Welcome to Santa Fe and to the International Conference on Ultrafast Phenomena!

This year’s event – the 20th biannual international conference – continues the tradition of bringing together a multidisciplinary group of researchers and students sharing a common interest in science and technology at the frontiers of ultrafast technology. Scientists and engineers from all over the world will converge in beautiful Santa Fe to take part in this event.

The conference will include oral and poster contributions. We have scheduled 12 invited, 135 oral and 143 poster presentations over what should be four and half full days. The presentations are in our opinion exceptional in their scientific quality and range of topics. A sponsor exhibit featuring leading companies will be held in conjunction with the meeting.

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

Sincerely,

General Chairs
Louis DiMauro, The Ohio State University, USA, General Chair
Makoto Kuwata-Gonokami, University of Tokyo, Japan, General Chair

Program Committee Chairs
Giulio Cerullo, Politecnico di Milano, Italy, Program Chair
Jennifer Ogilvie, University of Michigan, USA, Program Chair
COMMITTEE

General Chairs
Louis DiMauro, Ohio State Univ., USA
Makoto Kuwata-Gonokami, Univ. of Tokyo, Japan

Program Chairs
Giulio Cerullo, Politecnico di Milano, Italy
Jennifer Ogilvie, Univ. of Michigan, USA

Program Committee
Martin Aeschlimann, Technische Universität
Kaiserslautern, Germany
Andrius Baltuska, Technische Universität Wien, Austria
Jens Biegert, ICFO, Spain
Jenny Clark, Sheffield Hallam Univ., UK
Nuh Gedik, MIT, USA
Juergen Hauer, Vienna Technical Univ., Austria
Tony Heinz, Stanford Univ., USA
Jan Helbing, Universität Zurich, Switzerland
Kyung Taec Kim, Gwangju Inst. of Science & Tech., South Korea
Matthias Kling, Ludwig-Maximilians-Universität München, Germany
Kevin Kubarych, Univ. of Michigan, USA
Philipp Kukura, Univ. of Oxford, UK
Ruxin Li, Shanghai Inst. of Optics and Fine Mech, China
Christoph Lienau, Carl V. Ossietzky Univ. Oldenburg, Germany
Stefan Lochbrunner, Inst. für Physik, Universität Rostock, Germany
David Reis, Stanford Univ., USA
Claus Ropers, Georg-August-Universität Gottingen, Germany
Gregory Scholes, Princeton Univ., USA
Olga Smirnova, Max Born Inst., Germany
Tahei Tahara, RIKEN, Japan
Koichiro Tanaka, Kyoto Univ., Japan
Fabrice Vallee, Universite Lyon 1, France
David Villeneuve, National Research Council Canada, Canada
Chunfeng Zhang, Nanjing Univ., China
Dongping Zhong, Ohio State Univ., USA
Donatas Zigmantas, Lund Univ., Sweden

Advisory Committee
David H. Auston, Kavli Foundation, USA
Majed Chergui, Ecole Polytechnique Federale de Lausanne, Switzerland
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Steven T. Cundiff, Univ. of Michigan, USA
Sandro De Silvestri, Politecnico di Milano, Italy
Regina de Vivie-Riedle, Ludwig-Maximilians-Universität München, Germany
Kenneth Eischenthal, Columbia Univ., USA
Thomas Elsaesser, Max Born Inst., Germany
Graham R. Fleming, Univ. of California Berkeley, USA
James G. Fujimoto, MIT, USA
Charles B. Harris, Univ. of California Berkeley, USA
Erich P. Ippen, MIT, USA
David M. Jonas, Univ. of Colorado at Boulder, USA
Wolfgang Kaiser, Technische Universität Munchen, Germany
Wayne H. Knox, Univ. of Rochester, USA
Takayoshi Kobayashi, Univ. of Electro-Comm., Japan
Jean Llouis Martin, Ecole Polytechnique ENSTA, France
Arnold Migus, Cour des Comptes, France
R. J. Dwayne Miller, MPI - the Structure and Dynamics/ Matter, Germany
Gérard A. Mourou, Ecole Polytechnique, France
Shaul Mukamel, Univ. of California Irvine, USA
Margaret M. Murnane, Univ. of Colorado at Boulder, USA
Keith A. Nelson, MIT, USA
Eberhard Riedle, Ludwig-Maximilians-Universität München, Germany
Norbert F. Scherer, Univ. of Chicago, USA
Robert William Schoenlein, SLAC, Stanford Univ., USA
Charles V. Shank, Lawrence Berkeley National Lab., USA
Antoinette J. Taylor, Los Alamos National Lab., USA
Andrew M. Weiner, Purdue Univ., USA
Douwe A. Wiersma, Rijksuniversiteit Groningen, Netherlands
Tatsuo Yajima, Advanced Fusion Technology, Japan
Kaoru Yamanouchi, Univ. of Tokyo, Japan
Keitaro Yoshihara, JAISA, Japan
Ahmed Zewail, California Inst. of Tech., USA
Wolfgang Zinth, Ludwig-Maximilians-Universität München, Germany

Thank you to the International Conference on Ultrafast Phenomena Committee Members for contributing many hours to maintain the high technical quality standards of OSA topical meetings.
GENERAL INFORMATION

About the Santa Fe Community Convention Center
Built in 2008, the Santa Fe Community Convention Center stays true to Santa Fe’s historic adobe architecture and combines the best of old and new with traditional Navajo rugs, Spanish colonial tin accents and carved furniture accent pieces made by local artisans throughout the building. The Santa Fe Convention Center is a highly adaptable, state-of-the-art facility in which to gather and work.

Registration
Lobby

<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
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</thead>
<tbody>
<tr>
<td>Sunday, 17 July</td>
<td>15:00—18:00</td>
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<tr>
<td>Monday, 18 July</td>
<td>07:30—17:30</td>
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<tr>
<td>Thursday, 21 July</td>
<td>08:00—17:30</td>
</tr>
<tr>
<td>Friday, 22 July</td>
<td>08:00—12:00</td>
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</tbody>
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OSA Foundation Travel Grant
We are pleased to announce The OSA Foundation Travel Grant recipient for 2016 International Conference on Ultrafast Phenomena. OSA Foundation Student Travel Grant Program is designed to provide career development opportunities by assisting students who wish to attend conferences and meetings. The grants are given to students working or studying science in qualifying developing nations so they can attend OSA-managed technical meetings and conferences.

Congratulations to the OSA Foundation Student Travel Grant Recipient: Gyula Polonyi, University of Pécs, Hungary

Wireless Internet
OSA is pleased to offer complimentary wireless internet services throughout the meeting space at the Santa Fe Convention Center for all attendees and exhibitors.

Network: ConventionCenter
Passcode: no passcode necessary

About OSA Publishing’s Digital Library
Registrants and current subscribers can access the meeting papers on OSA Publishing’s Digital Library. The OSA Publishing’s Digital Library is a cutting-edge repository that contains OSA Publishing’s content, including 16 flagship, partnered and co-published peer-reviewed journals and 1 magazine. With more than 240,000 articles including papers from over 450 conferences, OSA Publishing’s Digital Library is the largest peer-reviewed collection of optics and photonics.

TECHNICAL PROGRAM

Online Access to Conference Summaries
For a zip file containing the conference summaries, select the button “Download Conference Summaries” from top right of conference website at www.osa.org/up. Postdeadline papers will be selected onsite. A list of the select ed papers will be posted at the registration area starting Monday, 18 July after 13:00, and the summaries will be available on the same link as a separate file. Access is limited to Full Technical Attendees and requires log in using your email and password used for registration.

Update Sheet
All program changes through 15 July will be communicated in the Program Update Sheet distributed with registration materials. We encourage you to review it carefully to stay informed to changes in the program.

Recorded Presentations
We are delighted to announce this valuable enhancement free to full technical registrants. Select presentations are being digitally captured for on-demand viewing. Session content will be available for on demand viewing until late September 2016. All captured session content will be live for viewing within forty-eight hours of being recorded. Just look for the play symbol next to the abstracts to easily identify the presentations being captured. Access to the recorded sessions is limited to full technical attendees only.

1. Visit the conference website, www.osa.org/UP
2. Select the Essential Link “Access meeting presentations/slidescasts” on the right side of the web page
3. Log in using your email and password used for registration.

Proceedings
The official 2016 Ultrafast Phenomena proceedings will be published online through OSA Publishing’s Digital Library. Authors of all presented papers are invited to submit a revised version of their summary paper for the proceedings no later than 16 September. Full Technical Attendees will have FREE continuous access to these papers once they are published in October 2016.

Access will be available by downloaded individually or by downloading the .zip file
1. Go to www.osa.org/UP.
2. Select “Access Conference Proceeding”
3. Log in using your email address and password used for registration. Please note: if you are logged in successfully, you will see your name in the upper right-hand corner.

If you need assistance with your login information, please use the “forgot password” utility or “Contact Help” link.

Poster Presentation PDFs
Authors presenting posters have the option to submit the PDF of their poster, which will be attached to their papers in OSA Publishing’s Digital Library. While accessing the papers in OSA Publishing’s Digital Library look for the multimedia symbol.

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**SPECIAL EVENTS**

The OSA Centennial Celebration Reception  
**Sunday, 17 July, 18:00—19:30**  
Convention Center Courtyard

The Optical Society (OSA) celebrates its 100th anniversary in 2016, marking a century of innovation. Throughout the Centennial, OSA will honor the significance of these advancements and others while also empowering the next generation of optics and photonics leaders. Come celebrate with us during the Conference reception with appetizers and drinks. Attendees may purchase extra tickets for their guests at registration. To learn more visit www.osa.org/100.

**Poster Sessions**  
**Tuesday, Wednesday and Thursday, 15:45—17:15**  
Sweeney C/D/E

Posters are an integral part of the technical program and offer a unique networking opportunity, where presenters can discuss their results one-on-one with interested parties. Drinks and snacks will be provided during the poster sessions.

**OSA Foundation Meet-the-Professionals Happy Hour**  
**Tuesday, 19 July, 19:00—20:30**  
Courtyard, Convention Center

Students and young professionals are invited to attend the OSA Foundation Meet-the-Professionals Happy Hour where they can connect with leaders in the industry for valuable insight and perspective. To RSVP or if you have questions, please email Curtis Burrill at cburrill@osa.org. OSA Membership is required.

**Conference Banquet**  
**Wednesday, 20 July, 18:00—21:00**  
Lumpkins Ballroom, La Fonda on the Plaza

Join your fellow attendees for a festive evening and another opportunity to network with your colleagues. There will be a special performance from the Troupe Tewa Dancers from the North. Guest tickets are available for $75 USD, as extra guest tickets are limited, please check registration for availability.

**Postdeadline Paper Session**  
**Thursday, 21 July, 19:30—20:30**  
Sweeney F

The Technical Program Committee has accepted a limited number of postdeadline papers for oral presentation. The purpose of the postdeadline papers is to give participants the opportunity to hear new and significant materials in rapidly advancing areas.

**OSA Short Wavelength Sources & Attosecond/High Field Physics Technical Group Student Poster Prize Ceremony and Reception**  
**Thursday, 21 July, 19:30—20:30**  
Coronado Room

Join the Short Wavelength Sources & Attosecond/High Field Physics Technical Group for a reception Thursday evening as they recognize the winner of their 2016 Ultrafast Phenomena Conference student poster prize. The networking reception will also provide an opportunity for members of this OSA Technical Group to connect with their colleagues and fellow attendees over appetizers and drinks.
BUYERS’ GUIDE

Exhibit Hall
Sweeney C/D/E

The exhibit will be located with the posters and coffee breaks and is open to all registered attendees.

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<thead>
<tr>
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<th>Monday, 18 July</th>
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</table>

APE Angewandte Physik & Elektronik GmbH
1 Plauener Str.163 - 165
Berlin, 13053 Germany
P: +49.30.986.011 x30
Email: sales@ape-berlin.de
URL: www.ape-berlin.de

APE GmbH is a worldwide operating developer and manufacturer of instruments for the generation of ultrashort laser pulses with widely tunable wavelength as well as devices for pulse measurement and management. APE’s product portfolio ranges from autocorrelators to harmonic generators, from acoustooptics to synchronously pumped optical parametric oscillators (OPOs). APE devices can be found in almost all renowned research institutes and universities.

Clark-MXR, Inc.
7300 West Huron River Drive
Dexter, MI 48130 USA
P: +1 734.426.2803
Email: sales@cmxr.com
URL: www.cmxr.com

Clark-MXR, Inc. manufactures ultrafast lasers and instrumentation for scientific, medical and industrial applications including Spectroscopy, Imaging and Micromachining. Customized system solutions are offered for non-standard applications. Clark-MXR, Inc. also offers contract development, prototyping and parts manufacturing services through our Micromachining Division. We have been providing products, solutions and services to the ultrafast laser field for nearly 30 years.

Class 5 Photonics GmbH
Notkestrasse 85
Hamburg, 22607 Germany
P: +49.40.370.26917
Email: info@class5photonics.com
URL: www.class5photonics.com

Class 5 Photonics provides engineered femtosecond lasers with average power up to 100 W based on optical parametric chirped-pulse amplification (OPCPA). Our robust technology has been developed for large-scale research facilities and tabletop experiments from atomic and molecular physics to life science applications. Our customized OPCPA products range from compact microjoule systems at megahertz repetition rates to Joule-class terawatt lasers. The systems can be flexibly adapted to ultraviolet, visible and infrared wavelengths and pulse duration.

Coherent, Inc.
PREMIER SPONSOR
5100 Patrick Henry Drive
Santa Clara, CA 95054 USA
P: +1 408.764.4000, +1 800.227.8840
Email: tech.sales@coherent.com
URL: www.coherent.com

Celebrating our 50th year as one of the world’s leading providers of lasers and laser-based systems, Coherent has been at the forefront of ultrafast laser technology since its introduction. Our newest generation of ultrafast systems is spearheading an Industrial Revolution in Ultrafast Science – a unique approach to designing and building ultrafast lasers with exceptional reliability and performance.

Continuum, Amplitude Laser Group
140 Baytech Drive
San Jose, CA 95134 USA
P: +1 408.727.3240
Email: info@continuumlasers.com
URL: www.continuumlasers.com

Continuum, an Amplitude Laser Group company, offers a full line of standard and custom high energy solid state lasers for scientific, industrial and commercial applications. These applications range from spectroscopy, materials analysis and Particle Image Velocimetry to x-ray generation and high power plasma physics. As part of Amplitude Laser Group, Continuum now offers high peak power femtosecond lasers, as well as average peak power ultrafast systems.

Electro-Optics Technology, Inc.
3340 Parkland Court
Traverse City, MI 49686 USA
P: +1 231.935.4044
Email: sales@eotech.com
URL: www.eotech.com

Electro-Optics Technology, Inc. has been supplying enabling components and diagnostic equipment worldwide for manufacturers and users of high power laser systems since 1987. Current products include: Faraday rotators, optical isolators, and fiber collimators for use with laser diodes, fiber lasers, and solid-state lasers, with an emphasis on high average power and peak power applications. EOT also stocks a complete line of high speed photodetectors used to monitor the output of pulsed, mode-locked and externally modulated CW lasers.
FASTLITE, world leader of pulse shaping and measurement of ultrafast laser pulses, introduces its new high flux OPCPA systems delivering the shortest MIR pulse durations at 100kHz. Benefiting from Fastlite landmark technologies, these new laser sources set new standards in ultrafast IR spectroscopy, HHG and attosecond science.

Light Conversion USA
SPONSOR
201 S. Wallace, Ste. B2C
Bozeman, MT 59715 USA
P: +1 866.658.5404
Email: sales@altosphotronics.com
URL: www.lightcon.com

Light Conversion is the world-leader for tunable ultrafast OPA systems with the worldwide recognized TOPAS series products. Light conversion is also an established manufacturer of Ytterbium laser PHAROS (180 fs, up to 20w, 2mJ, 1MHz), harmonics generators, parametric amplifier “ORPHEUS”. Together the portfolio forms a ‘best-in-class’ set of devices for femtosecond applications in industry, medicine, and fundamental research.

HOTLIGHT SYSTEMS brings together world-class researchers and research facilities from the Laser Physics Centre, Research School of Physics and Engineering from The Australian National University. HOTLIGHT SYSTEMS invents and develops laser devices in the mid-infrared spectrum, MIROPA fs being its flagship product, a compact, turn-key, near- and mid-infrared femtosecond source, based on a patented seeded optical parametric amplifier design.

KM Labs
1855 South 57th Court
Boulder, CO 80301 USA
P: +1 303.544.9068 x836
Email: ctooly@kmlabs.com
URL: www.kmlabs.com

Lighthouse Photonics develops & manufactures innovative DPSS lasers with a unique blend of performance, compactness and value. Sprout offers up to 18W at 532nm in a near-perfect TEMoo mode with extremely low noise and impressive power stability. Sprout is specifically designed for precision applications that demand excellent beam quality and high stability such as ng Ti:Sapphire oscillators.

Laser Quantum is a world-class manufacturer of revolutionary solid-state and ultrafast lasers. Our products lead the industry in performance specifications, reliability, compactness and operational lifetime. You will find Laser Quantum lasers used in laboratories and integrated in systems and machines worldwide. Our lasers are helping scientists to break new ground in many applications ranging from attosecond physics to forensics and genomics. Visit www.laserquantum.com for more information.

Mesa Photonics is the leader in Frequency Resolved Optical Gating (FROG) measurements for ultrafast lasers. Our FROGscan is the only real-time, comprehensive ultrafast pulse measurement system on the market. These simple-to-use and reconfigurable devices are the best value available in ultrafast measurement. We also offer fully automated autocorrelators for less demanding applications and modulatable delay lines for research applications.
See the nanoworld and study the femtosecond dynamics of electrons and atoms with an ultimate optical resolution of 10 nanometer: neaspec introduces the new ultrafast nano-FTIR imaging and spectroscopy tool based on scattering-type scanning near-field optical microscopy. With a wavelength independent spatial resolution of 10 nanometer throughout the VIS and IR spectrum, this cutting-edge technology allows you to directly access composition, optical or mechanical properties, and femtosecond dynamics of condensed matter systems on the nanoscale.

NTT Advanced Technology Corporation has been providing XUV and x-ray optics since the 1990s. Multilayer XUV mirrors, XUV filters, Fresnel zone plates, and membranes have been used for many applications such as attosecond-science, ultrafast spectroscopy, x-ray imaging. At the Ultrafast Phenomena, for the first time in the world, we will introduce the single crystal membrane for HH generation. Also, we will propose ultra-high resolution x-ray chart for resolution evaluation.

Spectra-Physics is singularly focused on helping customers use precision laser technologies to advance science and propel industries forward. The company does so by offering groundbreaking technologies, deep applications expertise, disruptive cost-performance, and a commitment to world-class customer experience. Our product portfolio spans CW to nanoseconds to femtosecond, UV to mid-infrared, and fiber to DPSS lasers. We enable applications in industrial and microelectronics manufacturing, medical and life sciences, and scientific research.
EXPLANATION OF SESSION CODES

The first letter of the code designates the meeting. The second element denotes the day of the week (M = Monday, Tu = Tuesday, W = Wednesday, Th = Thursday, F = Friday). The third element indicates the session series in that day (for instance, 1 would denote the first sessions in that day). Each day begins with the letter A in the fourth element and continues alphabetically through the parallel session. The lettering then restarts with each new series. The number on the end of the code (separated from the session code with a period) signals the position of the talk within the session (first, second, third, etc.). For example, a presentation coded UM2A.4 indicates that this paper is being presented on Monday (M) in the second series of sessions (2) and is the first parallel session (A) in that series and the fourth paper (4) presented in that session.

Invited papers are noted with Invited

Recorded presentations are noted with
### AGENDA OF SESSIONS

#### Sunday, 17 July

<table>
<thead>
<tr>
<th>Time</th>
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</thead>
<tbody>
<tr>
<td>15:00—18:00</td>
<td>Registration, Lobby</td>
</tr>
<tr>
<td>18:00—19:30</td>
<td>The OSA Centennial Celebration Reception, Convention Center Courtyard</td>
</tr>
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</table>

#### Monday, 18 July

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>07:30—17:30</td>
<td>Registration, Lobby</td>
</tr>
<tr>
<td>08:15—08:30</td>
<td>Opening Remarks, Sweeney F</td>
</tr>
<tr>
<td>08:30—10:15</td>
<td>UM1A · Attosecond Spectroscopy, Sweeney F</td>
</tr>
<tr>
<td>10:15—10:45</td>
<td>Exhibits &amp; Coffee Break, Sweeney C/D/E</td>
</tr>
<tr>
<td>10:45—12:30</td>
<td>UM2A · Ultrafast Raman and Vibrational Spectroscopy, Sweeney AB</td>
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<td></td>
<td>UM2B · Femtosecond Control, Sweeney F</td>
</tr>
<tr>
<td>12:30—14:00</td>
<td>Lunch Break (on your own)</td>
</tr>
<tr>
<td>14:00—15:45</td>
<td>UM3A · Multidimensional Spectroscopy Development, Sweeney F</td>
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<tr>
<td>15:45—16:15</td>
<td>Exhibits &amp; Coffee Break, Sweeney C/D/E</td>
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<tr>
<td>16:15—18:00</td>
<td>UM4A · Biology, Sweeney F</td>
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</tbody>
</table>

### Recorded Presentations

Presentation noted with the record symbol are being digitally captured for on-demand viewing. Session content will be available until late September 2016 via the directions below. Access to the recorded sessions is limited to full technical attendees only.

