Quantum Chemistry — Sebastian Reiter¹, Daniel Keefer¹, Vitus Beisel¹, and Regina de Vivie-Riedlé¹** — Department Chemie, Ludwig-Maximilians-Universität München, Butenandstr. 11, 81377 Munich, Germany

Recently, UV radiation was found to promote the self-repair of a damaged DNA nucleobase sequence. The proposed mechanism after photocexcitation of an adjacent guanine adenine sequence is now validated by our quantum chemical calculations.

**Poster**

**THU.PO.65  15:45**

**Dual Frequency Comb Transient Absorption Measurement Covering a Broad Dynamic Range — Jin Woo Kim¹, Byung Moon Cho¹, Tai Hyun Yoon¹,², and Minhaeong Cho¹,³** — ¹Center for Molecular Spectroscopy and Dynamics, Institute for Basic Science (IBS), Seoul 02841, Republic of Korea — ²Department of Physics, Korea university, Seoul 02841, Republic of Korea — ³Department of Chemistry, Korea university, Seoul 02841, Republic of Korea

We present a dual frequency comb transient absorption (DFC-TA) technique that does not rely on mechanical-time-delay scan. DFC-TA measures photo-physical or chemical processes occurring in several nanoseconds with femtosecond time resolution and millisecond data-acquisition time.

**Poster**

**THU.PO.66  15:45**

**Ultrafast non-adiabatic relaxation and fragmentation dynamics of high-lying acetone Rydberg states — Pascal Heid¹, Bernhard Thaler¹, Stefan Cesnik¹, Michael Rumetshofer¹, Sascha Ranftl¹, Leonhard Treiber¹,**
MIRIAM MEYER¹, WOLFGANG VON DER LINDEN², WOLFGANG E. ERNST¹, and MARKUS KOCH¹ — ¹Graz University of Technology, Institute of Experimental Physics, Graz, Austria — ²Graz University of Technology, Institute of Theoretical and Computational Physics, Graz, Austria

We combine femtosecond photoelectron-photon coincidence (PEPICO) spectroscopy and Bayesian data analysis to study acetone Rydberg state dynamics. Photoexcited population is transferred to the lower Rydberg manifold due to Rydberg-valence couplings, accompanied by fragmentation.

Poster

THU.PO.69 15:45

We use femtosecond photoelectron spectroscopy with wavelength-selected XUV pulses to study relaxation of organic molecules in solutions. Upon electronic excitation we observe relaxation processes, such as excited state intramolecular proton transfer and trans-cis isomerization.

Poster

THU.PO.70 15:45

Towards Studying Time-Resolved Photoelectron Circular Dichroism in Solution — JANINA LEBENDIG-KUHLA, HANS-HERMANN RITZE, and ANDREA LÜBCE — Max-Born Institute for Nonlinear Optics and Short Pulse Spectroscopy, Berlin, Germany

We apply time-resolved photoelectron spectroscopy to investigate the excited state dynamics and the photoelectron circular dichroism of hydrated chiral molecules.

Poster

THU.PO.71 15:45

Electron and fluorescence spectra of a water molecule irradiated by an x-ray free-electron laser pulse — JULIA M. SCHÄFER¹,2, LUDGER INHESTER¹,2, SANG-KIL SON¹, REINHOLD F. FINK², and ROBIN SANTRA¹,3,4 — ¹Center for Free-Electron Laser Science, DESY, Hamburg, Germany — ²Institute of Physical and Theoretical Chemistry, University of Tübingen, Germany — ³The Hamburg Centre for Ultrafast Imaging, Hamburg, Germany — ⁴Department of Physics, University of Hamburg, Germany

We report a computational study of molecular spectroscopy at ultrahigh x-ray intensity. The total intensities of the photoelectron, Auger electron and x-ray fluorescence spectra reflect the competition of microscopic electronic transition processes.
Friday Sessions

**FRI.1: Ultrafast Processes in Chemistry and Student Poster Prize Presentation**

Chairied by Munira Khalil, University of Washington, Seattle, USA

**Invited**

**FRI.1.1 8:30**

*Soft-Mode Driven Dynamics in Ferroelectrics - New Insight from Ultrafast Terahertz and X-Ray Experiments* — **Thomas Elsaesser**, Giulia Folpini, Carmine Somma, Klaus Reimann, Marcel Holtz, Antonio-Andres Hernandez Salvador, Christoph Hauß, and Michael Woerner — Max-Born-Institute, Berlin, Germany

The coupled lattice and charge dynamics connected with soft-mode excitations are mapped by nonlinear terahertz spectroscopy and ultrafast x-ray diffraction. Sub-picometer lattice displacements induce electron relocations over 100 pm and macroscopic polarization switching.