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#### Tuesday, 19 July

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<td>Registration, Lobby</td>
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<tr>
<td>08:30—10:15</td>
<td>UTu1A · Femtosecond Molecular Dynamics, Sweeney F</td>
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<tr>
<td>10:15—10:45</td>
<td>Exhibits &amp; Coffee Break, Sweeney C/D/E</td>
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<tr>
<td>10:45—12:30</td>
<td>UTu2A · Mid-Infrared and THz Sources, Sweeney AB</td>
<td>Sweeney F</td>
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<tr>
<td>12:30—14:00</td>
<td>Lunch Break (on your own)</td>
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<tr>
<td>14:00—15:30</td>
<td>UTu3A · Nonlinear and Ultrafast THz Spectroscopy, Sweeney F</td>
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<tr>
<td>15:45—17:15</td>
<td>Exhibits &amp; Coffee Break, Sweeney C/D/E</td>
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<tr>
<td>15:45—17:15</td>
<td>UTu4A · Poster Session I, Sweeney C/D/E</td>
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<tr>
<td>17:15—19:00</td>
<td>UTu5A · Strong Field Quantum Physics, Sweeney F</td>
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<tr>
<td>19:00—20:30</td>
<td>OSA Foundation Meet-the-Professionals Happy Hour, Courtyard, Convention Center</td>
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#### Wednesday, 20 July

<table>
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<tbody>
<tr>
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<tr>
<td>08:30—10:15</td>
<td>UW1A · Ultrafast Nanospectroscopy, Sweeney F</td>
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<tr>
<td>10:15—10:45</td>
<td>Exhibits &amp; Coffee Break, Sweeney C/D/E</td>
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<tr>
<td>10:45—12:30</td>
<td>UW2A · Dynamics in Low-Dimensional Materials, Sweeney AB</td>
<td>Sweeney AB</td>
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<tr>
<td>12:30—14:00</td>
<td>Lunch Break (on your own)</td>
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<tr>
<td>14:00—15:45</td>
<td>UW3A · Singlet Fission &amp; Coherence, Sweeney F</td>
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<tr>
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<td>Exhibits &amp; Coffee Break, Sweeney C/D/E</td>
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<tr>
<td>15:45—17:15</td>
<td>UW4A · Poster Session II, Sweeney C/D/E</td>
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<tr>
<td>18:00—21:00</td>
<td>Conference Banquet, Lumpkins Ballroom, La Fonda on the Plaza</td>
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<td>08:00—17:30</td>
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<tr>
<td>08:30—10:15</td>
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<td>Exhibits &amp; Coffee Break, Sweeney C/D/E</td>
</tr>
<tr>
<td>10:45—12:30</td>
<td>UTh2A · Pulse Generation and Characterization, Sweeney AB</td>
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<tr>
<td></td>
<td>UTh2B · Ultrafast Electron Diffraction, Sweeney F</td>
</tr>
<tr>
<td>12:30—14:00</td>
<td>Lunch Break (on your own)</td>
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<tr>
<td>14:00—15:45</td>
<td>UTh3A · Ultrafast Spin Dynamics, Sweeney AB</td>
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<tr>
<td></td>
<td>UTh3B · Dynamics of Molecular Systems, Sweeney F</td>
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<td>15:45—17:15</td>
<td>Exhibits &amp; Coffee Break, Sweeney C/D/E</td>
</tr>
<tr>
<td>15:45—17:15</td>
<td>UTh4A · Poster Session III, Sweeney C/D/E</td>
</tr>
<tr>
<td>17:15—19:00</td>
<td>Postdeadline Paper Session, Sweeney F</td>
</tr>
<tr>
<td>19:30—20:30</td>
<td>OSA Short Wavelength Sources &amp; Attosecond/High Field Physics Technical Group Student Poster Prize Ceremony and Reception, Coronado Room</td>
</tr>
</tbody>
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## Friday, 22 July

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<td>10:45—12:45</td>
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UM1A.1 • 08:30
Invited
Ultrastep Charge Dynamics Induced by XUV Attosecond Pulses in Bio-relevant Molecules, Francesca Calegari1, Mattea C. Castrovilli1, Mara Galli2,1, Erik Månsson3, Andrea Trabattoni2, David Ayuso4, Simone De Camillius5, Fabio Frassetto1, Luca Poletto1, Alicia Palacios1, Piero Decleva5, Jason Greenwood2, Fernando Martin1, Mauro Nisoli1; 1Consiglio Nazionale delle Ricerche - IFN, Italy; 2Physics, Politecnico di Milano, Italy; 3Università Autonoma de Madrid, Spain; 4Queen’s Univ., UK; 5Università di Trieste, Italy. We used isolated attosecond pulses to trigger pure electron dynamics in aromatic amino acids on a sub-4.5-fs temporal scale. Our work opens new perspectives for attosecond science, moving toward the investigation of bio-relevant systems.

UM1A.2 • 09:00
Attosecond energy- and population-transfer dynamics in solids, Martin Schultze1,2, Krausz Ferenc1,2, Annkatrin Sommer1, Elsabeth Bothschafter1, Shunsuke A. Sato3,4, Clemens Jakubietz1, Tobias Latka1, Olga Raskazovskaya1, Kazuhiro Yabana4, Vladislav S. Yakovlev1, Reinhard Kienberger1, Nicholas Karpowicz1, Hani Fattahi1, Vahe Shirvanyan1; 1Max Planck Institut fuer Quantenoptik, Germany; 2Physik, Ludwig-Maximilans-Universität, Germany; 3Center for Computational Sciences, Japan. We report the time resolved observation of transient and lasting optical excitations across

UM1A.3 • 09:15
Ultrafast Dynamics in the Insulator-to-Metal Phase Transition of Vanadium Dioxide Measured by Attosecond Transient Absorption Spectroscopy, Christian Ott1,2, Marieke F. Jager1, Christopher J. Kaplan1, Robert E. Marvel3, Richard F. Haglund4, Daniel M. Neumark1, Stephen R. Leone4; 1Dept. of Chemistry, UC Berkeley, USA; 2Max-Planck-Institut für Kemptphysik, Germany; 3Dept. of Physics, Vanderbilt Univ., USA. The photoinduced insulator-to-metal phase transition in VO2 is experimentally investigated by attosecond transient absorption spectroscopy. Ultrafast changes cover a broad ~20-eV-wide spectral range, emphasizing core spectroscopic access and the importance of electron correlation effects.

UM1A.4 • 09:30
Direct Observation of a Sub-Femtosecond Optical Response in the Diamond Conduction Band, Matteo Lucchini1, Shunsuke A. Sato2, Jens Hermann1, André Ludwig1, Mikhail Volkov2, Lamia Kasmi2, Yasushi Shinozaka2, Kazuhiro Yabana4, Lukas Gallmann1,4, Ursula Keller1; 1Dept. of Physics, ETH Zurich, Switzerland; 2Graduate School of Pure and Applied Sciences, Univ. of Tsukuba, Japan; 3Photon Science Center, The Univ. of Tokyo, Japan; 4Inst. of Applied Physics, Univ. of Bern, Switzerland. We studied reversible sub-cycle dynamics in the diamond conduction band by attosecond transient absorption spectroscopy. We show that absorption bleaching or enhancement can be controlled with few-femtosecond infrared pulses. Ab initio calculations support our interpretation.

UM1A.5 • 09:45
Electron and Hole Dynamics in Silicon-Germanium Alloy Measured by Attosecond XUV Transient Absorption, Michael Zuerch1, Lauren J. Borja1, Andrey Gandman1, James S. Prell2, Chattany D. Pemmamaju3,4, David Prendergast2, Daniel M. Neumark1,5, Stephen R. Leone1,4; 1Dept. of Chemistry, Univ. of California, USA; 2The Molecular Foundry, Lawrence Berkeley National Lab, USA; 3Chemical Sciences Division, Lawrence Berkeley National Lab, USA; 4Depts. of Chemistry and Physics, Univ. of California, USA. Electron-hole dynamics is measured by attosecond transient absorption in silicon-germanium alloy. The germanium atoms act as reporter atoms by time-dependent probing the M4,5-edge, revealing electron and hole dynamics, as well as a new midgap feature.

UM1A.6 • 10:00
Probing Quantum Trajectories by High-order Harmonics Driven by Elliptically Polarized Light, Davide Faccialà1, Anna G. Ciriolo1, Michele Devetta1, Matteo Negro1, Caterina Vozzi1, Salvatore Stagira2; 1IFN-CNR, Italy; 2Physics, Politecnico di Milano, Italy. We studied the dependence of harmonic signal on the ellipticity of the driving field in xenon. We were able to observe trajectories beyond the classical cutoff and interpret the results in the strong-field approximation picture.

10:15—10:45 • Exhibits and Coffee Break, Sweeney C/D/E
UM2A.1 • 10:45
Femtosecond Fully Resonant Electronically Enhanced CARS (FREE-CARS) for Simultaneous Minor-Species Detection and Single-Shot Thermometry, Hans U. Stauffer1, Jacob B. Schmidt1, Daniel R. Richardson1, Sukesh Roy1, Paul J. Wresinski2, James R. Gord2; 1Spectral Energies LLC, USA; 2Aerospace Systems Directorate, Air Force Research Lab, USA. Femtosecond time-resolved, fully resonant electronically enhanced coherent anti-Stokes Raman scattering (FREE-CARS) spectroscopy, incorporating a two-color excitation scheme, is used to demonstrate selective and sensitive gas-phase detection of minor species in mixtures and reacting flows.

UM2A.2 • 11:00
Broadband Fourier-Transform Pump-Probe and Stimulated Raman Scattering at Megahertz Modulation Frequencies, Fabrizio Preda1, Julien Rehault1, Francesco Crisafi1, Vikas Kumar1, Giulio Cerullo1, Dario Polli1; 1Politecnico di Milano, Italy. We experimentally demonstrate a new approach to broadband pump-probe spectroscopy and stimulated Raman scattering microscopy based on time-domain Fourier-transform detection employing a passive birefringent interferometer allowing high sensitivity measurements at MHz modulation frequencies.

UM2A.3 • 11:15
Ultrafast Isomerization Dynamics of a Unidirectional Molecular Rotor Revealed by Femtosecond Stimulated Raman Spectroscopy (FSRS), Christopher R. Hall1, Jamie Conyard1, Siarhei Laptenok1, Wesley Browne1, Ben Feringa1, Ismael Heisler1, Stephen Meech1; 1Univ. of East Anglia, UK; 2Univ. of Groningen, Netherlands. The ultrafast isomerization dynamics of a unidirectional molecular rotor are studied with femtosecond stimulated Raman spectroscopy. We observed structural rearrangement on the excited state surface and resolved the complete rotor cycle for the first time.

UM2A.4 • 11:30
Vibrational Wavepacket Motion in Ultrafast Cyanine Photoisomerization Revealed by Femtosecond Stimulated Raman Spectroscopy, Shinya Tahara1, Satoshi Takeuchi1·2, Hiroyuki Ohtani1, Tahei Tahara1·2; 1Molecular Spectroscopy Lab, RIKEN, Japan; 2Ultrafast Spectroscopy Research Team, RIKEN Center for Advanced Photonics, RIKEN, Japan; 3Graduate School of Bioscience and Technology, Tokyo Inst. of Technology, Japan. Real-time observation of nuclear motion during chemical reactions is crucial. Femtosecond near-infrared stimulated-Raman spectra of an isomerizing cyanine are drastically different from visible ones, reflecting the ultrafast wavepacket migration and spreading in the excited state.

UM2B.1 • 10:45
Laser-sub-cycle control of sequential double ionization dynamics of helium, Markus S. Schöffler1, Xinhua Xie1, Stefan Roither1, Philipp Wustelt2·3, Max Möller2·3, Daniil Kartashov1, Andrius Baltuska1, Gerhard Paulus1·4, Markus Kitzler1; 1Photonics Inst., Vienna Univ. of Technology, Austria; 2Institut für Optics and Quantum Electronics, Friedrich-Schiller-Universität Jena, Germany; 3Heinrich-Heine-Universität Düsseldorf, Germany. The dynamics of sequential two-electron emission from helium is extracted from measured momentum distributions. Emission in between the field-maxima and on sub-laser-cycle times is identified. Corresponding structures cannot be reproduced by an established semi-classical model.

UM2B.2 • 11:00
Correlation Effects in the Photoemission Delay of Helium, Marcus Osiander1·2, Florian Siegrist1·2, Vage Shrivyanyn2·3, Renate Pazourek2, Annkatrin Sommer1, Tobias Latka1·2, Alexander Guggenmos1·4, Ulf Kleineberg1·4, Krausz Ferenc1·4, Reinhard Kienberger1·2, Martin Schultze1·2, 1Max-Planck-Institut für Quantenoptik, Garching, Germany; 2Physik-Dept., Technische Universität München, Germany; 3Inst. for Theoretical Physics, Vienna Univ. of Technology, Austria; 4Fakultät für Physik, Ludwig-Maximilians-Universität München, Germany. We measured the energy dependent photoemission delay of electrons escaping during shake-down and shake-up processes in helium. Excellent agreement with ab-initio calculations identifies electronic correlation contributions and allows benchmarking of theoretical models.

UM2B.3 • 11:15
Asymmetric Wigner Time Delay in CO Photoionization, Laura Cattaneo1, Jannie Vos1, Sebastian Heuser1, Matteo Lucchini1, Claudio Cirelli1, Ursula Keller1; 1ETH Zurich, Switzerland. We present photoionization experiments on CO molecules excited by an extreme-ultraviolet attosecond pulse train using RABBITT technique. We found a non-zero difference in Wigner delays between photoelectron wavepackets escaping towards the C-side and the O-side.
UM2A.5 • 11:45
Coherent Signatures of Conical Intersections in Ultrafast Raman and Photoelectron Spectroscopy, Kochise Bennett1, Markus Kowalewski1, Shaul Mukamel1; 1UC-Irvine, USA. We present two ultrafast spectroscopic X-Ray schemes for the detection of electronic coherences. TRUECARS employs attosecond pulses to map the energy gap, while TRPES can provide signatures through fast oscillations in the time domain.

UM2A.6 • 12:00
Vibrational Coherence Spectroscopy of Biomimetic Molecular Switches, Moussa Gueye1, Mounika Rapolu1, Stefan Haacke1, Jeremie Leonard1; 1IPCMS, Université de Strasbourg & CNRS, France. C=C double-bond photoisomerization is investigated by impulsive vibrational spectroscopy using a 400-nm, 8-fs pump. A specific, very pronounced sub-100 cm⁻¹ vibrational mode is observed only when the electronic population decay is faster than 300 fs.

UM2A.7 • 12:15
Ultrafast Vibrational Spectroscopy of Photochemical High-Valent Iron Formation, Joel Torres-Alacan1, Denis Czurlok1, Jörg Lindner1, Peter Vöhringer1; 1Universität Bonn, Germany. The light-induced formation of a super-oxidized iron complex via dinitrogen cleavage from a ferric azido-iron precursor is measured by femtosecond UV/Vis-pump mid-infrared-probe spectroscopy.

UM2B.5 • 11:45
Two dimensional frequency resolved opto-molecular gating of high order harmonic generation, Barry D. Bruner1, Amélie Ferré2, Hadas Soifer1,3, Oren Pedatzur1, Charles Bourassin-Bouchet4, Rafaël Canonge5, Fabrice Catoire6, Dominique Deschamps6, Baptiste Fabre7, Eric Mével8, Stéphane Petit8, Nirit Dudovich1, Yann Mairesse9; 1Weizmann Inst. of Science, Israel; 2CNRS-CEA CELIA, Université de Bordeaux, France; 3Stanford Inst. for Materials and Energy Sciences, SLAC National Accelerator Lab, USA; 4Synchrotron Soleil, France. We introduce a new method for probing electronic dynamics in polyatomic molecules using high harmonic generation spectroscopy. Using a two-colour pump-probe scheme, we resolve the temporal amplitude and phase of harmonic emission from vibrationally excited molecules.

UM2B.6 • 12:00
Disentangling Ionization Processes by Two-Color Phase Contrast Strong Field Photoelectron Spectroscopy, Adi Natan1, Lucas J. Zipp2, Philip H. Bucksbaum1,2; 1SLAC National Accelerator Lab, USA; 2Physics, Stanford Univ., USA. We demonstrate a method to retrieve and visualize low-energy rescattering signals from the total photoelectron momentum map by Fourier decomposition of angle-resolved two-color strong field photoionization.

UM2B.7 • 12:15
Coincidence photoelectron spectroscopy of Ar irradiated by high-order harmonics and near infrared laser pulses, Kana Yamada1, Atsushi Iwaki1, Takahiro Sato1, Katsumi Midorikawa1, Kaoru Yamanouchi1; 1The Univ. of Tokyo, Japan; 2RIKEN, Japan. Photoelectron coincidence measurements were performed by irradiating Ar with high-order harmonics and near-infrared light pulses. Secondary electron emissions induced by the near-infrared light pulses were observed, indicating that the laser-enabled Auger decay proceeded.
UM3A.1 • 14:00
Chirality-Sensitive Ultrafast Spectroscopy, Andreas Steinbacher¹, Heiko Hildenbrand¹, Christian Kramer¹, Martin Schäferling², Harald Giessen², Tobias Brixner²; ¹Institut für Physikalische und Theoretische Chemie, Universität Würzburg, Germany; ²Fourth Physics Inst. and Research Center SCoPE, Univ. of Stuttgart, Germany. We implemented broadband transient circular dichroism spectroscopy by developing a setup that switches, shot-to-shot, between any ultrashort pulse and its polarization-mirrored image. Additionally, optical chirality enhancement is demonstrated theoretically via coherent control of plasmonic near-fields.

UM3A.2 • 14:30
Multidimensional Electronic Spectroscopy in Molecular Beams with Mass-Resolved Ion Detection, Sebastian Roeding¹, Tobias Brixner²; ¹Institut für Physikalische und Theoretische Chemie, Universität Würzburg, Germany. We present a novel setup which allows multidimensional electronic spectroscopy of gas-phase samples by mass-resolved ion detection. Phase cycling is used to disentangle different contributions to the ion signal and to extract the photon-echo response.

UM3A.3 • 14:45
Ultrafast Dynamics at 25T in Photosynthetic Protein Complexes, Margherita Maiuri¹, Jacob Dean¹, Michael Bishop², Stephen McGill³, Gregory D. Scholes¹; ¹Chemistry, Princeton Univ., USA; ²Physics, Univ. of Connecticut, USA; ³NHFML, Florida State Univ., USA. Ultrafast coherences in photosynthetic algae proteins are discriminated by using 25T-magnetic field coupled with a pump-probe apparatus. Electronic/vibronic coherences are modulated by the presence of the field, while vibrations are not perturbed.

UM3A.4 • 15:00
New Insight into Photophysics of DNA Nucleobases, Valentyn Prokhorenko¹, Alessandra Picchiotti¹, R. J. Dwayne Miller¹; ¹Max Planck Inst., Germany. Using broadband deep-UV transient absorption and electronic 2D spectroscopies we found that in all DNA nucleobases the photodeactivation of excited-state population occurs in two steps via a “dark” state which presumably is a nπ* state.

UM3A.5 • 15:15
Cavity-Enhanced Ultrafast Spectroscopy: Ultrafast meets Ultrasensitive, Thomas K. Allison¹, Melanie A. Reber¹, Yuning Chen¹; ¹SUNY Stony Brook, USA. Using a frequency comb laser and optical cavities, we introduce a new technique for performing femtosecond time-resolved optical spectroscopy with high sensitivity. We present transient absorption measurements with a noise level of ∆OD= 2 × 10⁻¹⁰.

UM3A.6 • 15:30
2D Electronic Stark Spectroscopy, Anton D. Loukianov¹, Andrew Niedringhaus¹, Jie Pan¹, Jennifer P. Ogilvie¹; ¹Univ. of Michigan, USA. We developed a novel nonlinear spectroscopy method for observation of ultrafast charge-transfer kinetics combining a background-free heterodyne-detected 2D electronic spectroscopy setup with Stark spectroscopy. We demonstrate the method on the photosystem II reaction center.

15:45—16:15 • Exhibits and Coffee Break, Sweeney C/D/E
UM4A.1 • 16:15
Compared Quantum Chemical Studies of the Ultrafast Isomerization of Microbial, Invertebrate and Vertebrate Rhodopsins, Silvia Rinaldi², Federico Melaccio², Hoi-Ling Luk¹, Samer Gozem¹, Massimo Olivucci¹,²; ¹Bowling Green State Univ., USA; ²Biotechnology, Chemistry and Pharmacy, Università di Siena, Italy. Quantum chemical models are employed to investigate the photoisomerization dynamics of distant rhodopsins. It is found that animal rhodopsins avoid a region of electronic degeneracy present in microbial rhodopsins thus achieve a much faster isomerization.

UM4A.2 • 16:45
Coherence Shift to the Ground State; a Photoprocess Explaining Long-Lived Coherences in Reaction Centers, Donatas Zigantas¹, David Palecek¹, Sebastian Westenhoff², Petra Edlund¹; ¹Lund Univ., Sweden; ²Univ. of Gothenburg, Sweden. Long-lived coherences have been observed in various biological complexes and their origin is debated. We used polarization-controlled 2D electronic spectroscopy to reveal a photophysical process of coherence shift, explaining coherences in bacterial reaction centers.

UM4A.3 • 17:00
Studying Spatio-Energetic Dynamics in Light Harvesting Complex II using Two-Dimensional Electronic-Vibrational Spectroscopy, Nicholas H. Lewis¹,², Thomas Oliver³, Matteo Ballottari⁴, Natalie Gruenke¹,², Roberto Bassi⁴, Graham R. Fleming¹,²; ¹Univ. of California, Berkeley, USA; ²Molecular Biophysics and Integrated Bioimaging Division, Lawrence Berkeley National Lab, USA; ³School of Chemistry, Univ. of Bristol, UK; ⁴Dept. of Biotechnology, Univ. of Verona, Italy. We present two-dimensional electronic-vibrational spectra of the chlorophyll (Chl) binding protein light harvesting complex II (LHCII) from spinach and of isolated Chl a and Chl b. We show how energy transfer from Chl b to Chl a can be observed in LHCII using this multidimensional technique.

UM4A.4 • 17:15
Probing Ultrafast Dynamics of Bacterial Reaction Centers Using Two-Dimensional Electronic Spectroscopy, Andrew J. Niedringhaus¹, Veronica R. Policht¹, Jennifer P. Ogilvie¹; ¹Physics, Univ. of Michigan, USA; ²Applied Physics, Univ. of Michigan, USA. We present two-dimensional electronic spectroscopic data from reaction centers of photosynthetic bacteria with excitation and detection bandwidths spanning the B, P, and H absorption bands. We fit the population kinetics using global analysis.

UM4A.5 • 17:30
Hydration of Native DNA: Ultrafast Structural Dynamics and Short-Range Electric Fields, Biswajit Guchhait¹, Yingliang Liu¹, Torsten Siebert¹, Thomas Elsaesser¹; ¹Max Born Inst., Germany. Two-dimensional infrared spectroscopy of backbone vibrations maps interactions of natural salmon DNA with its water shell. Fast fluctuations in the 300 fs regime are discerned from quasi-static disorder, establishing the short-range character of electrical interactions.

UM4A.6 • 17:45
Coherence Between Energetically-Remote Chromophores in a Marine Algae Antenna Complex, Jacob C. Dean¹, Tihana Mirkovic², Zi S. Toa¹, Gregory D. Scholes¹; ¹Princeton Univ., USA; ²Chemistry, Univ. of Toronto, Canada. Two-dimensional electronic spectroscopy and broadband transient absorption were executed over the full spectrum of phycocyanin 645 (PC645, Chroomonas mesostigmatica) at 295 and 77 K to reveal vibronic coherence between donor/acceptors separated by >1500 cm⁻¹.
UTu1A.1 • 08:30
Toward Femtochemistry with Circular Polarized Pulses, Samuel Beaulieu1, Antoine Comby1, Romain Geneaux2, Dominique Descamps1, Baptiste Fabre1, Amelie Ferre1, Gustavo Garcia3, François Légaré4, Yann Mairese1, Laurent Nahon1, Stéphane Petit1, Bernard Pons1, Thierry Ruchon2, Valérie Blanchet1; 1Université de Bordeaux I, France; 2CEA, IRAMIS, Lasers, Interactions and Dynamics Lab, France; 3Synchrotron SOLEIL, France; 4Centre EMT, Institut National de la Recherche Scientifique, Canada; 5CNRS, LP3, France. Femtochemistry induced by circularly polarization light coupled to velocity map imaging of photoelectron gives an access to new and sensitive observables that have to be compared to the standard ones.

UTu1A.2 • 09:00
Electronic Dynamics in Highly Excited States of Acetone and Methyl Azide Studied with Ultrafast PEPICO Spectroscopy, William Peters1, David E. Couch1, Ryan C. Fortenberry1, Henry C. Kapteyn1, Margaret M. Murnane1; 1Physics, Univ. of Colorado, USA; 2Chemistry, Georgia Southern Univ., USA. Excited electronic states near 8.0 eV are studied using femtosecond PEPICO spectroscopy, accessing dense manifolds of strongly coupled states. Ionization to multiple cation states is crucial for navigating the mixed states of this energy regime.

UTu1A.3 • 09:15
New Insights into Ultrafast Relaxation Dynamics of the Ethylene Cation C2H4+, Matteo Lucchini1, André Ludwig1, Elisa Liberatore2, Jens Herrmann1, Lamia Kasmi1, Lukas Gallmann1,3, Ursula Roethlisberger2, Ursula Keller1; 1Dept. of Physics, ETH Zurich, Switzerland; 2Lab of Computational Chemistry and Biochemistry, EPFL, Switzerland; 3Inst. of Applied Physics, Univ. of Bern, Switzerland. Ultrafast relaxation dynamics of the ethylene cation are investigated with unprecedented temporal resolution. This enabled us to redefine the isomerization time to 30 fs and identify relaxation channels evolving on time scales <50 fs.

UTu1A.4 • 09:30
Evidence of Hydrogen Migration rather than Isomerization in the Acetylene Dication, Chelsea E. Liekhus-Schmaltz1,2, Zheng Li1,2, Vladimir Petrovic1,2, Todd Martinez1,2, Philip H. Bucksbaum1,2; 1Stanford Univ., USA; 2PULSE Inst., USA. New ab initio calculations show that ultrafast isomerization in the acetylene dication has an extremely low probability because dissociation outcompetes isomerization. We propose that isomerization previously described in recent ultrafast LCLS x-ray experiments are in fact due to partial migration.

UTu1A.5 • 09:45
Attosecond Pump-Probe Spectroscopy of Electron Correlation Dynamics in the Double Ionization of Benzene, Alexander Winney1, Suk Kyoung Lee1, Yunfei Lin1, Qin Li3, Pradip Adhikari1, H. Bernhard Schlegel1, Wen Li1; 1Chemistry, Wayne State Univ., USA. Using newly developed three-dimensional (3D) two-electron angular streaking (3D-2eAS) method, we show the emission time delay between two electrons in a double ionization event can be measured from zero attosecond to more than one femtosecond.

UTu1A.6 • 10:00
Two-dimensional Terahertz Photon Echo and Rotational Spectroscopy in the Gas Phase, Jian Lu1, Yaqing Zhang1, Harold Y. Hwang1, Benjamin K. Ofori-Oka1, Sharly Fleischer2, Keith A. Nelson1; 1MIT, USA; 2Tel-Aviv Univ., Israel. Terahertz (THz) photon echoes from molecular orientation in acetonitrile vapor have been observed at room temperature. Two-dimensional (2D) rotational spectroscopy reveals third- and higher-order nonlinear rotational responses.
UTu2A.1 • 10:45
Generation of a Single-Cycle Pulse at 2.6 μm using Adiabatic Difference Frequency Generation, Peter Kroger1, Haim Suchowski2, Houkun Liang1, Kyung-Han Hong1, Franz Kaertner14, Jeffrey Moses13; 1Dept. of Electrical Engineering and Computer Science and Research Lab of Electronics, MIT, USA; 2Raymond and Beverly Sackler School of Physics and Astronom, Tel Aviv Univ., Israel; 3School of Applied and Engineering Physics, Cornell Univ., USA; 4Center for Free-Electron Laser Science, Univ. of Hamburg, Germany. We demonstrate the generation of phase- and amplitude-shaped single-cycle optical pulses spanning 1.8 – 4.4 μm based on down-conversion of near-IR pulses using chirped-pulse adiabatic difference frequency generation.

UTu2A.2 • 11:00
Generation of CEP-stable Mid-Infrared Fields Exceeding 20 MV/cm, Keisuke KANESHIMA1, Nobuhisa Ishii1, Kengo Takeuchi1, Jiro Itatani1; 1The Inst. for Solid State Physics, The Univ. of Tokyo, Japan. We produced 5-μJ CEP-stable mid-infrared pulses via BiBO-based dual-wavelength OPA. The field amplitude exceeds 20 MV/cm. The mid-infrared waveform was directly sampled by synchronized 6.5-fs visible pulses. High harmonic generation in GaSe was also observed.

UTu2A.3 • 11:15
A 1-kHz-repetition-rate 100-fs CEP-stable Mid-IR Parametric Amplifier Tunable across the Mid-IR FingerPrint Region, Tsuneto Kanai1, Pavel Malevich1, Sarayoo Kangaparambil1, Heinrich Glaubisch2, Ronald Holzwarth2, Audrius Pugzlys1, Andrius Baltuska1; 1Vilnius University, Lithuania; 2Menlo Systems GmbH, Germany. We report a novel source for mid-IR nonlinear spectroscopy in the molecular fingerprint spectral range based on a white-light-seeded ZnGeP2 OPA tunable in the 3-4.2 μm (signal) and 4.2-7 μm (idler) range and pumped by a 1-ps 2090-nm Ho:YAG laser.

UTu2A.4 • 11:30
Hollow-Core-Waveguide Compression of Multi-mJ CEP-Stable 3.2-μm Pulses, Guangyu Fan1, Tadas Balciunas1, Tsuneto Kanai1, Giedrius Malevich1, Sarayoo Kangaparambil1, Heinrich Glaubisch2, Ronald Holzwarth2, Audrius Pugzlys1, Andrius Baltuska1; 1The Inst. for Solid State Physics, The Univ. of Tokyo, Japan. We demonstrate the generation of phase- and amplitude-shaped single-cycle optical pulses spanning 1.8 – 4.4 μm based on down-conversion of near-IR pulses using chirped-pulse adiabatic difference frequency generation.

UTu2A.5 • 11:45
Demonstrating 100 kHz 2D IR Spectroscopy Using a Mid-IR OPCPA Laser Source, Bradley M. Luther1, Kathryn M. Tracy1, Amber Krummel1; 1Chemistry, Colorado State Univ., USA. We present a 100 kHz 2D IR spectrometer using MgO:PLN based OPCPA and ZGP DF stages to generate 4.65 mm pulses. Data collection at 100 kHz with high speed pulse shaping generates spectra in millisecond timescales.

Sweeney AB
Cascaded optical parametric chirped-pulse amplification for multi-cycle THz-wave generation, Michaël Hemmer1, Fabian Reichert1, Giovanni Cirmi1,2, Koustuban Ravi1,4, Frederike Ahr1,2, Francois Lemery1,2, Anne-Laure Calendron1,2, Huseyin Cankaya1,2, Damian Schimpf1,3, Luis Zapata1, Oliver Muecke1,2, Nicholas Matlis1, Franz Kaertner1,4; DESY - Deutsches Elektronen Synchrotron, Germany; 1Dept. of Physics, Univ. of Hamburg, Germany; 2The Hamburg Center for Ultrafast Imaging, Univ. of Hamburg, Germany; 3Dept. of Electrical Engineering and Computer Science, Massachusetts Inst. of Technology, USA. We experimentally demonstrate cascaded optical parametric chirped-pulse amplification, an efficient method for the amplification of multi-cycle THz-frequency waves. Experimental results are supported by numerical simulations and promise THz efficiencies at the percent level.

Electron and hole relaxation dynamics in CdTe nanorods studied by two-dimensional electronic spectroscopy, Tatjana Stoll1, Federico Branchi1, Ilka Kriegel2, Francesco Scotognella1, Giulio Cerullo1; 1Politecnico di Milano, Italy; 2Instituto Italiano di Tecnologia (IIT), Italy. We study exciton relaxation dynamics in CdTe nanorods by ultrafast two-dimensional electronic spectroscopy (2DES). We resolve the dynamics of both electron and hole transitions, an observation that is not possible with conventional transient absorption spectroscopy.

Highly Efficient Semiconductor Terahertz Pulse Sources Pumped Above the Three-Photon Absorption Edge, József A. Fülöp1,2, Balázs Monoszlai1, Gyula Polónyi1, Csaba Lombosi1, Giedrius Andriukaitis1, Edgar Kaksis1, Gregory Gáumann2, Tadas Balciunas3, Guangyu Fan3, Tsenuto Kana4, Audrius Puglisi3, Thomas Feurer4, Graham Arthur4, Andrius Baltuska2, Janos Hebling1,1; 1MTA-PTE High-Field Terahertz Res. Group, Hungary; 2ELI-ALPS, Hungary; 3Univ. of Pécs, Hungary; 4Vienna Univ. of Technology, Austria; 5Univ. of Bern, Switzerland; 6Scitech Precision Ltd., UK. THz pulses up to 14 μJ energy and 0.7% efficiency were generated by ZnTe sources with tilted pulse front pumping at 1.7 μm. A monolithic contact-grating source was also demonstrated, which is scalable to mJ energies.

Two-phonon quantum coherences in a semiconductor are observed by two-dimensional terahertz spectroscopy using three THz pulses. Because of the large interband dipole moment nonlinear interactions generate stronger two-phonon coherences than linear interactions.
14:00—15:30
UTu3A • Nonlinear and Ultrafast THz Spectroscopy, Sweeney F
Presider: Christoph Hauri; Paul Scherrer Institut, Switzerland

**UTu3A.1 • 14:00**
**Strong-field terahertz control of electronic quantum motion**, Rupert Huber1; 1Universität Regensburg, Germany. A direct time-domain study of terahertz-driven high-harmonic generation from a bulk solid reveals a novel non-perturbative quantum interference between multiple valence bands. The results identify key mechanisms for future solid-state attosecond sources and lightwave electronics.

**UTu3A.2 • 14:30**
**Nonlinear phonon dynamics in the topological insulator Bi2Se3 driven by intense THz pulses**, Pamela R. Bowlan1, John Bowlan1, Stuart Trugman1, Rolando Valdes Aguilar2, Jingbo Qi3, Xinyu Liu4, Jacek Furudyna5, Antionette Taylor1, Dmitry Yarotski1, Rohit Prasankumar1; 1Center for Integrated Nanotechnologies, Los Alamos National Lab, USA; 2Dept. of Physics, The Ohio State Univ., USA; 3The Peac Inst. of Multiscale Sciences, China; 4Dept. of Physics, Notre Dame Univ., USA. We demonstrate a powerful, table-top approach for directly visualizing crystal lattice dynamics using optical second harmonic generation after intense terahertz photoexcitation of a specific phonon mode in the topological insulator Bi2Se3.

**UTu3A.3 • 14:45**
**Light-induced Superconductivity in Metallic K3C60**, Alice Cantaluppi1, Matteo Mitrano1, Daniele Nicoletti1, Stefan Kaiser1, Andrea Perucchi2, Stefano Lupi3, Paola di Pietro3, Daniele Pinto1, Mauro Ricco4, Stephen Clark5, Andrey Cavalleri1; 1Condensed Matter, Max Plank Inst. (MPSD), Germany; 2INSTM UdR Trieste-ST and Elettra - Sincrotrone Trieste S.C.p.A, Italy; 3Dept. of Physics, Oxford Univ., UK. Resonant excitation of local molecular vibrations at mid-infrared wavelengths is shown to induce a transient superconducting state in the organic superconductor K3C60 for temperatures far above the equilibrium critical temperature.

**UTu3A.4 • 15:00**
**Resolving the Fundamentals of Magnetotransport in Metals with Ultrafast Terahertz Spectroscopy**, Dmitry Turchinovich1, Zuanming Jin1,6, Alexander Tkach2, Frederick Casper3, Victor Spetter4, Hubert Grimm5, Andy Thomas3, Tobias Kampfrath5, Mischa Bonn1, Mathias Kläui3; 1Max Planck Inst. for Polymer Research, Germany; 2Univ. of Aveiro, Portugal; 3Univ. of Mainz, Germany; 4Sensitec GmbH, Germany; 5Fritz-Haber-Institut, Germany; 6Dept. of Physics, Shanghai Univ., China. Using terahertz spectroscopy we directly resolved the fundamentals of spin-dependent conductivity in ferromagnetic metals. We quantified the differences in conduction by Fermi-level electrons with opposite spins on the sub-100 fs timescale of electron momentum scattering.

**UTu3A.5 • 15:15**
**Dynamic evolution of a two-dimensional electron gas in a magnetic field after optical photoexcitation**, Kamaraju Natarajan1, Wei Pan2, John L Reno2, Qi Zhang3, Junichiro Kono4, Antionette Taylor1, Rohit Prasankumar1; 1Los Alamos National Lab, USA; 2Sandia National Labs, USA; 3Dept. of Electrical and Computer Engineering, Dept. of Physics and Astronomy and Dept. of Materials Science and NanoEngineering, Rice Univ., USA. We used optical-pump, terahertz-probe spectroscopy to track carrier dynamics in a two-dimensional electron gas under a magnetic field, revealing photoinduced changes to the cyclotron frequency and scattering time, along with an unexpected higher frequency mode.

15:45—17:15 • Exhibits and Coffee Break, Sweeney C/D/E
**UTu4A.1 •** Thz based electro-optic modulator operating in the Thz frequency range, Vincent Juve1, Gwenaëlle Vaudel1, Zoltan Ollmann2, Janos Hebling1, Vitalyi Gusev1, Vasily Temnov1, Thomas Pezeril1; 1Institut des Matériaux et Molécules du Mans, France; 2Dept. of Experimental Physics, University of Pecs, Hungary; 1Laboratoire d’Acoustique de l’Université de Maine, France. Ultra-short single cycle THz pulses are used to induce Pockels effects in LiNbO3. The experimental results show that an electro-optic modulation of visible light operating in the THz frequency range with an efficiency up to 15% can be achieved.

**Ut4A.2 •** Electronic coherences in rhodamine dimers: vibronic coupling and distance dependence, Marco Cipolloni1, Barbara Freschi2, Ilaria Occhiuto2, Ksenija Komarova3, Alessandro Cecconello3, Itamar Willner1, Raphael d. Levine3, Francoise Remacle2; 1Dept. of Chemical Sciences, Univ. of Washington, USA; 2National Chiao Tung Univ., Taiwan; 3Univ. of Electro-Communications, Japan. Two-dimensional electronic-vibrational spectroscopy is presented using a sequence of two ~40 fs 400 nm pulses and an octave-spanning broadband mid-IR pulse (~20 fs) to measure correlated electronic and vibrational dynamics.

**UTu4A.3 •** Revealing the Excited State Dynamics of Betaine-30 using Two-dimensional Electronic-Vibrational Spectroscopy, Takahiro Teramoto1, Nicholas H. Lewis1, Thomas Oliver1, Akito Ishizaki1, Graham R. Fleming1; 1Ritsumeikan Univ., Japan; 2Chemistry, Univ. of California, Berkeley, USA; 3Chemistry, Univ. of Bristol, UK; ‘Molecular Biophysics and Integrated Bioimaging Division, Lawrence Berkeley National Lab, USA; ‘Inst. for Molecular Sciences, Japan. Two-dimensional electronic-vibrational spectroscopy was used to investigate the ultrafast photinduced dynamics of betaine-30 in methanol-d4 solution. Our study reveals three vibrational modes (1330, 1350 and 1370 cm^-1) are strongly coupled to the back charge transfer process.

**UTu4A.4 •** Critical Behavior of Relaxational Lattice Modes in Multiferroic Cupric Oxide, Toshiro Kohmoto1, Yukihiro Sawada1, Takeshi Moriyasu1; 1Kobe Univ., Japan. The ultrafast lattice dynamics in a multiferroics CuO was studied by a transient birefringence measurement. The observed critical behaviors suggest different characters of ferroelectric transition, order-disorder and disalike-like types, for the two multiferroic phase transitions.

**UTu4A.5 •** Coherent Spectroscopy of PDI-based Artificial Light-Harvesting Antenna, Margherita Maitai1, Maria Oviedo1, Marius Koch1, Maylo Mykhaylukovskii2, Felix Castellano2, Gregory D. Scholes1; 1Chemistry, Princeton Univ., USA; 2Chemistry, North Carolina State Univ., USA. We time-resolved the energy transfer process in artificial light-harvesting PDI-based tetramers with femtosecond broadband pump-probe anisotropy. We resonantly excite and study the isotropic/anisotropic nuclear motions during the transfer.

**UTu4A.6 •** Investigating Quantum Electronic or Vibronic Coherences via Energy Migration Dynamics in Light-Harvesting Complex II, Amy L. Stevens2, Samansa Manesh1, Lu Chen1, Oliver Ernst1, Valentin Prokhorenko2, R. J. Dwayne Miller1; 1Univ. of Toronto, Canada; 2Max Planck Inst. for the Structure and Dynamics of Matter, Germany; ‘Dept. of Biochemistry and Molecular Genetics, Univ. of Toronto, Canada. The possibility of quantum electronic coherence in photosynthetic complexes is a hotly debated topic. Our two-dimensional spectroscopic results at physiologically-relevant temperatures attribute these to vibronial, instead of excitonic, origins.

**UTu4A.7 •** Coherent Fourier Transform Two-Dimensional Electronic Spectroscopy using an Octave-Spanning Mid-IR Probe, James D. Gaynor1, Trevor L. Courtney1, Madhumitha Balasubramanian1, Munira Khalil1; 1Chemistry, Univ. of Washington, USA. Two-dimensional electronic-vibrational spectroscopy is presented using a sequence of two ~40 fs 400 nm pulses and an octave-spanning broadband mid-IR pulse (~20 fs) to measure correlated electronic and vibrational dynamics.

**UTu4A.8 •** DUV ultrafast electronic relaxation and real-time vibration dynamics in 3-trypytophan, Naoyuki Shikowka1, Xue Bing1, Kazuaki Nakata1, Eiji Tokunaga1; 1Tokayoshi Kobayashi1, 2Kobe Univ., Japan; ‘Univ. of Electro-Communications, Japan; ‘Tokyo Univ. of Science, Japan; ‘National Chiao Tung Univ., Taiwan. We observed ultrafast conical intersection relaxation process and molecular vibration of L-trypytophan by pump probe spectroscopy with sub-10fs DUV pulses.

**UTu4A.9 •** Ultrafast dynamics studies of uracil and thymine by using sub-10fs deep ultraviolet laser excitation, Takayoshi Kobayashi1,2, Xue Bing1; ‘Univ. of Electro-Communications, Japan; ‘National Chiao Tung Univ., Taiwan. Ultrafast dynamics of uracil and thymine are observed for uracil and thymine using sub 10fs deep ultraviolet laser pulses. Dynamic times the conical intersection is assigned from mtt* state with ultrashort relaxation to mtt* states and ground state.

**UTu4A.10 •** Photochemical Radical Delivery Through Vitamin B6, Nicholas A. Miller1, Theodore E. Wiley1, William R. Miller1, Kenneth Spears1, Roseanne J. Sension1; 1Univ. of Michigan, USA. UV-visible transient absorption spectroscopies were used to characterize the excited state dynamics of several B6 vitamins including hydroxocobalamin and synthetic antivitamins.

**UTu4A.11 •** Femtosecond Time-Resolved Spectroscopy of Photochemical Dynamics of 2'-Hydroxycalcone, Nanae Yokoyama1, Xue Bing1, Hisashi Taniaka1, Naoyuki Shikowka1, Tohru Horiuchi1, Satoshi Maeda1, Yoshitomo Yamakita1, Takayoshi Kobayashi1; 1The Univ. of Electro-Communications, Japan; 2Tokyo Univ. of Science, Japan; 3Hokkaido Univ, Japan. Ultrafast dynamics of 2'-Hydroxycalcone are observed by femtosecond spectroscopy using deep ultraviolet pump (11 fs) and visible broadband probe lasers. Dynamics of internal conversions from S3, proton recolliding electron. It might provide the necessary "pump" step for “pump-probe" studies.

**UTu4A.12 •** Photodynamics of Coumarin Caged Puromycin: Release of an Antibiotic on the Ultrafast Timescale, Lisa-Marie Herzig1; 1Goethe-Universität Frankfurt, Germany; ‘Friedrich-Schiller-Universität Jena, Germany; ‘Helmholz Inst. Jena, Germany. Single and double electron recapture processes into Rydberg states driven by few-cycle laser pulses are studied for argon dimers. The electron emission and recapture dynamics shows a strong dependence on the pulses’ carrier-envelope phase.