**Student Poster Prize Presentation**

**Oral**

**FRI.1.2 9:30**

*Visualizing excited state dynamics of conjugated molecules through femtosecond stimulated Raman scattering* — **Giovanni Battigiani**, Emanuele Pontecorvo, Carino Ferrante, Massimiliano Aschì, Christoph G. Elles, and Tullio Scopigno — Dipartimento di Fisica, Università di Roma “La Sapienza”, Roma, 00185, ITALY — DiIstituto Italiano di Tecnologia, Center for Life Nano Science @Sapienza, Roma, 00161, ITALY — Dipartimento di Scienze Fisiche e Chimiche, Università degli studi dell’Aquila, L’Aquila, 67100, ITALY — Department of Chemistry, University of Kansas, Lawrence, Kansas, 66045, USA

The reaction pathway in the photoexcited model compound 2-methyl-5-phenylthioephene has been unravelled by Femtosecond Stimulated Raman Scattering and quantum chemical calculations. The excited state dynamics, including structural rearrangement, vibrational cooling and intersystem-crossing, will be presented.

**FRI.1.3 9:45**


Sub-20-fs transient absorption spectroscopy and simulations show that CNN-bendings dominate the sub-ps dynamics of π-π* excited trans-azo-benzene, thereby driving the system to the ground state through a non-productive decay channel in violation of the Kasha rule.

**FRI.1.4 10:00**

*Two-Dimension Electronic-Vibrational Spectroscopic Studies of Relaxation via a Conical Intersection: Triphenylmethane Dye* — **Eric C. Wu**, Nicholas H. C. Lewis, Natalie L. Grunenke, Eric A. Arsenault, and Graham R. Fleming — Department of Chemistry, University of California, Berkeley, California 94720, USA — Physical Biosciences Division, Lawrence Berkeley National Laboratory, Berkeley, California 94720, USA — Kavli Energy Nanosciences Institute at Berkeley, Berkeley, California 94720, USA — James Franck Institute, University of Chicago, Chicago, Illinois 60637, USA

The relaxation of Crystal Violet after photoexcitation is tracked using two-dimensional electronic-vibrational (2DEV) spectroscopy. The 2DEV spectrum suggests that the excited state has some charge-transfer characteristics initially and the relaxation occurs through a conical intersection.

**10:15–10:45: COFFEE BREAK**

**FRI.2: New Concepts in Ultrafast Electron Microscopy**

Chairied by Christoph Lienau, University of Oldenburg, Oldenburg, Germany

**Oral**

**FRI.2.1 10:45**

*Generation and Attosecond Shaping of High Coherence Free-Electron Beams for Ultrafast TEM* — **Armin Feist**, Katharina E. Priebe, Christopher Rathe, Nora Bach, Nara Rubiano da Silva, Thomas Danz, Marcel Möller, Till Domröse, Thomas Rittmann, Sergei V. Yalunin, Thorsten Hohage, Murat Sivis, Sascha Schäfer, and Claus Ropers — 4th Physical Institute, University of Göttingen, Göttingen, Germany — 2nd Institute of Physics, University of Oldenburg, Oldenburg, Germany — Institute for Numerical and Applied Mathematics, University of Göttingen, Göttingen, Germany

We demonstrate the generation and optical control of ultrashort high-coherence electron pulses. The free-electron quantum state is phase-modulated in the longitudinal and transverse dimensions, and the formation of attosecond electron pulse trains is quantitatively probed.