**UTu4A.13 •** Probing charge dynamics in bare and dye-sensitized ZnO nanocrystals with time-resolved XPS, Stefan Nepp1, Johannes Mahl1, Andrei Shavyskovyi1, Hendrik Bluhm2, Oliver Gessner1; 1Lawrence Berkeley National Lab, USA; 2MAX IV Lab, Sweden. Time-resolved XPS is used to monitor charge carrier dynamics in bare and dye-sensitized ZnO nanoparticle films upon sub-bandgap excitation. Results are discussed in the context of impurity-related bandgap states and electron transfer from the chromophore.

**UTu4A.14 •** Excitonic Relaxation and Coherent Vibrational Dynamics in Zinc Chlorin Aggregate as a Model of Supramolecular Antenna Complexes, Juan Du1, Dongjia Han2, Takayoshi Kobayashi1, Tomohiro Miyatake1, Hitoshi Tamaki1, Yanyan Li1, Xin Lk2; 3Advanced Ultrafast Laser Research Center, Univ. of Electro-Communications, Japan; 4Ryukoku Univ., Japan; 5Ritsumeikan Univ., Japan; 6Shanghai Inst. of Optics and Fine Mechanics, China. The excitonic relaxation and coherent vibrational dynamics in starlike zinc chlorin aggregates prepared for mimicking chlorosome in nature have been studied by 6.8 fs real-time laser spectroscopy.

**UTu4A.15 •** Ultrafast Vibrational Spectroscopy Reveals the Primary Photochemical Processes of a Ferroclycobutadiene, Boris Wexisla, Joel Torres-Alacan, Jörg Lindner1, Peter Vöhringer1; 1Universität Bonn, Germany. The primary photoinduced processes of distorted square-pyramidal ferroclycobutadiene tricarbonyl have been studied in liquid acetonitrile solution under ambient conditions using femtosecond UV-pump mid-infrared-probe spectroscopy.

**UTu4A.16 •** Ultrafast Laser Induced Inner Shell Excitations by Electron Recollision, Yunpei Deng1, Zhinan Zeng1, Zhengmao Jia1, Pavel Komín1, Yinhui Zheng1, Xiaochun Ge1, Ruxin Li1, Gilad Mas1, Marcus1; 1The Hebrew Univ., Jerusalem, Israel; 2Shanghai Inst. of Optics and Fine Mechanics, China; ‘SwissFEL, Switzerland. By using a few cycles 1800nm source, we demonstrated the possibility to excite inner-shell electrons in a sub-femtosecond time scale, using the recolliding electron. It might provide the necessary "pump" step for "pump-probe" studies.

**UTu4A.17 •** Laser-sub-cycle Fragmentation Dynamics of Argon Dimers, Vimal Kunnumel1, Sonia Erratpalli1, Vaclav Hanus3, Markus Koch1, Seydrezera Larriman1, Markus Schöfler1, Xinhua Xie1, Andrius Baltuska1, Gerhard Palusa1; 1Institut für Optik und Elektronik, Austria; 2Graz Univ. of Technology, Austria; 4Friedrich-Schiller-Universität Jena, Germany; ‘Helmholz Inst. Jena, Germany. Single and double electron recapture processes into Rydberg states driven by few-cycle laser pulses are studied for argon dimers. The electron emission and recapture dynamics shows a strong dependence on the pulses’ carrier-envelope phase.

**UTu4A.18 •** Non-Dipole Effects on Rescattered Photoelectrons from Strong-Field ionization with Elliptical Polarization, Jochen Maurer1, Benjamin Willenberg1, Benedikt W. Mayer1, Christopher R. Phillips1, Lukas Gallmann1, Ursula Keller1; 1Dept. of Physics, ETH Zurich, Switzerland; 2Inst. of Applied Physics, Univ. of Bern, Switzerland. We study strong-field ionization with elliptically polarized mid-infrared pulses beyond the long-wavelength limit of the dipole approximation. Recattering creates a sharp structure in 3D photoelectron momentum distributions influenced by non-dipole effects.
CMI measurement using few-cycle laser pulses

UTu4A.20 • Experimental Observation of Cusp Catastrophes in Strong Field Dissociation, Adi Natan1, Matthew R. Ware1,2, Philip H. Bucksbaum1,2, SLAC National Accelerator Lab, USA; 1Physics, Stanford Univ., USA; We observe a sharp peak in angle-resolved H+ photodissociation over the entire measured kinetic energy releases range, due to a cusp type catastrophe that drives angular focusing of non-resonant states coupled to the strong field.

UTu4A.21 • Retrieval of Geometrical Structure of Molecules by Intense NIR Laser Induced Electron Rescattering, Yuta Ito1, Misaaki Okunishi1, Robert R. Lucchese1, Toru Morishita1, Kiyoshi Ueda1, Tohoku Univ., Japan; 2Texas A&M Univ., USA; 3Univ. of Electro-Communications, Japan. We have tried extracting differential cross section of free electron-C4H4+ scattering from intense near-infrared laser induced rescattering photoelectron spectra in several different ways toward molecular structure retrieval.

UTu4A.22 • Slow electrons from intense laser-cluster interactions, Bernd Schuette1,2, Nikolay Golubev3,4, Andrius Baltuska1, Markus Kitzler1, Xinhua Xie1,2, Andrius Nagele2, Shuhei Yoshida2, Joachim Burgdörfer2, Andrius Seckin Senlik1, Jie Pan1,2, Jon P. Marangos2, Marc Richards1; 1Max-Born-Institut, Germany; 2Imperial College London, UK; 3Universität Heidelberg, Germany; 4Universität Rostock, Germany; 2Univ. of Manchester, UK; 3Univ. of New South Wales, Australia. We present a comparative two-dimensional electronic spectroscopy study of coherent dynamics in the photosystem II reaction center, the bacterial reaction center and their constituent monomers pigments. We discuss the physical origin of the observed coherences.

UTu4A.23 • Retrieval of Geometrical Structure of Molecules by Intense NIR Laser Induced Electron Rescattering, Yuta Ito1, Misaaki Okunishi1, Robert R. Lucchese1, Toru Morishita1, Kiyoshi Ueda1, Tohoku Univ., Japan; 2Texas A&M Univ., USA; 3Univ. of Electro-Communications, Japan. We have tried extracting differential cross section of free electron-C4H4+ scattering from intense near-infrared laser induced rescattering photoelectron spectra in several different ways toward molecular structure retrieval.

UTu4A.24 • Optical freezing of charge motion in organic metal, Shinichiro Iwai1, Yota Naitoh1, Yohei Kawakami1, Hiroto Itcho1, Sumio Ishihara1, Koaru Yamamoto1, Hideko Kishida1, Kenji Yonemitsu1, Tohoku Univ., Japan; 2Dept. of Applied Physics, Okayama Science Univ., Japan; 3Dept. of Applied Physics, Nagoya Univ., Japan; 4Deptartment of Physics, Chuo Univ., Japan. Dynamical localization that is, reduction of the interstate electronic transfer integral, was realized by strongly strcngthened electric filed (10 MV/cm) of 1.5-cycle (7 fs) near infrared light in layered organic conductor.

UTu4A.25 • Filamentation by Combining Sub-Critical Peak Power Ultrashort Pulses, Daniel J. Kepler1,2, Sherminne Rostami1,2, Matthieu Baudelet1,2, Martin C. Richardson1; 1Laser & Plasma Lab, USA; 2Chemistry, National Center for Forensic Science, USA. This work experimentally demonstrates in air coupling between two beams below the critical power threshold for filamentation. Dependent upon the pulse overlap in time, space, and polarization these two beams are observed to fuse and form a single filament.

UTu4A.26 • Light-field induced reduction of ‘plasma’ frequency in organic conductor, Shinichiro Iwai1, Yota Naitoh1, Yohei Kawakami1, Hiroto Itcho1, Sumio Ishihara1, Koaru Yamamoto1, Kenji Yonemitsu1, Tohoku Univ., Japan; 2Dept. of Applied Physics, Okayama Science Univ., Japan; 3Dept. of Physics, Chuo Univ., Japan. Strong (> 10 MV/cm) light-field effect of (MTM71)2AsF6 was investigated utilizing 7-fs infrared pulses. The ultrafast (~20 fs) and large (~40%) response of the plasma-like reflectivity edge (~0.7 eV) was discussed in terms of dynamical localization.

UTu4A.27 • Long-lived Hydrocarbon Dications from Strong Field Interaction, Seyyedreza Larimian1, Sonia Eraztuzitia1, Erik Löttstedt1, Tamás Szidarovszky1, Raffael Maurer1, Stefan Roither1, Markus S. Schöffler1, Danil Kartashov1, Koaru Yamamoto1, Andrius Baltuska1, Markus Kitzler1, Xinhua Xie1,2; 1Photonics Inst., Vienna Univ. of Technology, Austria; 2Dept. of Chemistry, School of Science, The Univ. of Tokyo, Japan. We experimentally investigated a delayed fragmentation of hydrocarbon molecules on nanosecond to microsecond timescale after double ionization by femtosecond pulses. Quantum chemical simulations suggest that it originates from meta-stable high-lying vibrational states of dications.

UTu4A.28 • Retrieval of Geometrical Structure of Molecules by Intense NIR Laser Induced Electron Rescattering, Yuta Ito1, Misaaki Okunishi1, Robert R. Lucchese1, Toru Morishita1, Kiyoshi Ueda1, Tohoku Univ., Japan; 2Texas A&M Univ., USA; 3Univ. of Electro-Communications, Japan. We have tried extracting differential cross section of free electron-C4H4+ scattering from intense near-infrared laser induced rescattering photoelectron spectra in several different ways toward molecular structure retrieval.

UTu4A.29 • Full-Dimensional Simulation of Alignment Dynamics of H3+ in Laser Fields, Tamás J. Szidarovszky1, Koaru Yamamoto1, The Univ. of Tokyo, Japan. All the bound rovibrational states of H3+ are computed and used to expand the vibronic coupling. In which the matrix of time-dependent configuration-interaction coefficients is factorized into three matrices of lower dimension.

UTu4A.30 • Factorization of the Configuration-Interaction Coefficient Matrix in the Multiconfiguration Time-Dependent Hartree-Fock Method, Erik Löttstedt1, Tsuyoshi Kato1, Koaru Yamamoto1; 1Univ. of Tokyo, Japan. A method to solve the time-dependent Schrödinger equatation for laser-driven many-electron systems is proposed, in which the matrix of time-dependent configuration-interaction coefficients is factorized into three matrices of lower dimension.

UTu4A.31 • First-principles Simulations of General Molecules in Intense Laser Fields, Ryohto Sawada1, Takeshi Sato1, Kenichi L. Ishikawa1; 1Univ. Tokyo, Japan. We have successfully implemented the multiconfiguration time-dependent Hartree-Fock method on a multi-resolution Cartesian grid. This will open a way to first-principles study of strong-field and attosecond phenomena in general molecules.

UTu4A.32 • Impulsive Stimulated Raman Scattering by Atomsconfined plasmons, Jie Pan1,2, Jon P. Marangos2, Ryohto Sawada1, Andre Kamalov1, Matthew R. Ware1,2, Daniel J. Haxton2, Shungo Miyabe1, Philip H. Bucksbaum1; 1PULSE Inst. for Ultrafast Energy Science, SLAC National Accelerator Lab, USA; 2Chemical Sciences Division, Lawrence Berkeley National Lab, USA; 3RIKEN Center for Advanced Photonics, Japan. We present theoretical results for creating superpositions of valence excited states through impulsive stimulated Raman scattering by a broadband laser pulse. We also present our experimental method to produce high intensity isolated attosecond pulses required to drive this process.
UTu4A.28 • Ultrafast Photoisomerization in Anabaena Sensory Rhodopsin: High Speed but Small Quantum Yield, Daniel A. Gheorghiu1,2, Alexandre V. Chemin1,2, Jeremie Leonardi1,2, Hideki Kandori3, Kwan-Hwang Jung1, Stefan Haacke1,2,1 Université Strasbourg, France; 2IPCMS, CNRS, France; 3Dept. of Materials, Nagoya Inst. of Technology, Japan; 4Dept. of Life Science and Inst. of Biological Interfaces, Sobug Univ., Korea. Femtosecond broadband pump-probe spectroscopy disentangles the ultrafast photo-isomerization kinetics of all-trans and 13-cis retinal in ASR. At odds with the conventional picture, the faster reaction displays a smaller photo-product quantum yield.

UTu4A.29 • Dynamics of O2 Rebinding to Myoglobin and Hemoglobin Probed by Femtosecond Infrared Spectroscopy, SeongChul Park1, Jaeheung Park1, Manho Lim1;1 Pusan National Univ., Korea. Rebinding dynamics of O2 to myoglobin and hemoglobin, observed by probing O=O stretching mode of bound oxygen to the heme proteins, were found to be independent of their conformations.

UTu4A.40 • Energy Transfer between Subunits of Photosystem II Dimer Observed by Femtosecond Transient Absorption, Yusuke Yoneda1, Tetsuro Katayama1, Yutaka Nagasawa2,3, Hiroshi Miyasaka1, 1 Université de Strasbourg, France; 2IPCMS, CNRS, France; 3Dept. of Life Science and Inst. of Biological Interfaces, Sobug Univ., Korea. The modes of an intracavity etalon couple to the modes of a mode-locked bidirectional ring laser, resulting in large modifications of the gyroscopic beat note response in a manner uncorrelated with the intracavity pulse velocity.

UTu4A.41 • Filamentation and Self-compression of High-Energy mid-IR Pulses, Audrius Pugzlys1,5, Valentina Shumakova1, Pavel Malevich1, Skimantas Alisiuskas1, Alexander Koronin1,2, Alexander Mitrofanov1,2, Aleksei M. Zheltikov1,2,4, Daniele Faccio1, Danil Kartashov1, Andrius Balsutis1,5, Vienna Univ. of Technology, Austria; 3Moscow State Univ., Russia; 4Heriot-Watt Univ. Edinburgh, UK; 5Friedrich-Schiller Univ. Jena, Germany; 6Texas A&M Univ., USA; 7Russian Quantum Center, Russia. We report self-action of 0.5-TW peak-power few-cycle 4-mm pulses in air and bulk dielectrics that is strikingly different compared to the case of near-IR drivers. An example of scalable nonlinear self-compression of 20-MJ is highlighted.

UTu4A.42 • Large changes in gyro response of a mode-locked laser by creation of slow-light/fast-light with an intracavity Fabry-Perot, James Hendrie1, Matthias Lensing1,2, Ladan Assadian1, Jean-Claude Diels1, 1Univ. of New Mexico, USA; 2Lenserian Research LLC., USA. The modes of an intracavity etalon couple to the modes of a mode-locked bidirectional ring laser, resulting in large modifications of the gyroscopic beat note response in a manner uncorrelated with the intracavity pulse velocity.

UTu4A.43 • 18 µJ multi-pass OPCPA system at 100 kHz pumped by a CPA-free Nd:YVO4 amplifier, Jan Ahrens1,2, Oliver Prochnow1, Thomas Binhammer1, Tino Lang1, Bastian Schulz1, 1Universite de Strasbourg, France; 2IPCMS, CNRS, France; 3Dept. of Life Science and Inst. of Biological Interfaces, Sobug Univ., Korea. We present a compact, multi-pass OPCPA system delivering 8.7 fs with a pulse energy of 18 µJ at 100 kHz repetition rate pumped by a frequency doubled CPA-free picosecond Nd:YVO4 solid-state amplifier.

UTu4A.44 • Towards TW Few-Cycle Infrared Laser Pulses via Fourier Optical Parametric Amplification, Guilmot Emrotte1, Philippe Lassonde1, Mathieu Giguère2, Bruno E. Schmidt2,1, François Légaré1;1 INRS-EMT, Canada; 2few-cycle, Canada. We report the amplification up to 13 mJ of a broadband 1.8 µm femtosecond pulse in a two crystal Fourier optical parametric amplifier (FOPA) pumped by 80 mJ picosecond Ti:Sa pulses.

UTu4A.45 • High Photon Flux 70 eV HHG Source for Ultrafast Dynamics, Robert Klas2,3, Steffen Hädrich2,3, Armando Rua1, Félix Fernández1;1 INRS-EMT, Canada; 2Inst. of Applied Physics, Abbe Center of Photonics, Germany; 3Deutsches Elektronen-Synchrotron DESY, Germany; 4neolASE GmbH, Germany. We present a compact, multi-pass OPCPA system delivering 7.6 fs with a pulse energy of 18 µJ at 100 kHz repetition rate pumped by a frequency doubled CPA-free picosecond Nd:YVO4 solid-state amplifier.

UTu4A.46 • Ultrafast Carrier Dynamics in the Large Magnetoresistance Material WTe2, Yaomin Dai1, John M. Bowlan1, Hang Li2, Hu Miao2, Shangfeng Wu3, Wandong Kong4, Pierre Richard5, Youguo Shi6, Stuart Trugman6, Jian-Xin Zhu1, Hong Ding5, Antionette Taylor1, Dmitry Yarotski1, Rohit Prasankumar1, Los Alamos National Lab, USA; 1Inst. of Physics, Chinese Academy of Sciences, China. Ultrafast optical spectroscopy was used to study carrier dynamics in the large magnetoresistance material WTe2. Our study reveals relaxation processes due to electron-phonon thermalization and phonon-assisted electron-hole recombination, providing insights into the large magnetoresistance mechanism.

UTu4A.47 • Effects of Strain in Mesoscale VO2 Grains on Light-Induced Insulator-Metal Transition, Sergiy Lysenko1, Armando Rua1, Felix Fernandez1;1 Univ. of Puerto Rico, USA; 2Inst. of Applied Physics, Abbe Center of Photonics, Germany. We present a compact, multi-pass OPCPA system delivering 8.7 fs with a pulse energy of 18 µJ at 100 kHz repetition rate pumped by a frequency doubled CPA-free picosecond Nd:YVO4 solid-state amplifier.
17:15—19:00

UTu5A • Strong Field Quantum Physics, Sweeney F
Presider: David Reis; Stanford University, USA

UTu5A.1 • 17:15
Heralding Subcycle Quantum Physics, Denes Seletskiy1, Claudius Riek1, Philipp Sulzer1, Maximilian Seege1, Alfred Leitenstorfer1; ‘Univ. of Konstanz, Germany. We directly detect the multi-terahertz vacuum field and analyze its dependence on the probed space-time volume. A scheme for sensing the time derivative of the field enables time-domain quantum tomography with simultaneous sampling of both quadratures.

UTu5A.2 • 17:45
Quantum coherent control of free electrons by optical near-fields in an ultrafast electron microscope, Armin Feist1, Katharina E. Echternkamp1, Murat Sivis1, Sergei Yalunin1, Sascha Schäfer1, Claus Ropers1; IV. Physical Inst., Univ. of Göttingen, Germany. We demonstrate the quantum coherent control of free electron momentum states by confined light fields. Optical phase modulation drives multilevel Rabi oscillations, enables Ramsey-type electron interferometry and is predicted to facilitate the generation of attosecond electron pulse trains.

UTu5A.3 • 18:00
A Road toward Attosecond Physics in Solids - Atomic-Like Rydberg States Localized at a Nanotip, Jörg Robin1, Jan Vogelsang1, Benedek J. Nagy2, Pétér Dombi2, Christoph Lienau1, Petra Gross1; ‘Carl V. Ossietzky Univ Oldenburg, Germany; ‘Wigner Research Centre for Physics, Hungary. We report the first observation of strong-field above threshold ionization of Rydberg electron wave packets localized to a gold nanotip. Our experiments represent a step to transferring attosecond techniques from atomic to solid state nanosystems.

UTu5A.4 • 18:15
THz induced keV Electron Emission from Metallic Nanotips, Sha Li1, R. R. Jones1; ‘Univ. of Virginia, USA. Intense, single-cycle THz pulses have been employed to explore field emission from tungsten nano-tips. Electrons with several keV energies are observed. Comparison of the emissions from tips with various tip radius provides insight into the emission mechanism and local electron-field interactions.

UTu5A.5 • 18:30
Subcycle Phase Control of Electron Tunneling in an Optical Nanoantenna, Daniele Brida1, Tobias Rybka1, Markus Ludwig1, Michael Schmalz1, Vanessa Knittel1, Alfred Leitenstorfer1; ‘Univ. of Konstanz, Germany. We exploit the carrier-envelope phase of near-infrared 1.4-cycle pulses with picojoule-level energy to control the probability and direction of single-electron tunneling across the 8 nm gap of an optical antenna at 80 MHz repetition rate.

UTu5A.6 • 18:45
Ultrafast Strong-Field Control of electron Motion in Au-SiO2 Nanoplasmonic Guides, Abdulhakem Y. Elezzabi1, Shawn M. Sederberg1; ‘Ultrafast Optics and Nanophotonics Lab, Dept. of Electrical and Computer Engineering, Univ. of Alberta, Canada. Strong-field electron acceleration is observed in an Au-SiO2 nanoplasmonic guide. Carriers in the tightly-confined nanoplasmonic field reach energies exceeding the threshold for impact ionization, broadband white light emission, ultrafast electron sweep, and avalanche growth.

19:00—20:30 • OSA Foundation Meet-the-Professionals Happy Hour, Courtyard, Convention Center

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Ultrafast Nanoscopy of Energy and Charge Transport, Libai Huang; Purdue Univ., USA. Ultrafast optical nanoscopy is employed to visualize exciton and charge transport in solar energy harvesting materials from the nano to mesoscale, coupling simultaneous high spatial, structural, and temporal resolution.

Ultrafast Stimulated Emission Nanoscopy for Charge Dynamics, fs-Detection and Nanolasing, Lukasz Piatkowski, Nicolo Accanto, Sotirios Christodoulou, Gaétan Calbris, Iwan Moreels, Niek F. van Hulst; ICF-Instutut de Ciencies Fotoniques, Spain; Nanochemistry Dept., IIT - Italian Inst. of Technology, Italy; Dept. of Physics, Univ. of Genoa, Italy. We present a newly developed technique called time-resolved stimulated emission nanoscopy, which enables imaging and studying the femtosecond dynamics in nanosamples. Direct insights into femtosecond charge transfer and relaxation pathways in semiconductor nanoparticles are presented.

Femtosecond Dynamics of Nanoscale Molecular Heterogeneity, Joanna M. Atkin, Benjamin Pollard, Bernd Metzger, Paul Sass, Sibel E. Yalcin, A. Scott Lea, Paul E. Teichen, Joel D. Eaves, Markus B. Raschke; Univ. of North Carolina - Chapel Hill, USA; Chem. Univ. of Colorado, USA; JILA, Univ. of Colorado, USA. Using femtosecond infrared nanospectroscopy we probe spatial variations in vibrational coherence in molecular solids. With attomolar sensitivity we resolve the homogeneous response limit identifying static and dynamic heterogeneities in local chemical environments.

Femtosecond Infrared Nanospectroscopy with Sub-cycle Temporal Resolution, Max Eisele, Tyler L. Cocker, Markus A. Huber, Markus Plankl, Leonardo Viti, Daniele Ercolani, Lucia Sorba, Miriam S. Vitiello, Rupert Huber; Dept. of Physics, Univ. of Regensburg, Germany; neaspec GmbH, Germany; NEST, CNR – Instituto Nanoscienze and Scuola Normale Superiore, Italy. We combine sub-cycle, mid-infrared spectroscopy and near-field microscopy to achieve a 10-nm spatial and 10-fs temporal resolution. Our novel system is used to spatially, temporally and spectrally resolve the femtosecond carrier-dynamics in photoexcited InAs nanowires.

Femtosecond Near-Field Imaging with Plasmonic Nanofocused Four-Wave Mixing, Vasily Kravtsov, Ronald Ulbricht, Joanna M. Atkin, Markus B. Raschke; Univ. of Colorado at Boulder, USA; Univ. of North Carolina, USA. Combining broadband plasmonic nano-focusing and femtosecond pulse-shaping we demonstrate spatio-temporal nano-imaging based on four-wave mixing, resolving the coherent electron dynamics at a rough Au edge with few-fs temporal and 10’s nm spatial resolution.

Efficient Emission of Ultrafast Electron Bursts by Plasmonic Nanofocusing of Light, Jan Vogelsang, Jörg Robin, Benedek J. Nagy, Péter Dombi, Petra Gross; Institut für Physik and Center of Interface Science, Carl von Ossietzky Universität, Germany; Wigner Research Centre for Physics, Hungary. We report highly efficient photoelectron emission from gold nanotapers via long-range plasmonic nanofocusing. This new source of remotely-generated few-femtosecond electron pulses is implemented in a point-projection-microscope and first steps towards ultrafast electron microscopy are discussed.
For WSe2, both techniques yield the same dissociation rate dependence, enabling the direct measurement to extract the rates determining photocurrent efficiency.

Clara Nyby1, Hua Zhou2, Q Zhang2, Friederike Ernst1,4, Kyle Seyler3, Michael K. L. Man1, Skylar Deckoff-Jones1, Takaaki Harada1, E Laine Wong1, Athanasios Margiokalis1, M Bala Murali Krishna1, Julien Madéo1, and exhibit valley-sensitive photocurrent kinetics.

We present a novel, compact and robust inline apparatus for generation of high harmonics with elliptical and circular polarization. We employ this system to explore perturbative spin mixing regime in high harmonic generation.

Visualization of Electron Transport in 2D Semiconductor Heterojunctions, Michael K. L. Man1, Skylar Deckoff-Jones1, Takaaki Harada1, E Laine Wong1, Athanasios Margiokalis1, M Bala Murali Krishna1, Julien Madéo1, Andrew Winchester1, Sidong Lei2, Robert Vajtai2, Pulickel M. Ajayan2, and exhibit valley-sensitive photocurrent kinetics.

Ultrafast atomic-scale structural response in monolayer and multilayer transition metal dichalcogenides, Ehren Mannebach1, I-Cheng Tung3, Clara Nyby1, Hua Zhou2, Q Zhang2, Friederike Ernst1,4, Kyle Seyler1, Genevieve Clark3, Yu Lin1,4, Diling Zhu2, James Glownia4, Michael Hoogle1, Sanghoon Song2, Silke Nelson2, Yifei Yu2, Anupum Pant2, Archanha Raja2, Yinheng Guo1, Anthony DiChiaro2, Wendy Mao1, Linyou Cao5, Sefaattin Tongay3, Tony Heinzi4, Xiaodong Xu1, Haidan Wen2, Aaron M. Lindenberg1,4, Stanford Univ., USA; 2Argonne National Lab, USA; 3Univ. of Washington, USA; 5North Carolina State Univ., USA; 6Arizona State Univ., USA; 7Columbia Univ., USA. Femtosecond x-ray studies of 2D transition metal dichalcogenide films reveal ultrafast in-plane and out-of-plane responses, including compression of the out-of-plane lattice spacing, structure factor modulations, and in-plane dynamics occurring on few picosecond time-scales.

Ultrafast valley depolarization dynamics in monolayer MoS2, Stefano Dal Conte1,2, Federico Bottegoni1, Eva Pogna1, Domenico De Fazio1, Stefano Ambrogio1, Ilaria Bargiglia1, Cosimo D’Andrea1, Antonio Lombardo1, Matteo Bruna1, Franco Ciccacci1, Andrea Ferrari1, Giulio Cerullo1,2, Marco Finazzi1; 1Dipartimento di Fisica, Politecnico di Milano, Italy; 2CNR-IFN, Italy; 3Cambridge Graphene Centre, Univ. of Cambridge, UK; 4Dipartimento di Elettronica, Informatica e Bioingegneria, Politecnico di Milano, Italy; 5Center for Nano Science and Technology @ IIT, Istituto Italiano di Tecnologia, Italy. We study the ultrafast valley relaxation dynamics in monolayer MoS2 by time resolved Faraday rotation and circular dichroism. We find that the intervalley scattering process is ultrafast and display a peculiar bi-exponential behavior.

Dynamic Resolution of Photocurrent Generating Pathways by Field Dependent Ultrafast Microscopy, Kyle Vogt1, Sufei Shi2,3, Feng Wang3, Matthew W. Graham1; 1Physics, Oregon State Univ., USA; 2Chemical Engineering, Rensselaer Polytechnic Inst., USA; 3Physics, Univ. of California, Berkeley, USA. Combining E-field-dependent ultrafast photocurrent and transient absorption microscopy, we develop a novel measurement to extract the rates determining photocurrent efficiency. For WSe2, both techniques yield the same dissociation rate dependence, enabling the direct measurement to extract the rates determining photocurrent efficiency.

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Threshold Switching in Phase-Change Materials by Picosecond Electric Fields, Michael J. Shu1, Peter Zalden2, Frank Chen1, Yi Zhu3, Haidan Wen4, Scott Johnston5, Zhi-Xun Shen6, Patrick Landreman1, Mark Brongersma1, Scott Fong1, H.-S. Philip Wong1, Meng-Ju Shen7, Peter Jost7, Matthias Kaes8, Martin Salinga4, Alexander von Hoegen9, Mattias Wuttig10, Aaron M. Lindenberg1,2; 1Stanford Univ., USA; 2SLAC National Accelerator Lab, USA; 3Advanced Photon Source, USA; 4RWTH Aachen Univ., Germany. Amorphous chalcogenides undergo a sharp increase in conductivity upon application of a strong electric field, called threshold switching. Here, we show evidence for threshold switching driven by picosecond terahertz-frequency electric field pulses.

Generation of isolated attosecond pulse with over 70 eV bandwidth by double optical gated sub-two-cycle pulse, Katsuya Oguri1, Hiroki Mashiko1, Tatsuya Ogawa1,2, Yasutaka Hanada2, Hideki Gotoh3; 1NTT Basic Research Labs, NTT Corporation, Japan; 2Faculty of Science and Technology, Hiroasaki Univ., Japan. We demonstrate an isolated attosecond pulse generation based on the double optical gated 4.7 fs driving laser. The generated supercontinuum spectrum has an extremely broad bandwidth of 70 eV, which supports 32-as duration.

Coherent Multidimensional Spectroscopy in Semiconductor Quantum Wells Reveals Dark Excitons and Interactions at Low Excitation Density, Jonathan Tollerud1, Jeffrey A. Davis1; Swinburne Univ. of Technology, Australia. Using a very sensitive coherent multidimensional spectroscopy in semiconductor quantum wells we reveal dark excitons and their coupling to bright excitons, interactions between excitons at low densities and new approaches to eliminate unwanted signals.

Extended phase matching of high harmonic generation driven by truncated beams in tight focusing geometry, Hung-Wei Sun1, Pei-Chi Huang1,2, Yi-Hsuan Tseng1, Ren-Ting Huang1, Ming-Chang Chen1, Cheng Jin1, C.D. Lin2; 1Inst. of Photonics Technologies, National Tsing Hua Univ., Taiwan; 2Inst. of Atomic and Molecular Sciences, Academia Sinica, Taiwan; 1Dept. of Applied Physics, Nanjing Univ. of Science and Technology, China; 2Physics Dept., Kansas State Univ., USA. We demonstrate that phase-matching cutoff of high-order-harmonic generation can be extended by only modifying the geometric parameter and fundamental beam profile, resulting in a 400-times flux enhancement at ≈65 eV in argon using truncated 0.8 μm pulses.

Ultrafast Spin Control of Few-Fermion Dynamics and Inversion in a Single CdSe/ZnSe Quantum Dot, Christopher Hinz1, Christian Traum1, Pascal Gumbsheimer1, Johannes Haase1, Alfred Leitenstorfer1, Denis Seletskiy1; 1Physics, Univ. of Konstanz, Germany. Sub-picosecond hole relaxation and bi-excitonic signatures are studied via two-color pump-probe spectroscopy in a singly-charged CdSe/ZnSe quantum dot. Alignment of the resident spin in an external magnetic field supports few-picosecond buildup of pure single-photon gain.

Narrowband High Harmonic Source with Multi-mW Average Power Based on Cascaded Frequency Conversion, Stefan Demmler1,2, Robert Klas1,2, Maxim Tschernajew1,2, Steffen Hädrich1,2, Jan Rothhardt1,2, Jens Limpert1,2, Andreas Tünnermann1,2; 1Inst. of Applied Physics, Friedrich-Schiller-Universität Jena, Germany; 2Helmholtz-Inst. Jena, Germany. We report on a fiber laser based XUV source generating record high average powers of up to 2.8 mW (8*10^14 photons/s) in a single harmonic at 21.6 eV and narrow relative energy bandwidths down to 3*10^-3 at 26.6 eV.

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14:00—15:45  UW3A • Singlet Fission & Coherence, Sweeney F
Presider: Tobias Brixner; Universität Würzburg, Germany

**UW3A.1 • 14:00**
*Exploring the Ultrafast Vibronic Dynamics of Singlet Exciton Fission*, Akshay Rao1, Andrew Musser1, Philipp Kukura2, Christoph Schnedermann3;
1Univ. of Cambridge, UK; 2Univ. of Oxford, UK. We use ultrafast vibronic spectroscopy to study how in organic semiconductors vibrational modes couple to electronic excitations to drive the conversion of singlet excitons to entangled triplet pair states via the process of singlet fission.

**UW3A.2 • 14:30**
*Ultrafast Spatial Dynamics of Excitons During Intramolecular Singlet Fission*, Matthew Sfeir1, Samuel Sanders2, Elango Kumarasamy2, Andrew Pun3, Kannatassen Appavoo1, Michael Steigerwald1, Luis Campos2; 1Center for Functional Nanomaterials, Brookhaven National Lab, USA; 2Chemistry, Columbia Univ., USA. Using ultrafast transient absorption and emission spectroscopy, we probe the spatial dynamics of excitons during intramolecular singlet fission in asymmetric oligoacene heterodimers. Exciton-exciton correlations are crucial for promoting both triplet pair formation and recombination.

**UW3A.3 • 14:45**
*Singlet Fission Mediating States in TIPS-Pentacene and its Aza-Derivatives Uncovered by Pump-Depletion-Probe Spectroscopy*, Tiago Buckup1, Julia Herz1, Fabian Paulus2, Jens Engelhart1, Uwe Bunz2, Marcus Motzkus1; 1Physikalisch-Chemisches Institut, Ruprecht-Karls-Universität Heidelberg, Germany; 2Organisch-Chemisches Institut, Ruprecht-Karls-Universität Heidelberg, Germany. Femtosecond pump-depletion-probe experiments were carried out in order to unveil the ultrafast excited singlet fission dynamics of TIPS-pentacene derivatives. The extremely short-lived intermediate 1TT state is revealed and the nitrogen-substitution leads to shorter dynamics.

**UW3A.4 • 15:00**
*Long-Lived Vibronic Coherence in Pentafluorobenzene in the ππ* Excited State*, Ole Hüter1, Matthieu Sala1, Dassia Egorova1, Friedrich Temps1; 1Christian-Albrechts-Univ. Kiel, Germany. We report on a long-lived vibronic coherence by coupling of the lowest ππ* and πσ* electronic states of pentafluorobenzene observed by femtosecond mass spectrometry, photoelectron imaging and high-level ab initio quantum dynamics calculations.

**UW3A.5 • 15:15**
*Coherent vibronic coupling in a conjugated polymer at room temperature*, Antonietta De Sio1, Ephraim Sommer1, Filippo Troiani2, Margherita Maiuri2, Julien Rehault1, Elisa Molinari2, Giulio Cerullo3, Christoph Lienau1; 1Universität Oldenburg, Germany; 2CNR, Centro S3, Italy; 3Politecnico di Milano, Italy. Two-dimensional electronic spectroscopy with sub-10-fs time resolution shows that coherent vibronic coupling promotes charge delocalization and results in long-lasting coherent oscillatory dynamics of strongly coupled excitons and polaron-pairs in a conjugated polymer thin film at room temperature.

**UW3A.6 • 15:30**
*Observation of an Excitonic Quantum Coherence in CdSe Nanocrystals*, Shuo Dong1, Dhara Trivedi2, Sabyasachi Chakrabortty1, Takayoshi Kobayashi3, Yinhai Chan1, Oleg Prezhdo2, Zhi-Heng Loh1; 1Nanyang Technological Univ., Singapore; 2Univ. of Rochester, USA; 3Univ. of Electro-Communications, Japan; 4Univ. of Southern California, USA. Optical pump-probe spectroscopy with 6-fs pulses elucidates the 1S1S2→1S2S2 exci tonic quantum coherence in CdSe nanocrystals. This coherence encodes hole migration over nanometer length scales and markedly alters the displacement amplitudes of coherent phonons.

15:45—17:15 • Exhibits and Coffee Break, Sweeney C/D/E
UW4A.1 • Coherent Acoustic Phonon Amplification in a Strongly Coupled Semiconductor Superlattice under Intraminiband Transport, Keisuke Shinokita1, Klaus Reimann1, Michael Woerner2, Thomas Elsaesser1, Rudolf Hey3, Christos Flytzanis2, *Max-Born-Institut für Nichte lineare Optik und Kurzzeitspektroskopie, Germany; *Paul-Drude-Institut für Festkörper elektrophysikologie, Germany; *Laboratoire Pierre Aigrain, Ecole Normale Supérieure, France. We report a new technique to amplify coherent acoustic phonons in a semiconductor superlattice under intraminiband transport. The interaction between drift electrons and copropagating acoustic phonons leads to an amplification of the sound amplitude by 200%.

UW4A.2 • Ultrafast plasmonic dephasing dynamics studied by time-resolved spectroscopy based on SHG-FROG methods, Atsushi Sugita1, Sunsuke Nihashi2, Atsushi Ono3, Yoshishama Kawata3, Shizouka Univ., Japan. Ultrafast optical response of localized surface plasmons in Au nanorods are presented. The dynamics of the plasmonic polarizations was examined with the time-resolved spectroscopy based on SHG-FROG and the dephasing time ~15 fs was estimated.

UW4A.3 • Manipulating Ultrafast Nondiabatic Dynamics of Molecules in Optical Cavities, Markus Kowalewski1, Kochise Bennett1, Shaik Mukamel1, *Chemistry, Univ. of California, Irvine, USA. Strong coupling to a cavity field can modify the potential energy surfaces, opening new chemical reaction pathways. We theoretically investigate the ultrafast dynamics of molecules confined in optical micro cavities.

UW4A.4 • Ultrafast Strain Pulses Generated at Buried GaP/Si Interfaces, Kuniti Ishioka1, Avinash Rustagi1, Andreas Bayer1, Kersten Volz2, Wolfgang Stolz2, Ulrich Hofer2, Hinwe Petek3, Christophor Stanton1, *National Inst. for Materials Science, Japan; *Univ. of Florida, USA; *Marburg Univ., Germany; *Univ. of Pittsburgh, USA. Photocarrier excitation of a GaP/Si (001) interface generates an ultrafast acoustic pulse with temporal width <1 ps which propagates ballistically in the GaP layer and is detected as an echo in reflectivity when it reaches GaP/Si surface.

UW4A.5 • Time-domain study for Fano resonance in p-type Si, Keiko Kato1, Yuya Hasegawa2, Kazuya Oguri2, Tadahi Nishikawa2, Atsushi Ono1, Yoshishama Kawata3, Shizouka Univ., Japan. Sub-10 fs laser pulses allow time-resolved observation of discrete and continuum states under Fano resonance in p-type Si. The temperature dependence of the Fano parameter mainly originates from an initial phase shift of the phonons.

UW4A.6 • Ultrafast Multiexciton Dynamics and Optical Gain Development in Perovskite Semiconductor Nanocrystals, Chunfeng Zhang1, Yanqing Xu1, Qi Chen1, Bin Li1, Min Xiao1, *Nanjing Univ., China; *Physics, University of Arkansas, USA. We perform ultrafast transient absorption spectroscopy to study the exciton dynamics relevant to optical gain in perovskite CsPbBr3 nanocrystals. We observe amplified spontaneous emission with pump density in the multi-exciton regime with a clear signature of Auger recombination.

UW4A.7 • Influence of rotational wavepackets on the nitrogen ion emission in filament, Ladan Arissian1, Brian Kamer1, Chengyong Feng1, Amin Rasoulof1, Jean-Claude M. Diels1, *Univ. of New Mexico, USA. We study the effect of rotational states of nitrogen ion on the emission at 428 nm. A comparison between different pump wavelengths and polarizations suggest crucial dependence of stimulated emission on the stimulated rotational Raman scattering.

UW4A.8 • Transient Nonlinear Refraction of Organic Solvents in Liquid and Gas Phase, Peng Zhao1, Salimeh Tofighi1, Matthew Reichert1,2, David J. Hagan1, Eric W. Van Stryland1, *CREOL Univ. of Central Florida, USA; *Dept. of Electrical Engineering, Princeton Univ., USA. The nonlinear refractive transients of organic solvents are measured. The response functions derived from liquids are used to predict pulsewidth dependent n2 uw . Comparisons are made between fundamental frequency and second hyperpolarizabilities measured in liquid and gas phases.

UW4A.9 • Time-Resolved Fourier Measurement for Semiconductors by Near-Infrared Dual-Comb Spectroscopy, Akifumi Aaxhara1,2, Akiko Nishiyama3, Satoru Yoshida4, Ken-ichi Kondo4, Yoshifuki Nakajima1,2, *Univ. of Electro-Communications, Japan; *ERATO Intelligent Optical Synthesizer Project, Japan. Complex near-infrared reflective-index spectra of Si and GaAs wafers were characterized by dual-comb spectroscopy (DCS). Transient interferogram was observed for a GaAs-based saturable absorber in time-resolved DCS, demonstrating potential as a full-characterization tool.

UW4A.10 • No Substantial Asymmetries in the Ion Emission from Metal Cluster Nanoplasmas, Oszmity Mihaly1, Marko Krstic2, Robert Irsig1, *Miklos Ligeti2, Karl-Heinz Meiwes-Broer1, *Univ. Rostock, Germany. The charge-state resolved energy spectra of 30 fs laser-excited Ag clusters show an almost isotropic emission. Our findings contradict recent findings on rare gas clusters that ions are emitted perpendicular to the polarization axis.

UW4A.11 • High-Field THz Lattice Control Via Anharmonic Vibrational Coupling, Jeremy A. Johnson1, Parker D. Salmans1, Nicholas R. Ellsworth1, *Brigham Young Univ., USA. We investigate the non-linear response of water to strong THz fields leading to enhanced transmission and corresponds to a decrease of the static dielectric constant by an amount almost three orders of magnitude larger than for DC fields.

UW4A.12 • Transient Transparency of Water Induced by High-Field Terahertz Pulses, Jeffrey A. Davis1, Fabio Novelli2, *Swinburne Univ. of Technology, Australia. The non-linear response of water to strong THz fields leads to enhanced transmission and corresponds to a decrease of the static dielectric constant by an amount almost three orders of magnitude larger than for DC fields.

UW4A.13 • Gas-based time-resolved THz time-domain spectroscopy for the study of nonequilibrium electron-phonon interaction in semiconductors, Luca K. Huber1, Filippos Kapsalidis1, Steven L. Johnson1, *ETH Zurich, Switzerland. Using a fully gas-based wideband THz spectrometer we show evidence of strongly nonequilibrium electron-phonon dynamics in InSb.

UW4A.14 • Terahertz Kerr Effect in an Organic Ferroelectric, Jian Lu1, Xian Li, Harold Y. Hwang1, Pet Ondrejko1, Stanislaw Kamba2, Jan Petzel2, Petr Kuzel1, Keith A. Nelson1, *Dept. of Chemistry, MIT, USA; *Inst. of Physics, Academy of Sciences of the Czech Republic, Czech Republic. Using the terahertz (THz) Kerr effect, we record nonlinear time-domain vibrational responses in tris-sarcosine calcium chloride (TSCC) through two-photon processes with THz fields. The results reveal two Raman-active modes at 1.0 and 1.24 THz excited by THz fields.

UW4A.15 • Ultrafast Light Scattering by Transient Inhomogeneities in Vanadium Dioxide, Sergiy Lysenko1, Amando Rua1, Jose Figueroa2, Lee Cheves1, Felix Fernández2, *Dept. of Physics, Univ. of Wisconsin-Madison, USA. Structural defects both affect the light-induced insulator-to-metal phase transition dynamics on the mesoscale. Angle-resolved light scattering reveals substantial differences in transient statistics of optical inhomogeneities for non-epitaxial and crystalline epitaxial films.