**FRI.2.2 11:00**

*Sub-cycle Manipulation of Electrons in a Tunnel Junction with Phase-controlled Single-cycle THz Near-fields* — **Katsunisa Yoshokka**, Ikufumi Katayama, Yusuke Arashida, Atsuhiro Ban, Yoichi Kawada, Hiroshi Takahashi, and Jun Takeya — 1st Department of Physics, Graduate School of Engineering, Yokohama National University, Yokohama 240-8501, Japan — 1st Central Research Laboratory, Hamamatsu Photonics K. K., Hamamatsu 434-8601, Japan

By utilizing terahertz scanning tunneling microscopy (THz-STM) with a carrier envelope phase shifter for broadband THz pulses, we could successfully control the near-field-mediated electron dynamics in a tunnel junction with sub-cycle precision.
Oral FRI.2.3 11:15

Antiresonant-Like Behavior in Carrier-Envelope-Phase-Sensitive Sub-Optical-Cycle Photoemission from Plasmonic Nanoantennas — •Phillip Keathley1, William Putnam1,2,3, Praful Vasireddy1, Richard Hobbs1,4, Karl Berggren1, and Franz Kärtner1,2,5 — 1Department of Electrical Engineering and Computer Science and Research Laboratory of Electronics, Massachusetts Institute of Technology, Cambridge, MA 02139, USA — 2Department of Physics and Center for Ultrfast Imaging, University of Hamburg, Luruper Chaussee 149, 22761, Hamburg, Germany — 3Northrop Grumman Corporation, NG Next, 1 Space Park Blvd., Redondo Beach, CA 90278, USA — 4Centre for Research on Adaptive Nanostructures and Nanodevices (CRANN), Advanced Materials and Bio-Engineering Research Centre (AMBER), and School of Chemistry, Trinity College Dublin, Dublin 2, Ireland — 5Center for Free-Electron Laser Science and Deutsches Elektronen-Synchrotron (DESY), Notkestraße 85, 22607 Hamburg, Germany

We study carrier-envelope-phase-sensitive (CEP-sensitive) photoemission from plasmonic nanoantennas excited with laser pulses of varying incident optical intensities. The CEP-sensitive current exhibits antiresonant-like features that we attribute to competing sub-optical-cycle bursts of photoelectrons.

Oral FRI.2.4 11:30

Plasmon-Driven Ultrafast Point-Projection Electron Microscopy — •Jan Vogelsang1, Germain Hergert1, Andreas Wöste1, Dong Wang2, Petra Gross1, and Christoph Lienau1 — 1Institut für Physik and Center of Interface Science, Carl von Ossietzky Universität, 26129 Oldenburg, Germany — 2Institut für Werkstofftechnik und Institut für Mikro- und Nanotechnologien, TU Ilmenau, 98693 Ilmenau, Germany

We implement a plasmon-driven ultrafast electron source in a point-projection electron microscope. A proof-of-principle experiment investigating the charge propagation in a single nanoresonator demonstrates an unprecedented spatiotemporal resolution of 20 nm and 25 fs.

Oral FRI.2.5 11:45

Mapping momentum-dependent electron-phonon coupling and non-equilibrium phonon dynamics with ultrafast electron diffuse scattering — •Mark J. Stern1, Laurent P. René de Cotret1, Martin R. Otto1, Robert P. Chatelain1, Mark Sutton1, and •Bradley J. Siwick1,2 — 1Department of Physics, Center for the Physics of Materials, McGill University, Montreal, CA — 2Department of Chemistry, McGill University, Montreal, CA

We show that ultrafast electron diffuse (inelastic) scattering provides a detailed, momentum-resolved view of electron-phonon and phonon-phonon coupling across the entire Brillouin zone. Ultrafast time-resolution and scattering selection rules can distinguish between phonon branches without energy-resolution.

Oral FRI.2.6 12:00

Microscopy and Diffraction with Attosecond Electron Pulse Trains — •Yuya Morimoto1,2 and Peter Baum1,2 — 1Ludwig-Maximilians-Universität München, Garching, Germany — 2Max-Planck-Institute of Quantum Optics, Garching, Germany

Attosecond imaging with electrons can access light-driven electron-dynamics in space and time. Here we report first proof-of-principle diffraction and microscopy experiments. We study timing of Bragg-spot emission and visualize light-wave propagation in space and time.

Invited FRI.2.7 12:15

From Strong-Field Physics in and at Nanoscale Matter to Photonics-Based Laser Accelerators — •Peter Hommelhoff — Physics Department, Friedrich-Alexander University Erlangen-Nürnberg, Erlangen, Germany, EU

We demonstrate new control over quasi-free and free electrons by means of ultrashort laser pulses: entering the strong-field regime in the conductor graphene, the longitudinal Kapitza-Dirac effect and laser acceleration of electrons in nanophotonic structures.

15:00–18:00: DESY and European XFEL Visiting Tour
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