UW4A.16 • Femtosecond Carrier Dynamics of Metallic Single-Walled Carbon Nanotubes under Applied Bias-Voltage, Kafumi Katayama1, Keisuke Shinokita1, *Institut Lumiere Matiere, France. We investigated bias -voltage dependence of carrier dynamics in metallic single-walled carbon nanotubes. By tuning the Fermi energy with the bias-voltage, the carrier relaxation time becomes minimum near the Dirac point, indicating the carrier-carrier interaction.

UW4A.17 • Ultrafast Relaxation of Multi-electronic States in Benzene Cations Induced by XUV Pulses, Martin C. Gaibraith1, *Nickolai Zhavoronkov2, *Martin Luther-Univ. Halle-Wittenberg, Germany. Correlated electrons in solids are studied directly by double photoemission spectroscopy using a megahertz high-order harmonic light source. Characteristic two-dimensional energy spectra of sp and d electron pairs from Ag and NO are revealed.

UW4A.18 • Time-resolved dynamics of a complex molecular system through time-resolved spectroscopy in conjunction with microfluidics is presented. Results obtained for nanotubular J-aggregates reveal intermediate aggregation species.
UW4A.20 • Femtosecond Time-resolved Study on Nonlinear Dynamics of Exon Clusters Irradiated with High Intensity Hard X-rays at SACL, Yoshiaki Kumagai1, Hirofumi Fukuzawa1, Koji Motomura1, Denis Iablonskyi1, Kiyonobu Nagaya2,3, Shin-ich Wada2,4, Yuta Ito1,5, Takuasa Takanashi1, Yuta Sakakibara1, Daeyoung You1, Toshiyuki Nishiyama1, Kaku Asa1, Yuhiro Satoh1, Takayuki Umemoto1, Kango Kariyazono1, Edwin Kükü1, Kuno Kooser1, Christoph Nicolaus1, Colin Miron1,2, Theodor Asavei1, Liviu Neagu1, Markus Schöffler1, Gregor Kastirke1, Xiao-jing Liu1, Shigeki Owada1,2, Tetsuo Katayama1,2, Tadashi Takayama4, Tatjana Stoll2, Enrico Sgro2, Jeremy Jarrett1, Julien Sanchez-Garcia1, Patrick Nuenemberger1, Rolf Diller1, Sebastian Kruppa1, Florian Bäppler1, 2IPCMS, Université de Strasbourg et CNRS, France; 3LBP, Université de Strasbourg, France. Ultrafast, broadband transient absorption spectroscopy of 4'-methoxy-3'-hydroxyflavone, a fluorescent probe for its microenvironment, reveals that the ESIPt reaction dynamics is controlled by the solvation dynamics of the first excited state in polar solvents.

UW4A.31 • Ultrafast, Solvation-Controlled Excited-State Intramolecular Proton Transfer in 3'-Hydroxyflavone, Anastasias I. Skliros1, Damiranos Agathangelou1, Andrei Klymychenko1, Yves Mély1, Stefan Haacke1, Jeremie Leonard2, IPCMS, Université de Strasbourg et CNRS, France; 3LBP, Université de Strasbourg, France. Ultrafast, broadband transient absorption spectroscopy of 4'-methoxy-3'-hydroxyflavone, a fluorescent probe for its microenvironment, reveals that the ESIPt reaction dynamics is controlled by the solvation dynamics of the first excited state in polar solvents.

UW4A.28 • Excited State Intramolecular Proton Transfer of a n-conjugated Saliycilidene Chromophore: An Experimental and Theoretical Study, Marcelo G. Vivas1,3, Jose Carlos Germino1,2, Cristina A. Barbosa1, Pedro Vazquez1, Leonardo De Boni2, Tereza D. Atara1,3, Cleber Mendonca1,2, IFSC-USP, Brazil; 3UNIFAL, Brazil; 4UNICAMP, Brazil. We investigate the excited state intramolecular proton transfer dynamic for a salphen derivative chromophore by using continuous femtosecond pump-probe and quantum chemical calculations within the DFT framework.

UW4A.29 • Ultrafast Photoinduced Charge Transfer of 1-Naphthol and 2-Naphthol Photoacids to Halogenated Solvents, Mirabelle Prémont-Schwarz1, Shubhajoti Chaudhuri1, Dina Pines1, Ehsed Pines1, Dan Huppert1, Victor S. Batista4, Erik T.J. Nijsbergen1, 1Univ. of Arizona, USA. We report the first supercontinuum generated in a gas-filled single-ring hollow-core PCF. When pumped with ultrashort pulses at 1500 nm, the emitted spectrum spans three octaves from the deep ultraviolet to the mid-infrared.

UW4A.35 • On the Edge: Characterizing Broadband Dielectric Mirrors from UV to NIR Using a Pump-Probe Technique, Bastian Baudisch1, Florian Habel1, Vladimir Pervak1, Eberhard Riedle1, Chair of Experimental Physics - Laser Physics, LMU Munich, Germany; 2IPCMS, Université de Strasbourg et CNRS, France; 3LBP, Université de Strasbourg, France. Overcoming limitations of interferometric techniques in the UV, we present an alternate scheme to directly gauge the group delay with fs precision utilizing the coherent artifact in pump-probe measurements. Femtosecond-UV and NIR mirrors are characterized.
UW4A.36 • Excitation Energy Transfer Competes with Intraband Relaxation in Dye-Quantum Dot Complexes, Lars Dworak1, Bottin Anne1, Thomas Basch1, Josef Wachtveitl1; 1Goethe Univ. Frankfurt, Germany; 2Univ. of Mainz, Germany. In perylene dye-CsSe quantum dot complexes excitation energy transfer has been studied by transient absorption and fluorescence spectroscopy. Electronically excited perylene forms on a time scale similar to QD intraband relaxation indicative of an ultrafast energy transfer.

UW4A.37 • Generation and Compression of Tunable Broadband Femtosecond Mid-IR Pulses for Nonlinear Spectroscopy, Madhumitha Balasubramanian1, Trevor L. Courtney1, James D. Gaynor1, Munira Khalil1; 1Univ. College Cork, Cork, Ireland; 2Dept. of Physics, Philips Universitat, Marburg, Germany; 3College of Optical Sciences, Univ. of Arizona, USA. We present a deformable mirror pulse shaper designed to compress broadband mid-IR pulses between 3 and 7 μm. The electric fields of the nearly transform limited octave-spanning IR pulses are retrieved using XFROG.

UW4A.38 • Colliding Pulse Mode-Locked VECSEL, Declan A. Marah1, Alexandre Laurain1, Wolfgang Stolz2, Stephan Koch2,3, Antje R. Perez2, John McInerney1,3, Jerome Maloney1,2; 1Univ. College Cork, Ireland; 2Dept. of Physics, Philips Universitat, Marburg, Germany; 3College of Optical Sciences, Univ. of Arizona, USA. We report for the first time a colliding-pulse modelocked VECSEL, with the gain and SESAM inside a ring cavity. We obtained output power of 2.2W, repetition rate of 1GHz and pulse duration of 1.16ps.

UW4A.39 • Hydrogen Raman laser for high-energy femtosecond pulse production at 1.28 μm, Christoph P. Hau1, M. Mostafal Shafiei1, A. Carlos Vicario1; 1Paul Scherrer Institut, Switzerland. We present high-energy pulses at 1.28 μm by stimulated Raman scattering in hydrogen using a pair of chirped pulses. The Stokes pulse carries record-high energy of 4.4 mJ and was compressed to 80 fs.

UW4A.40 • Two-dimensional Spectroscopy in the Ultraviolet by a Birefringent Delay Line, Rocio Borrego-Varillas1, Aurelio Oriana1, Luca Gasara1, Cristian Manzoni1, Giulio Cerullo1; 1Politecnico di Milano, Italy. We introduce a scheme to generate collinear, interferometrically locked UV pulse pairs by combining birefringence and sum-frequency generation between a narrowband infrared light and broadband visible pulses. The scheme is applied to 2D electronic spectroscopy.

UW4A.41 • Isolated circularly polarized attosecond pulses driven by few-cycle and multi-cycle non-collinear laser beams, Carlos Hernandez-Garcia1,2, Charles G. Durfee1, Daniel D. Hickstein1, Tenio Popmintchev1, Amanda Meier3, Íñigo J. Sola1; 1Univ. of Washington, USA; 2Dual-probe Nano-focusing, Fumihiko Kannari1, Yasuhiro Kojima1, Yuta Masaki1; 1Keio Univ., Japan. Dual-probe scanning near-field optical microscopy consisting of ultrafast surface-plasmon polariton nanofocusing for excitation and spectral interferometry for detection is constructed to observe spatiotemporal dynamics of surface-plasmon polariton (SPP) pulses.

UW4A.42 • Observation of shot-to-shot spectral amplitude and phase reorganization in a fs-pulse pumped photonic crystal fiber ring cavity at 80 MHz, Jonas Hammer1, Finland; 2Université d’Aix Marseille, France. Spectral interferometry and dispersive Fourier transformation are combined to retrieve spectral phase information at ~80 MHz in a fiber ring-cavity pumped with ultrashort pulses. Shot-to-shot spectral phase reorganization is observed.

UW4A.43 • Ultrafast spectral switching of a Non-collinear Optical Parametric Oscillator (NOPC), Alexander Pape1, Thomas Binhammer1, Yuliya Khankavea1, Tino Lang1, Jan Ahrens1, Oliver Prochnow1, Uwe Morgner2; 2Laser Quantum VENTRON, Germany; 3Deutsches Elektronen-Synchrotron DESY, Germany; 4Leibniz Universität Hannover, Inst. of Quantum Optics, Germany. We demonstrate ultrafast switching of a broadband non-collinear parametric oscillator with a speed of ~1000 nm/ns over a wide spectral range from 650-1100 nm. This system is ideally suited for novel ultrafast bio-imaging techniques.

UW4A.44 • High Order Harmonic Generation in Multiply Ionized Plasmas, Valer Tosa1,2; 1Natl Inst R&D Isotopic Mol Technologies, Romania. High-order harmonic generation in multiply ionized Ar is modeled macroscopically. The propagation equations for both driving and harmonic fields are solved aiming to explain recent experiments which generate soft x-rays up to 280 ev photon energies.

UW4A.45 • Ultrafast Surface Plasmon Polariton Pulses Observed with a Dual-probe Scanning Near-field Optical Microscopy (DSNOM) Utilizing Plasmon Nano-focusing, Fumihiko Kannari1, Yasuhiro Kojima1, Yuta Masaki1; 1Keio Univ., Japan. Dual-probe scanning near-field optical microscopy consisting of ultrafast surface-plasmon polariton nanofocusing for excitation and spectral interferometry for detection is constructed to observe spatiotemporal dynamics of surface-plasmon polariton (SPP) pulses.
Surface-Enhanced, 2D Attenuated Total Reflectance IR Spectroscopy for Surface-Sensitive Ultrafast Dynamics, Jan Philip Kraack¹, Peter Hamm¹;
¹Univ. of Zürich, Switzerland. 2D ATR IR spectroscopy is introduced as a new and versatile spectroscopic method for studying ultrafast vibrational dynamics at solid-liquid interfaces. Investigations are reported comprising organic monolayers, surface-enhanced IR spectroscopy and spectro-electrochemistry.

Preferential Solvation of a Rhenium Photocatalyst Facilitates Ultrafast Intermolecular Electron Transfer, Laura Kiefer¹, Kevin J. Kubarych¹; ¹Univ. of Michigan, USA. Equilibrium 2D IR spectroscopy was used to measure spectral diffusion of the photocatalyst Re(bpy)(CO)₃Cl in multiple TEOA/solvent mixtures. The spectral diffusion was slowest at the 20%/80% TEOA/solvent (v/v) ratio, indicating occurrence of preferential solvation.

Femtosecond Ultrafast Water Dynamics at Charged Lipid Interfaces Revealed by 2D Heterodyne-Detected Vibrational Sum Frequency Generation, Satoshi Nihonyanagi¹, Prashant Singh¹, Ken-ichi Inoue¹, Shoichi Yamaguchi², Tahei Tahara³; ¹RIKEN, Japan; ²Saitama Univ., Japan. 2D HD-VSFG spectra of lipid/water interfaces revealed that interfacial water exhibits drastically different ultrafast dynamics depending on the charge of the lipid headgroup.

Two Dimensional Sum Frequency Generation Spectroscopy of Catalysts on a Surface, Jiaxi Wang¹, Yingmin Li¹, Higuo Li¹, Melissa Clark¹, Clifford Kubiak¹; ¹Univ. of California, San Diego, USA. 2D SFG spectroscopy is used to characterize the orientation and vibrational dynamics of a catalytic monolayer on a gold surface. We found that the catalysts are influenced by the image dipole on the gold surface.

Coherent Two-Dimensional Spectroscopy of Exciton-Exciton Interactions, Jakub Dostal¹, Federico Koch¹, Stefanie Herbst², Pawaret Leowanawat², Frank Würthner³, Tobias Brixner¹; ¹Institut für Physikalische und Theoretische Chemie, Universität Würzburg, Germany; ²Institut für Organische Chemie, Universität Würzburg, Germany. We theoretically show that exciton-exciton interaction in molecular systems can be directly monitored by fifth-order non-linear optical signals of -2k₁+2k₂+k₃ type. The concept is experimentally demonstrated on exciton-exciton annihilation in perylene bisimide aggregates.

Measuring Molecular Vibronic Couplings and Dynamics with Two-Dimensional Vibrational-Electronic Spectroscopy, Trevor L. Courtney¹, Zachary Fox¹, Munira Khalill¹; ¹Univ. of Washington, USA. 2D vibrational-electronic spectroscopy is a novel third-order technique that provides a direct probe of vibronic couplings in solution. We report on the coupling of specific high frequency vibrations to charge-transfer transitions in small molecules.
UTh2A.1 • 10:45
Absolute frequency measurement and phase-locking of a THz quantum cascade laser with 10 GHz Ti:sapphire frequency combs, Oliver Klieberisch1, Dirk C. Heinecke1, Thomas Dekorsy1, Hua Li2, Carlo Sirtori2, Giorgio Santarelli2, Stefano Barbieri3; ‘Center for Applied Photonics, Univ. of Konstanz, Germany; 2Laboratoire Matériaux et Phénomènes Quantiques, Université Paris Diderot, France; 3Laboratoire Photonique, Numérique et Nanosciences, Université Bordeaux, France. Dual comb sampling of an actively mode-locked phase-stabilized THz quantum cascade laser with 10 GHz Ti:sapphire frequency combs provides a method to directly determine the absolute frequency of the QC laser with Hz-level precision.

UTh2A.2 • 11:00
Combining Bound-State Quantum Dynamics Measurements and Characterization of the Driving Pulse in one Experiment, Alexander Blättermann1, Christian Ott1, Andreas Kaldun2, Thomas Ding2, Veit Stooss1, Martin Laux1, Marc Rebbolz1, Thomas Pfeifer1; ’Max Planck Inst. for Nuclear Physics, Germany. We introduce and demonstrate an in situ method for characterizing intense few-cycle laser pulses with transient absorption spectroscopy. Thereby, we obtain crucial pulse properties precisely where the physics of ultrafast quantum dynamics experiments takes place.

UTh2A.3 • 11:15
Determination of absolute CEP of circularly-polarized few-cycle laser pulses from energy-resolved angular distribution of tunnel-ionized photoelectrons, Shinichi Fukahori1, Toshiaki Ando1, Shun Miura1, Reika Kanya1, Tim Rathe2, Gerhard Paulus3, Kaoru Yamanouchi1; ’The Univ. of Tokyo, Japan; 2Friedrich Schiller Universität Jena, Germany. Absolute CEP of few-cycle laser pulses is determined by measuring relative CEP by a single-shot stereo-ATI phasemeter in coincidence with the energies of photoelectrons generated by circularly polarized few-cycle laser pulses.

UTh2A.4 • 11:30
Linearly and Circularly Polarized Carrier-Envelope-Phase Stable Attosecond Pulse Generation, Gyorgy Toth1, Zoltan Tibai1, Zsuzsanna Nagy-Csíha1, Jozsef Andras Fülöp2,3, Gabor Almasi1,2, Janos Hebling1,3; ’Univ. of Pécs, Hungary; 2MTA-PEOPLE High-Field Terahertz Research Group, Hungary; 3Szentágothai Research Centre, Hungary. We propose a robust method for producing waveform-controlled few-cycle attosecond pulses based on coherent undulator radiation of relativistic electron layers. Carrier-envelope-phase stable pulses with tens of nJ energy and 80 as duration are predicted.

UTh2B.1 • 10:45
Atomically-Resolved Structural Changes during a Solid State Geminate Recombination Reaction, Rui Xian1, Gaston Corthey1, Stuart A. Hayes1, Carole A. Morrison1, David M. Rogers2, Alexander Marx1, Valentyn Prokhorenko1, Cheng Lu1, R. J. Dwayne Miller1, 2; ’Max Planck Inst. of the Structure and Dynamics of Matter, Germany; 2School of Chemistry and EasTChem Research School, Univ. of Edinburgh, UK; 3Depts of Chemistry and Physics, Univ. of Toronto, Canada. Joint investigation of the photo-initiated geminate recombination of triiodide in solid state using transient absorption spectroscopy and ultrafast electron diffraction resolves the atomic origins of the internal and external modes driven by the reaction.

UTh2B.2 • 11:00
Ultrafast Snapshots of the Molecules Twisting in Liquid Crystal State, Masaki Hada1,2, Shohei Saito2, Seichi Tanaka1, Ryuma Sato1, Kyohei Matsu1, Mitsuo Hara1, Yasuhiro Hayashi1, Kazuhiro Mour1, Masahiko Yoshimura1, Yasuteru Shigeta1, Shigeiho Yamaguchi1, Ken Onda2, R. J. Dwayne Miller1, 2; 1Graduate School of Natural Science and Technology, Okayama Univ., Japan; 2JST-PRESTO, Japan; 3WPI-ITbM, Nagoya Univ., Japan; 4Graduate School of Science and Engineering, Tokyo Inst. of Technology, Japan; 5Center for Computational Sciences, Univ. of Tsukuba, Univ. of Tsukuba, Japan; 6Max Planck Inst. of the Structure and Dynamics of Matter, Germany; 7Univ. of Toronto, Canada; 8Graduate School of Engineering, Nagoya Univ., Japan. We demonstrated time-resolved electron diffraction and vibrational spectroscopy to characterize the structure and dynamics of molecules in liquid crystal state. Our findings present the ultrafast local deformation triggering helical twisting motion in molecules.

UTh2B.3 • 11:15
Probing the emergence of complex charge-density waves at surfaces by time-resolved low-energy electron diffraction, Simon Schweda1, Gero Storeck1, Sebastian Schramm1, Kai Rossnagel2, Sascha Schäfer1, Claus Ropers1; 1Georg-August-Universität Gottingen, Germany; 2Univ. of Kiel, Germany. We present a tip-based time-resolved low-energy electron diffraction setup for the study of structural dynamics at surfaces. Using this setup, we investigate the optically-driven transition between different charge-density wave phases at the surface of 1T-TaS2.

UTh2B.4 • 11:30
Light-induced Dynamics of a Dodecanethiol-capped Gold Nanoparticles Supracrystal Revealed by Ultrafast Small-angle Electron Diffraction, Giulia F. Mancini1,2, Tatiana Latychevskaya3, Francesco Pennacchio1, Javier Reguera4,5, Francesco Stellacci6, Fabrizio Carbone1; 1LUMES, ICMP, EPFL, Switzerland; 2JILA, Univ. of Colorado, USA; 3Physics Dept., Univ. of Zurich, Switzerland; 4Supramolecular Nanomaterials and Interfaces Lab, Inst. of Materials., EPFL, Switzerland; 5CIC biomaGUNE, Spain. We use ultrafast small-angle electron diffraction combined with angular cross-correlation analysis to characterize the static local order and the dynamics of a glassy dodecanethiol-capped gold nanoparticles supracrystal with fs time-resolution and sensitivity to the light elements in the ligands.
UTh2A.5 • 11:45
Self-Referenced Waveform Measurement of Few-Cycle Mid-Infrared Pulses, Hideto Shirai1, Yutaka Nomura1, Takao Fuji1; 1Inst. for Molecular Science, Japan. The electric field oscillations of few-cycle mid-infrared pulses were characterized by using a self-referencing technique based on frequency-resolved optical gating capable of carrier-envelope phase determination.

UTh2A.6 • 12:00
Extreme spectral broadening by cross-phase modulation driven by an intense THz transient, Christoph P. Hauri1, Carlo Vicario1, Mostafa Shalaby1; 1Paul Scherrer Institut, Switzerland. We present giant spectral broadening by cross phase modulation of a 60 fs nIR pulse in GaP by means of an intense Terahertz transient. The spectral broadening supporting sub-10 fs nIR pulses.

UTh2A.7 • 12:15
Low noise few-cycle OPCPA system with adjustable repetition rate from 0.2 – 4 MHz, Alexander Pape1, Jan Ahrens1, Oliver Prochnow1, Tino Lang1, Hauke Bensch1,2, Stefan Rausch1, Uwe Morgner1, Thomas Binhammer1; 1Laser Quantum VENTEON, Germany; 2Deutsches Elektronen-Synchrotron DESY, Germany; 3Leibniz Universität Hannover, Inst. of Quantum Optics, Germany. We present a low noise, few-cycle OPCPA system operating at repetition rates over a wide range from 200 kHz - 4 MHz with μJ-level energy and high average output power of more than 2W.

UTh2B.5 • 11:45
Few-nanometer femtosecond electron probe pulses in ultrafast transmission electron microscope, Armin Feist1, Katharina E. Echternkamp1, Reiner Bornmann1, Nara Rubiano da Silva1, Marcel Möller1, Wenxi Liang2, Sascha Schäfer1, Claus Ropers1; 14th Physical Inst.-Solids and Nanostructures, Georg-August-Univ., Germany; 2Huazhong Univ. of Science and Technology, China. We demonstrate the generation of low-emittance ultrashort electron pulses derived from nanoscale photocathodes and their application in ultrafast transmission electron microscopy. Few-nanometer electron focal spot diameters are achieved, enabling the investigation of ultrafast nanoscale dynamics.

UTh2B.6 • 12:00
Diffraction Imaging of Dissociation Channels of Acetylene with Few-femtosecond Resolution, Benjamin Wolter1, Michael Pullen1, Anh-Thu Le2, Matthias Baudisch1, Arne Senftleben1, Michael Hemmer1, Claus Dieter Schröter3, Joachim Ullrich4,5, Robert Moshhammer1, Thomas Pfeifer1, C. D. Lin2, Jens Biegert1,6; 1ICFO - The Inst. of Photonic Sciences, Spain; 2Physics Dept., Kansas State Univ., J. R. Macdonald Lab, USA; 3Universität Kassel, Institut für Physik und CINSAat, Germany; 4Max-Planck-Institut für Kernphysik, Germany; 5Physikalisch-Technische Bundesanstalt (PTB), Germany; 6ICREA - Institut Catalana de Recerca i Estudis Avancats, Spain. In order to probe molecular dynamics at few-femtosecond resolution we use laser-induced electron diffraction imaging driven by mid-IR electric waveforms. Combined with coincidence detection we can extract structural information of fragmentation pathways of acetylene.

UTh2B.7 • 12:15
Imaging of C60 with laser-induced electron diffraction using strong mid-IR laser pulses, Harald Fuest1,2, Yu Hang Lai3, Junliang Xu1, Philipp Rupp1,2, Hui Li1,2, Cosmin I. Blaga1, Louis F. DiMauro2, Matthias F. Kling1,2; 1Physics Dept., Ludwig-Maximilians-Universitaet Muenchen, Germany; 2Max-Planck-Institut für Quantenoptik, Germany; 3Dept. of Physics, The Ohio State Univ., USA. Laser-driven electron diffraction, which offers sub-cycle time resolution down to attoseconds, has so far only been demonstrated for small, diatomic molecules. We demonstrate the application of the technique to C60 showing its full potential.

12:30—14:00 • Lunch (on your own)
Thursday, 21 July

**UTh3A • Ultrafast Spin Dynamics**

**Presider: Margaret Murmane; Univ. of Colorado Boulder, USA**

**UTh3A.1 • 14:00**

*Heisenberg vs. Stoner: Magnon Generation and Exchange Renormalization during Ultrafast Demagnetization*, Dmitry Zuzin, Emrah Turgut, Dominik Legut, Karel Carva, Christian Gentry, Cong Chen, Zhenhong Tao, Hans Nembach, Justin Shaw, Stefan Mathias, Martin Aeschlimann, Claus Schneider, Thomas Silva, Peter Oppeneer, Patrick Grychtol, Henry C. Kapteyn, Margaret M. Murmane; 1Dept. of Physics and JILA, Univ. of Colorado, USA; 2IT4Innovations Center, VSB Technical Univ. of Ostrava, Czech Republic; 3Dept. of Condensed Matter Physics, Charles Univ., Czech Republic; 4Electromagnetics Division, National Inst. of Standards and Technology, USA; 5Faculty of Physics, Georg-August-Universitat Gottingen, Germany; 6Dept. of Physics, Univ. of Kaiserslautern and Research Center OPTIMAS, Germany; 7Peter-Grüninger-Institut PGI-6, Research Center Julich, Germany; 8Dept. of Physics and Astronomy, Uppsala Univ., Sweden. Using tabletop high harmonics to probe laser-driven demagnetization dynamics, we uncover the role of ultrafast magnon excitations, enhanced electron temperature and transient renormalization of the exchange splitting in the ultrafast temperature range above the spin flip transition.

**UTh3A.2 • 14:15**

*2D Nonlinear Terahertz Magnetic Resonance Spectroscopy of Magnons in a Canted Antiferromagnet*, Jian Lu, Xian Li, Harold Hwang, Benjamin K. Ofori-Okai, Takayuki Kurihara, Tohru Suemoto, Keith A. Nelson; 1MIT, USA; 2The Univ. of Tokyo, Japan. Using two intense time-delayed terahertz (THz) magnetic fields, we record 2D THz spectra of magnons, from which multiple nonlinear field-magnon interactions are identified. Our study presents a prototype for multi-dimensional THz magnetic resonance spectroscopy in condensed matter.

**UTh3A.3 • 14:30**

*Ultrafast Surface Magnetoelastic Waves*, Chia-Lin Chang, Julius Janusonis, Alexey Lomonosov, Viktor Shalagatskyi, Vladimir Vlasov, Vasily Temnov; 1Univ. of Groningen, Netherlands; 2Universite du Maine, IMMM CNRS, France; 3Physikalische Chemie, Fritz-Haber-Inst. der Max-Planck Gesellschaft, Germany. Surface magnetoelastic waves are generated using the all-optical transient grating technique. We measure the structural and magnetic degrees of freedom independently and demonstrate resonant excitation of magnetization precession by elastic waves.

**UTh3A.4 • 14:45**

*Ultrafast X-Ray Probe of Dynamics in Chromium*, Brian K. McFarland, Rohit Prasankumar, George Rodrigue, Richard L. Sandberg, Antionette Taylor, Stuart Trugman, Jian-Xin Zhu, Dmitry Yarotski; 1Los Alamos National Lab, USA. We apply ultrafast soft X-ray (SXR) magnetic spectroscopy to reveal the competition between different spin states in photoexcited antiferromagnetic (AFM) chromium (Cr) metal in a broad temperature range above the spin flip transition.

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**UTh3B • Dynamics of Molecular Systems**

**Presider: Kaoru Yamanouchi; Univ. of Tokyo; Japan**

**UTh3B.1 • 14:00**

*Coherent Wavepacket Evolution Analysis Reveals a Conical Intersection in a Highly Fluorescent Molecule*, Johanna Brazard, Laurie Bizimana, Will Carbery, Tobias Gellen, Daniel Turner; 1Chemistry, New York Univ., USA. Time–frequency analysis of high-sensitivity transient absorption spectra acquired using sub-8 fs laser pulses reveals phase shifts of the coherent wavepacket evolution signal due to the unexpected propagation of a wavepacket through a conical intersection.

**UTh3B.2 • 14:15**

*How to Control the Ultrafast Dynamics of Uracil with Shaped Laser Pulses: Theoretical Insights*, Daniel Keefer, Sebastian Thallmair, Spiridoula Matsika, Regina de Vivie-Riedle; 1Ludwig-Maximilians-Universität München, Germany; 2Temple Univ., USA. After photoexcitation, the femtosecond relaxation time of the RNA-nucleobase uracil is manipulated in two extreme ways. It is halved by wavepacket guidance to the conical intersection seam or the relaxation is prevented by wavepacket trapping.

**UTh3B.3 • 14:30**

*Ultrafast Isomerization Dynamics of Bisazobenzenes*, Chavdar Slavov, Chong Yang, Luca Schweighauser, Chokri Boumrifak, Hermann A. Wegner, Andreas Drews, Josef Wachtveitl; 1Inst. of Physical and Theoretical Chemistry, Goethe Univ., Germany; 2Inst. of Organic Chemistry, Justus-Liebig Univ. Giessen, Germany; 3Theoretical and Computational Chemistry, Interdisciplinary Center for Scientific Computing (IWR), Univ. of Heidelberg, Germany. Ultrafast transient absorption was used to study the isomerization dynamics of bisazobenzenes – a model system for multiphotonic constructs. The dynamics and the quantum efficiency is strongly dependent on the connectivity pattern between the individual units.

**UTh3B.4 • 14:45**

*Observation of Ligand-Centred Fluorescence and Intramolecular Relaxation at Sub-Vibrational Time Scales*, Enrico Pomarico, Fabrizio Messina, Mahsa Slatami, Etienne Baranoff, Majed Chergui; 1Laboratoire de Spectroscopie Ultrarapide (LSU) and Lausanne Center for Ultrafast Science (LACUS), École Polytechnique Fédérale de Lausanne (EPFL), Switzerland; 2Dipartimento di Fisica e Chimica, Università degli Studi di Palermo, Italy; 3School of Chemistry, Univ. of Birmingham, UK. Using broadband photoluminescence upconversion, we observe fluorescence from a high-lying ligand-centred state in Ir (ppy). This result allows us to clock the electronic relaxation to the lowest MLCT state, occurring at sub-vibrational time scales.
Excitation and coherent control of antiferromagnetic spin waves with sub-20-fs optical pulses, Stefano Dal Conte1,2, Davide Bossini3, Yusuke Hashimoto4, Andrea Secchi5, R. V. Piseri6, Theo Rasing7, Giulio Cerullo1,2, Alexey Kimel3, Tullio Scopigno1,2; 1Politecnico di Milano, Italy; 2IFN-CNR, Italy; 3Inst. for Molecules and Materials, Radboud Univ., Netherlands; 4Ioffe Physical-Technical Inst., Russian Academy of Sciences, Russia. We study the ultrafast spin dynamics in an antiferromagnet with sub-20 fs temporal resolution. Our experiments demonstrate the coherent manipulation of such spin excitations laying the foundations for a magnon-based nanotechnology operating in the 20 THz regime.

Spin-lattice relaxation in antiferromagnetic manganites, Pamela R. Bowlan1, Stuart Trugman1, Eric Bauer1, Xueyun Wang1, Sang Cheong1, Namjung Hur1, Antionette Taylor1, Dmitry Yarotski1, Rohit Prasankumar1; 1Los Alamos National Lab, USA; 2Rutgers Center for Emergent Materials and Dept. of Physics and Astronomy, Rutgers Univ., USA; 3Dept. of Physics, Inha Univ., Korea. We directly investigate spin-lattice relaxation in antiferromagnetic (AFM) manganites using optical-pump, THz-probe spectroscopy, where the THz-pulse is resonant with a magnon. We consider two different AFM systems and contrast these with previous studies on ferromagnets.

Probing ultrafast photo-induced dynamics of the exchange energy in a Heisenberg antiferromagnet, Giovanni Batignani1, Davide Bossini2, Nicola Di Palo3, Carino Ferrante1, Emanuele Pontecorvo1, Giulio Cerullo1, Alexey Kimel3, Tullio Scopigno1,2; 1Univ degli Studi di Roma La Sapienza, Italy; 2Center for Life Nanoscience, Italian Inst. of Technology, Italy; 3Inst. for Molecules and Materials, Radboud Univ. Nijmegen, Netherlands; 4Politecnico Milano, Italy. An ultrafast enhancement of the exchange interaction between two spins in an antiferromagnetic insulator is detected, developing an all-optical pump–probe method based on

Optimal Control Theory for Molecular Reactions in Atomistic Surroundings, Daniel Keefer1, Sebastian Thalmair1, Julius P. Zauleck1, Regina de Vivie-Riedle1; 1Ludwig-Maximilians-Universität München, Germany. We introduce a new approach which includes explicit environments in quantum control simulations. Its capabilities are demonstrated for C-C-bond formation in solution. Flexible few-cycle pulses allow to shape light fields for this complex synthetic task.

Femtosecond Dynamics of Solvated Electrons in Nanodroplets Probed with Extreme Ultraviolet Beams, Jennifer L. Ellis1, Daniel D. Hickstein1, Wei Xiong1,2, Franklin Dollar1, Brett B. Palm3, K E. Keister1, Kevin M. Dorney1, Chengyuang Ding1, Tingting Fan1, Molly B. Wilker4, Kyle J. Schnitzenbaumer5, Gordana Dukovic6, Jose L. Jimenez7, Henry C. Kapteyn1, Margaret M. Murnane1; 1JILA - NIST and Dept. of Physics, Univ. of Colorado, Boulder, USA; 2Dept. of Chemistry and Biochemistry, Univ. of California, San Diego, USA; 3CIRES and Dept. of Chemistry and Biochemistry, Univ. of Colorado, Boulder, USA; 4Dept. of Chemistry and Biochemistry, Univ. of Colorado, Boulder, USA. We use ultrafast extreme ultraviolet (EUV) light to conduct time-resolved photoemission measurements of isolated nanodroplets in vacuum. We observe the creation and relaxation of solvated electrons within the nanodroplets after the absorption of EUV photons.

Coherent Dynamics of Phosphate Ions in Bulk H2O, Rene Costard1, Tobias Tyborski1, Benjamin Fingerhut1; 1Max-Born-Institut, Germany. Phosphates as important biomolecular building blocks are studied by 2D-IR spectroscopy. Excitation with spectrally broad pulses generates a coherent superposition of phosphate stretching modes resulting in the observation of quantum beats in aqueous solution.
UTh4A.1 • Artemis: An Ultrafast Beamline for Measuring Photo-induced Reactions, Richard T. Chapman1, Hannah Watts2, Russell Minn2, Adam Smith1, Edward Jager1, Daniel Horke1, Emma Springman2, Céphise Cacho1, Oliver Alexander1, 2Central Laser Facility, STFC, UK; 3Univ. of Southampton, UK; 4Center for Free-Electron Laser Science, Germany. A demonstration of a new beamline for measurement of ultrafast photo induced processes. A scheme is developed to look at transient molecular dynamics in small molecule complexes.

UTh4A.2 • Monitoring Charge Transfer Excited States of Transition Metal Mixed Valence Complexes with Femtosecond X-ray Absorption and Emission Spectroscopies, Zachary Fox1, Amy Cordones-Hahn2, Kasper S. Kjær1, James D. Gaynor1, Kiyong Hong1, Jae Hyuk Lee1, Julia Carlst1, Marco Rein1, Seunghee Lee1, Roberto Alto1, Matthieu Chollet1, Thomas Kroll1, James Glow1, Tae Kyu Kim1, Amit Desmeth1, Yuzhao Zhang1, Shaul Mekel1, Nirjanand K. Shriv1, Travis W. Wright1, Alex Belk1, 2Graduate Group in Applied Science and Technology, Univ. of California, USA; 3Chemical Sciences Division, Lawrence Berkeley National Lab, USA; 4Pulsed Power Accelerator National Lab, USA; 5Stanford Synchrotron Radiation Lightsource, SLAC National Accelerator Lab, USA; 6Environmental Molecular Sciences Lab, Pacific Northwest National Lab, USA; 7Dept. of Chemistry, University of California, Los Angeles, USA. Femtosecond X-ray absorption and emission spectroscopies are used at the Fe K-edge to directly monitor transient oxidation states and orbital occupancy during charge transfer in a series of solvated mixed-valence complexes.

UTh4A.3 • Onset Times in Time-Resolved Photoelectron Spectra to Measure Ultrashort Non-Adiabatic Dynamics in Small Molecular Systems, Elio G. Champenois1,2, James P. Cayan1, Nirjanand K. Shriv1, Travis W. Wright1, Alex Belk1, 2Graduate Group in Applied Science and Technology, Univ. of California, USA; 3Chemical Sciences Division, Lawrence Berkeley National Lab, USA; 4Pulsed Power Accelerator National Lab, USA; 5Stanford Synchrotron Radiation Lightsource, SLAC National Accelerator Lab, USA. Using signal onset times, time-resolved photoelectron kinetic energy spectra from a two VUV photon pump-probe scheme allow for the tracking of ultrafast (U(10-15)fs) non-adiabatic dynamics of valence excited molecules.

UTh4A.4 • Molecular Orbital Imaging of Excited States Using Time-resolved (e, 2e) Electron Momentum Spectroscopy, Masakazu Yamazaki1,2,3, Henry Oishi1, Hirooyuki Nakazawa2,3, Kei Watanabe2,3, Shuntaro Hiti1, Kiyokazu Yamazaki1,2,3, Yusuke Hori2,3,4, Norihiko Irie1, Tomoyuki Watanabe2,3,4, Masahiro Ohsawa1,2,3, Masahiko Takahashi1,2,3, 4Multidisciplinary Research for Advanced Materials, Tohoku Univ., Japan; 5Institut de Moléculaire et Physique des Solides, National Chiao-Tung Univ., Taiwan. A time-resolved electron momentum spectroscopy which employs ultrashort laser and electron pulses in a pump-probe scheme is developed to look at transient molecular orbitals and the recent progress of it is reported here.

UTh4A.5 • Dissociative Double Ionization of Acetylene in Strong Laser Field, Atia Atia Tul Noor1,6,2, Wei Xu1, Xiaoshan Wang1, Robert T. Sang1, Igor V. Litvinyuk1,2, 3G Griffith Univ., Australia. We studied the dynamics of dissociative double ionization of acetylene using pump-probe technique with few-cycle laser pulses and Reaction Microscope detection system.

UTh4A.6 • Time-Resolved X-ray Spectroscopy Reveals the Role of Metal-Centered Valence States in the Isomerization Reaction of a Photocromatic Switch, Jae Hyuk Lee1, Kiyong Hong1, Amy Cordones-Hahn2,3, Hanne M. Dehnhardt1, Robert J. Rack1, Nils Huse1,2, Tae Kyu Kim1, Robert W. Schoenlein1, 2Dept. of Physics, Univ. of Hamburg, Germany; 3Max Planck Inst. for the Structure and Dynamics of Matter, Germany; 4Ultrafast X-ray Science Lab, Lawrence Berkeley National Lab, USA; 5Dept. of Chemistry, Pusan National Univ., Korea; 6Dept. of Chemistry and Biochemistry, Ohio Univ., USA; 7Center for Inorganic Analysis, Korea Research Inst. of Standards and Science, Korea. Ultrafast photoionization of a photochromatic molecular switch is captured by time-resolved X-ray-based structure and spin probes, providing the first experimental evidence of competing metal-centered spin states as intermediates in a complex reaction pathway scheme.

UTh4A.7 • Light induced radial functional, isomerization, and dimerization of an aromatic thiol in the liquid phase followed by time-resolved sulfur-1s photoelectron spectroscopy, Miguel Ochmann1,5, Inga von Ahnen1,5, G. Champenois1,2, James P. Cryan3, Niranjan H. Govind1, Robert W. Schoenlein1,2,5, Munira Chollet5, Thomas Kroll1, Thomas Kroll1, James Glow1, Tae Kyu Kim1, Amit Desmeth1, Yuzhao Zhang1, Shaul Mekel1, Nirjanand K. Shriv1, Travis W. Wright1, Alex Belk1, 2Graduate Group in Applied Science and Technology, Univ. of California, USA; 3Chemical Sciences Division, Lawrence Berkeley National Lab, USA; 4Pulsed Power Accelerator National Lab, USA; 5Stanford Synchrotron Radiation Lightsource, SLAC National Accelerator Lab, USA; 6Environmental Molecular Sciences Lab, Pacific Northwest National Lab, USA; 7Dept. of Chemistry, University of California, Los Angeles, USA. Femtosecond X-ray absorption and emission spectroscopies are used at the Fe K-edge to directly monitor transient oxidation states and orbital occupancy during charge transfer in a series of solvated mixed-valence complexes.

UTh4A.8 • The hydrated excess proton - ultrafast vibrational dynamics of the Zundel cation H3O+, Fabian Dahms1, René Costard1, Benjamin P. Fingerhut1, Ebdur Fines1, Erik T.J. Nibbering1, Thomas Elsasser1, 2Max Born Inst., Germany; 3Dept. of Chemistry, Ben Gurion Univ. of the Negev, Israel. Femtosecond infrared spectroscopy allows for separating the absorption continuum of hydrated protons in solution from OH stretching and bending excitations of H3O+. The extremely broad lineshape of the proton transfer vibration originates from solvent fluctuations.

UTh4A.9 • Direct Observation of Sub-picosecond Vibrational Dynamics in Photoexcited Myoglobin, Carino Ferrante1, Emanuele Ponte2, Giulio Cerullo1, Marten Voss1, Tullio Scipogno1, 2Univ degli Studi di Roma La Sapienza, Italy; 3Politecnico Milano, Italy; 4Ecole Polytechnique, France. Using Femtosecond Stimulated Raman Scattering, we report the observation of sub-picosecond flow of energy locally deposited in a prototype cofactor - the heme of myoglobin- prior to directing heat into the protein moiety.

UTh4A.10 • Substituted building blocks of life under UV radiation: Ultrafast excited state dynamics of 2-thiouracil vs uracil, Susanne Ulrich1, Hui Yu2, Jesus Sanchez Rodrigues2, 3Physics and Astronomy, Univ. of Georgia, USA. The photophysics of uracil and 2-thiouracil have been investigated using time-resolved photoelectron spectroscopy with emphasis on evaluating the role of intermolecular crossways pathways.

UTh4A.11 • Pyrene Dynamics: Covalently Linked Dimers Accelerate the Kinetics from ns to ps and Produce Excimers, Bastian Baudisch1, Ashok Keerthi2, Parthasarathi Das3, Andrew L. Sweeney4, C/D/E, Munich, Germany; 5Max Planck Inst. for Polymer Research, Germany. Multiscale transient absorption and streak camera measurements yield a clear picture of pyrene excimer and triplet dynamics. Linking pyrene can accelerate relaxation dynamics by three orders of magnitude. Oligomers with tailored properties are now feasible.

UTh4A.12 • Porphyrin S-S internal conversion dynamics studied with pump-DPFW, James Abraham1,2,3,4, Abraham1, Jesus Nieto-Pescador1, Lars Gundlach1, 2Univ. of Delaware, USA. We present pump four-wave mixing experiments that address the initial ultrafast dynamics frequently observed in transient absorption measurements of metal-porphyrins. Our measurements show that this dynamics can be explained by vibrational relaxation in S1.

UTh4A.13 • Exploring the Ultrafast Excited-State Intramolecular Proton Transfer (ESPT) of β-Diketones in the deep-UV, Andreas Steinbach1, Pramod K. Verma2, Federico Koch1, Patrick Nuernberger1, Tobias Brinzer1, 2Institut für Physikalische und Theoretische Chemie, Universität Würzburg, Germany; 3Dept. of Molecular Spectroscopy and Dynamics, Inst. for Basic Science (IBS), Korea; 4Physikalische Chemie II, Ruhr-Universität Bochum, Germany. The photodynamics in symmetric and unsymmetric β-diketones are studied with time-resolved absorption and emission spectroscopy. Intramolecular proton transfer leads to ultrafast ESPT while further relaxation and isomerization processes depend on the molecular symmetry and solvent environment.

UTh4A.14 • Ultrafast Metamorphosis of a Complex Charge Density Wave in Tantalumdiselenide, Kerstin Haupt1, Maximilian Eichberger2, Nicolas Erasmus1, Jure Demsar1, Kai Rosnagel1, Heinrich Schoorner1, 2Univ. of Stellenbosch, South Africa; 3Univ. of Konstanz, Germany; 4Univ. of Mainz, Germany; 5Univ. of Kiel, Germany. Using ultrafast electron diffraction, we record the transformation between a nearly-commensurate and an incommensurate charge-density-wave in 1T-TaS2, which takes places orders of magnitude faster than previously observed for commensurate-to-incommensurate transitions.

UTh4A.15 • Using Phase Shifts from High-order Harmonics to Generate Near-infrared Light: Application to Study Nuclear Dynamics, Maitum Madaniyoun,1,2,3,4, Dominik Gut1,2,3,4, Matthew Wood1, Igor Litvinyuk1, Robert T. Sang1, 2Griffith Univ., Australia. We present initial phase shift measurements of high-order harmonic radiation generated from hydrogen isotopes using Grant Phase interferometer. We will study the nuclear dynamics of molecules after they undergo strong-field ionization by ultrashort laser pulses.

UTh4A.16 • Effects of electron correlation and band relaxation on laser-induced ultrafast demagnetization, Guoping Zhang1, Yihua Bai1, Thomas F. George2, 3Univ. of Delaware, USA. We investigate how electron correlation and band structure affect laser-induced demagnetization. Pure electron-electron scattering cannot explain the large spin moment reduction observed, and the band relaxation and exchange splitting are essential to the spin change.

UTh4A.17 • Measuring the Nonlinear Refractive Index of Ar, N2, and O2 as a Function of the Pulse Width, Tiago Quâlbert1, Maria Miguez1, Lino Misoguti1, 2USP Inst de Fisica de Sao Carlos, Brazil. We have identified strong influence of pulse width in the nonlinear refractive index, n2, of gases due to contribution of noninstantaneous response. Using 50fs-1.2ps pulses, the n2 values were determined by nonlinear ellipse rotation measurements.
UTh4A.18 • Single-shot Ultrafast 2-D burst imaging by STAMP utilizing Spectral Filtering (SF-STAMP), Takakazu Suzuki1, Ryohi Hida1, Ryuta Ueda1, Fumihiro Isa1, Keiichi Nakagawa1, Fumihiro Kannani1,2, Keki Univ., Japan; 3Univ. of Tokyo, Japan. We improve a system performance of SF-STAMP for single shot 2-D burst imaging with 25 frames. We capture ultrafast phenomena with sub-picosecond temporal resolution using a frequency-chirped supercontinuum pulse broadened from 300 to 1000 nm.

UTh4A.19 • Femtosecond Two-Beam Coherent Anti-Stokes Raman Scattering for High Pressure Gas Analysis, Roland Ackermann1, Ioannis Makos2, Marita Kerstan3, Andreas Türnenmer1,2, Stefan Nolte3,2, Friedrich-Schiller-Universität Jena, Germany; 2Fraunhofer Inst. for Applied Optics and Precision Engineering IOF, Germany. We analyze the temperature in air and neat N2 under high pressure using ultrabroadband, two-beam femtosecond coherent Anti-Stokes Raman scattering. The derived temperatures are compared to numerical simulations.

UTh4A.20 • Exploring the Potential of Tailored Probing for a Flexible Coherent Raman Excitation Scheme, Lukes Brünnker1, Tiago Buckup1, Marcus Motskus1, Physikalisch-Chemisches Institut, Universität Heidelberg, Germany. We exploit pulse shaping for controlling the spectral focusing signal generation process. Contrast based on the decoherence times of Raman modes is achieved while boosted signal intensities enable simultaneous multimodal imaging demonstrated on biological tissue.

UTh4A.21 • Novel Techniques for Nonresonant Background Removal in Multiplex Coherent Anti-Stokes Raman Spectroscopy Spectra, Stephen D. Roberson1, Sherrie Pilkington1, Paul Pellegrino1; US Army Research Lab, USA. Nonresonant background is removed from multiplex CARS spectra using experimental and analytical methods independently and jointly to identify frequency dependent resonant spectra without a priori knowledge of the analyte or the surrounding matrix.

UTh4A.22 • Generating 100+ GHz repetition rate soliton pulse trains with a Kerr microcavity, Erin S. Lambi1, Daniel C. Cole1, Pascal Del’Hayer2, Ki Youl Yang1, Kerry Vahala1, Scott A. Diddams1, Scott B. Papp1; 2National Inst. of Standards and Technology, USA; 3California Inst. of Technology, USA. We explore highly ordered configurations of up to 24 Kerr-cavity solitons in a silica disk microresonator. Our work relaxes thermal stability requirements for Kerr-soliton generation, and suggests a mechanism that mediates soliton interactions.

UTh4A.23 Thin-Disk-Laser-Driven High-Harmonic Generation at Megawatt Repetition Rate, Andreas Diebold1, Florian Emaury1, Clara J. Saraceno1, Ursula Keller1, Ultrafast Laser Physics, ETH Zurich, Switzerland. We demonstrate high-harmonic generation at 2.4-MHz repetition rate from the compressed output of a thin-disk-oscillator, obtaining a compact XUV source with >5x1015 photons/s (19th harmonic). Furthermore, we investigate phase-matching conditions towards higher XUV photon flux.

UTh4A.24 Few-Cycle Mid-IR OPCPA Front-end at 100 kHz with Sub-50 mrad CEP-Stability, Alexandre Thal1, Raman Maksimenka1, Clément Ferchaud1, Nicolas Thiré1, Nicolas Fustiñe2, France. We present an OPCPA front-end delivering mid-IR (3.2 μm) pulses supporting sub-3.5 optical cycles with unprecedented passive CEP stability (44.2 mrad rms over 84 sec).

UTh4A.25 • High Contrast CEP-Stable OPCPA Front-end for PW-Class Ti:Sapphire System, Alexandre Thal1, Emilien Gontier1, Clément Ferchaud1, Pierre-Marly Paul1, Franck Falcoz1, Nicolas Forget1, Fustiñe2, France; 3Amplitudes Technologies, France. We demonstrate a hybrid OPCPA/OPCPA front-end for PW Ti:Sapphire systems delivering 3 mJ, 27 fs, CEP-stable pulses at 800 nm with a temporal contrast exceeding 2.1015 and 80 mrad CEP fluctuations.

UTh4A.26 Attosecond Streaking of XUV High Harmonics Using a 1.6-μm Optical Field, Naruyuki Saito1, Nobuhiro Ishii1, Teruto Kanai1, Shuntaro Watanabe1, Jiro Itatani1; 1Inst. for Solid State Physics, Japan; 2Tokyo Univ. of Science, Japan. High harmonics below the silicon L edge, which are generated by few-cycle optical pulses at 1.6 μm from a m-class BBO OPCPA, are characterized by attosecond streaking method with the IR electric field.

UTh4A.27 Multi-soliton pulse characterization and compression, Gennady Raskazkov1, Anton Ryabtsev1, Kirill Charan1, Tianyu Wang2, Chris Xu2, Marcos Dantus3,4, Physics and Astronomy, Michigan State Univ., USA; 3Chemistry, Michigan State Univ., USA; 4School of Applied and Engineering Physics, Cornell Univ., USA. Shaper-based characterization and compression of the multi-soliton output of a large-mode area photonic-crystal fiber pumped at 1550 nm is presented. Spectral phase correction of each soliton in the output results in sub-30 fs pulses.

UTh4A.28 Fast-Frame Single-Shot Acquisition of Ultrafast Waveforms, Masataka Koyabachi1, Jeremy A. Johnson1,2, Yasuo Minami1, Courtney L. Johnson2, Parker D. Salmans2, Nicholas R. Ellsworth1, Jun Takeuda1, Ikufumi Katayama1; 1Faculty of Engineering, Yokohama National Univ., Japan; 2Dept. of Chemistry and Biochemistry, Brigham Young Univ., USA. We demonstrated a new method of measuring Kerr-ultrashort waveforms using chirped femtosecond pulses, a single photodiode and an oscilloscope. This allowed the full pump intensity dependence to be binned obtained recorded within one second.

UTh4A.29 • Percent-Level Accuracy in Measuring Strong-Field Photoionization and Laser Intensity, William C. Waldner1, Omar Ghafoor1,3, Champak Khurmi1,5, Staya Sainadi1, James E. Calvet1,5, Michael Pullen1,3, Igor V. Litvinyuk1, Robert T. Sang1, Dave Kielkis1, Klaus Bartschat2, Alexi N. Grum-Grzhimailo1, Emilien Gontier1, Clément Ferchaud1, Nicolas Thiré1, Clément Thévenod2, Clément Flament4, Yoann Olivier4, Jérôme Cornil4, Sergei A. Ivanov1,5, Maxim S. Pahinchikov1; 1The Zernike Inst. for Advanced Materials, Univ. of Groningen, Netherlands; 2National Laser Center and Faculty of Physics, Moscow State Univ., Russia; 3Enskologolov Inst. of Synthetic Polymeric Materials of the Russian Academy of Sciences, Russia; 4Service de Chimie des Matériaux Nouveaux, Université de Mons, Belgium. Photovoltaic blends based on novel TPA-based oligomers with different intramolecular donor and acceptor units are studied by ultrafast visible-IR spectroscopy and DFT calculations. Polaron and charge transfer dynamics are observed and discussed.

UTh4A.34 Ultrafast Carrier Dynamics in Individual GaN/InGaN Multiple Quantum Well Nanowires, Stephane Boubariga-Tombet1, Michael R. Williams1, Jeremy Wright2, George Wang3, Rohit Prasankumar1, Los Alamos National Lab, USA; 1Research Inst. of Electrical Communication, Tohoku Univ., Japan; 2Sandia National Labs, USA. Individual nanowires consisting of a GaN core and a shell of multiple InGaN quantum wells were studied using ultrafast pump-probe spectroscopy to determine the mechanisms and relaxation pathways through which excited carriers recombine.
Ultrafast Charge Carrier Dynamics in Bulk MoS₂ Following Optical Excitation, Tim Völzer1, Matthias Lütgens1, Franziska Fennel1, Stefan Lochbrunner1; 1Univ. of Rostock, Germany. We present a novel method to spatially and temporally control avalanching in clusters. An XUV pulse generates seed electrons, which are efficiently heated by an NIR laser pulse, leading to extensive ionization at moderate intensities.

High-Power Narrow-Linewidth Yb/fiber Laser Frequency Comb, Xinlong Li1, Peng Zhao1, Christopher Corder1, Thomas K. Allison1; Stony Brook Univ., SUNY, USA; 2Stony Brook Univ., USA. Cavity enhanced broadband few-cycle femtosecond source. In this summary, we present a Yb:fiber laser with 55 W average output power, 150 fs pulse duration and 78 MHz repetition rate ideal for driving cavity-enhanced HHG.

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Ultrafast Interaction between Intense X-rays and Atoms, Kenji Tamasaki; RIKEN, Japan. Ultrafast interaction between intense x-rays and core-hole atoms with sub-femtosecond lifetime is discussed based on the recent experiments at x-ray free-electron laser facility, SACLA.

Towards two-dimensional spectroscopy on inner-shell transitions with XUV and soft-X-ray pulses, Thomas Ding, Alexander Blättermann, Veit Stöoss, Christian Ott, Kristina Meyer, Andreas Kaldun, Marc Rebholz, Paul Birk, Maximilian Hartmann, Lennart Aufleger, Andrew Brown, Hugo van der Hart, Thomas Pfeifer; Max Planck Inst. for Nuclear Physics, Germany; Chemistry Dept., Univ. of California, Berkeley, USA; Centre for Theoretical Atomic, Molecular and Optical Physics, Queen’s Univ. Belfast, UK; Ruprecht-Karls-Universität Heidelberg, Centre for Quantum Dynamics, Germany. Firstly, we demonstrate time-resolved four-wave-mixing spectroscopy on inner-valence transitions in neon using high-harmonic generated (HHG) pulses. Secondly, we present the design of a two-dimensional spectroscopy setup for extreme ultraviolet (XUV) and soft-X-ray pulses.

Transient NEXAFS Spectroscopy at the Oxygen Edge: Pinning Down ππ*→nπ* Internal Conversion, Thomas Wolf, Rolf H. Myhré, Sonia Coriani, Henrik Koch, Andrea Battistoni, Nora Berrah, Philip H. Bucksbaum, Ryan Coffey, Giacomo Coslovich, James P. Cryan, Raimund Feifel, Kelly Gaffney, Todd Martinez, Shungo Myabe, Stefan P. Moeller, Melanie Mucke, Adi Natan, Razib Obaid, Timur Osipov, Oksana Plekan, Alexander Sage, Richard Squibb, Song Wang, Markus Gühr, Stanford PULSE Inst., SLAC National Accelerator Lab, USA; Dept. of Chemistry, Norwegian Univ. of Science and Technology, Norway; Dipartimento di Scienze Chimiche e Farmaceutiche, Università degli Studi di Trieste, Italy; Dept. of Physics, Univ. of Connecticut, USA; Dept. of Physics, Stanford Univ., USA; Linac Coherent Light Source, SLAC National Accelerator Lab, USA; Dept. of Physics of Gothenburg, Sweden; Dept. of Chemistry, Stanford Univ., USA; Dept. of Physics and Astronomy, Uppsala Univ., Sweden; Elettra-Sincrotrone Trieste, Italy; Institut für Physik und Astronomie, Universität Potsdam, Germany. We present results from time-resolved NEXAFS spectroscopy at the oxygen edge, which show an extremely high sensitivity on nπ* to ππ* internal conversion. Application to thymine clarifies the current picture of its photoprotection mechanism.

Direct Observation of Ultrafast High-Valent Iron Formation, Alexander Britz, Tadesse Assefa, Michael Diez, Andreas Galler, Wojciech Gawelda, Dmitry Khakhulin, Peter Zalden, Joel Torres-Alacán, Zoltán Németh, Eva Bajnoczi, Dorottya Szemes, Gilles Doumy, Anne Marie March, Jakub Szlachetko, Tokushi Sato, Shunsuke Nozawa, Tetsuo Katayama, Shin-ichi Adachi, Christopher J. Milne, György Vankó, Peter Vöhringer, Christian Bressler; European XFEL, Germany; The Hamburg Centre for Ultrafast Imaging, Germany; Institut für Physikalische und Theoretische Chemie, Rheinische Friedrich-Wilhelms-Universität Bonn, Germany; Wigner Research Centre for Physics, Hungarian Academy of Sciences, Hungary; X-ray Science Division, Argonne National Lab, USA; SwissFEL, Paul Scherrer Institut, Switzerland; Center for Free-Electron Laser Science, Deutsches Elektronen-Synchrotron, Germany; Inst. of Materials Structure Science, High Energy Accelerator Research Organization, Japan; Japan Synchrotron Radiation Research Inst., Japan. Ultrafast X-ray techniques serve as a direct probe of a long-lived pseudo-octahedral high-valent iron(V) complex. Its photo-induced formation from an azido-iron(III) precursor is observed in real-time with sub-picosecond resolution at SACLA XFEL.

Soft-x-ray absorption spectroscopy simultaneously at carbon and nitrogen K-shell edges using attosecond pulses, Stephan M. Teichmann, Barbara Buades, Seth L. Cousin, Francisco Silva, Jens Biegert; ICF0 - Institut de Ciencies Fotoniques, The Barcelona Inst. of Science and Technology, Spain; ICREA - Institucio Catalana de Recerca i Estudis Avancats, Spain. We demonstrate near edge soft-x-ray absorption spectroscopy in the valence window using attosecond pulses by simultaneously probing transitions from inner core shell electrons to unoccupied states on an organic film B:subPC:Cl.

Femtosecond X-ray Absorption and Emission Spectroscopy on ZnO Nanoparticles in Solution, Thomas J. Penfold, Jakub Szlachetko, Wojciech Gawelda, Fabio G. Santomauro, Alexander Britz, Tim B. van Driel, Leonardo Sala, Simon Ebner, Steve H. Southworth, Gilles Doumy, Anne Marie March, Carl S. Lehmann, Jakub Szlachetko, Tokushi Sato, Shunsuke Nozawa, Tetsuo Katayama, Shin-ichi Adachi, Christopher J. Milne, György Vankó, Peter Vöhringer, Christian Bressler; European XFEL, Germany; The Hamburg Centre for Ultrafast Imaging, Germany; Institut für Physikalische und Theoretische Chemie, Rheinische Friedrich-Wilhelms-Universität Bonn, Germany; Wigner Research Centre for Physics, Hungarian Academy of Sciences, Hungary; X-ray Science Division, Argonne National Lab, USA; SwissFEL, Paul Scherrer Institut, Switzerland; Center for Free-Electron Laser Science, Deutsches Elektronen-Synchrotron, Germany; Inst. of Materials Structure Science, High Energy Accelerator Research Organization, Japan; Japan Synchrotron Radiation Research Inst., Japan. We have performed femtosecond X-ray techniques measurements after UV photoexcitation of a colloidal solution of ZnO nanoparticles. The results indicate sub-ps hole trapping at oxygen vacancies with shallowly-trapped electrons in the conduction band.
UF2A.1 • 10:45
Optical attosecond pulses: tracing the nonlinear delay response of bound electrons in matter, Mohammed Hassan1,5, Tran Trung Luu1, Antoine Moulet1, Olga Raskazovskaya2, Peter Zhokhov2,4, Manish Garg1, Nicholas Karpowicz1, Aleksii M. Zheltikov1,4, Vladimir Pervak2, Krausz Ferenc1,2, Eleftherios Goulielmakis1; 1Max-Planck-Institut für Quantenoptik, Germany; 2Dept. für Physik, Ludwig-Maximilians-Universität, Germany; 3Dept. of Physics and Astronomy, Texas A&M Univ., USA; 4Physics Dept., International Laser Center, M.V. Lomonosov Moscow State Univ., Russia; 5Physical Chemistry, California Inst. of Technology, USA. Here we demonstrate the first intense optical attosecond pulses synthesized in the visible and nearby spectral ranges and their use for revealing the nonlinear response time of bound electrons of Kr atoms.

UF2A.2 • 11:15
Observation of High-Harmonic Generation from an Atomically Thin Semiconductor, Hanzhe Liu1,2, Yilei Li1,3, Yongsing You1, Shambhu Ghimire1, Tony Heinz1,2, David A. Reis1,3; 1Stanford Pulse Inst., USA; 2Dept. of Physics, Stanford Univ., USA; 3Dept. of Applied Physics, Stanford Univ., USA. We report the observation of nonperturbative high-harmonic generation from monolayer MoS2. The yield is higher in monolayer compared to a single layer of the bulk, an effect attributed to strong electron-hole interactions in the monolayer.

UF2A.3 • 11:30
Isotope Effect in the three Break-up Channels of the Acetylene Cation, Heide Ibrahim1, Benji Wales3, Samuel Beaulieu1, Bruno E. Schmidt2,1, Nicolas Thire1, Eric Bisson1, Vincent Wanie1, Jean-Claude Kieffer1, Michael Schuurman3, Joseph Sanderson3, François Légaré1; 1INRS EMT, Canada; 2few-cycle Inc., Canada; 3Dept. of Physics and Astronomy, Univ. of Waterloo, Canada; 4National Research Council of Canada, Canada. The dynamics and the isotope effect on the symmetric (CH++CH+), the deprotonation (C2H++H+), and the isomerization channel (CH2++C+) is studied systematically by pump (four 266 nm photons) probe (800nm) excitation.

UF2A.4 • 11:45
Excited-State Phase Control In Strong Laser Fields: From Fundamental To Complex Systems, Kristina Meyer1, Zuoye Liu1,2, Niklas Müller1, Jan-Michael Mewes1, Andreas Dreuw1, Tiago Buckup1, Marcus Motzkus1, Thomas Pfeifer1,2; 1Max-Planck-Institut für Kernphysik, Germany; 2School of Nuclear Science and Technology, Lanzhou Univ., China; 3Interdisciplinary Center for Scientific Computing, Universität Heidelberg, Germany; 4Physikalisch-Chemisches Institut, Universität Heidelberg, Germany; 5Center for Quantum Dynamics, Universität Heidelberg, Germany. We measure and control the quantum-mechanical phase shift of excited quantum states using strong laser fields. This concept is demonstrated in gaseous helium and then generalized to a complex dye molecule in the liquid phase.

UF2A.5 • 12:00
Sub-10-fs Population Inversion In Air Driven By Few-cycle Laser Pulses, Huailiang Xu1,2, Erik Lötstedt2, Atsushi Iwasaki2, Kaoru Yamanouchi2; 1Jilin Univ., China; 2Dept. of Chemistry, The Univ. of Tokyo, Japan. We experimentally demonstrate the generation of sub-10-fs population inversion in N2+ induced by few-cycle intense laser pulses, and theoretically clarify that the ultrafast population inversion results from the post-ionization dynamics through multiple states coupling.

UF2A.6 • 12:15
Direct observation of efficient heat dissipation in close-packed nanoheaters using coherent EUV beams, Jorge Nicolas Hernandez Charpak1, Travis Frazer1, Joshua Knobloch1, Weilun Chao1, Damiano Nardi1, Kathleen Hoogeboom-Pot1, Henry C. Kapteyn1, Margaret M. Murnane1; 1JILA-CU Boulder, USA; 2LBNL, USA. We use coherent EUV beams to probe transport away from nanoheater arrays of varying width, spacing and substrate. We validate new collectively-diffusive transport predictions, where nanowires cool faster when closely spaced than when widely separated.

UF2A.7 • 12:30
UV Harmonics from Solids Excited at High Repetition Rate by Intense and Phase-Locked Few-Cycle Pulses, Patrick Storz1, Jonathan Fischer1, Jonas Tauch1, Marcel Wunram1, Alfred Leitenstorfer1, Daniele Brida1; 1Dept. of Physics and Center for Applied Photonics, Univ. of Konstanz, Germany. We harness carrier-envelope phase control of intense 2.3-cycle pulses from an optical parametric amplifier operating in the near infrared at 10 MHz repetition rate to produce even and odd harmonics up to fifth order from solids.
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