Online Conference Program Now Available

Online Access to Technical Digest Now Available! Full Technical Attendees now have an alternate way to access the digest papers at the meeting. Access the papers through Optics InfoBase using the same login email address and password provided during the meeting registration process. Access is currently limited to Laser Congress Full Technical Attendees only. If you need assistance with your login information, please use the forgot password utility or "Contact Help" link.

HILAS - a topical meeting highlighting the dramatic recent advances in research on high field optical science and high intensity sources.

The aim of the High-Intensity Sources and High-Field Phenomena meeting is to assemble a multi disciplinary group of participants to present and exchange breakthrough ideas relating to the physics and applications of high field sources, and related developments in high intensity lasers and related technology. The conference topics include both fundamental science and applications of high field phenomena, as well as technical aspects related to source development. The latest research results in terawatt/petawatt lasers, amplification of a few cycle pulses, laser fusion technologies, EUV and X-ray sources based on lasers, plasmas in ultra high fields, advances in attosecond science and relativistic nonlinear phenomena are among the topics to be discussed.

High quality experimental and theoretical contributions are solicited in any topical area related to the coverage of the conference, including the following:

- High-peak power lasers and high-intensity laser-matter interactions
- Recent progress in terawatt to petawatt lasers and the amplification of few cycle pulses
- Laser technology for fusion and laser based EUV and X-ray sources
- Strong field laser science including interactions with atoms, molecules, clusters, and plasmas
- Advances in attosecond science
- High harmonic generation, high-field rescattering physics, relativistic nonlinear phenomena, intense pulse propagation
- Plasmas in ultrahigh fields, and laser based particle acceleration

General Chairs
Jon Marangos, Imperial College London, UK
Joachim Ulrich, Max-Planck-Institut fur Kernphysik, Germany

Program Chairs
Andrius Baltuska, TU Vienna, Austria
Jens Biegert, ICFO, Spain

Research in Optical Sciences is collocated with:

Sponsored by:
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- High Intensity Lasers and High Field Phenomena (HILAS)
- International Conference on Ultrafast Structural Dynamics (ICUSD)
- Quantum Information and Measurement (QIM)

This Optics and Photonics Congress (OPC) is designed to examine some of the latest research advances in Optical Physics and Chemistry. The advent of ultra-short pulse, extremely high power lasers is making it possible to examine material system responses to very intense light beams and to study the evolution of the structure and optical properties of these systems as they are strongly perturbed. Of equally strong interest are the subtle effects observed when photons are generated in entangled states. These entangled photons have the potential of leading to major advances in the development of advanced information and computing systems. This Congress on research topics in the optical sciences includes three meetings which will bring together world renowned researchers to discuss forefront advances in the optical sciences. The High-Intensity Lasers and High Field Phenomena (HILAS) meeting will discuss the latest developments in high peak power lasers and the material interactions resulting from the use of these lasers. A related meeting in this OPC, the 2ND International Conference on Ultrafast Structural Dynamics, will examine material system structural modifications at ultra-short time scales and the time evolution of these modifications. The third meeting, Quantum Information and Measurement (QIM), will present the most recent research advances in the field of entanglement phenomena and will examine how this phenomena may be exploited to advance information transfer and processing technologies.

Congratulations to the 2012 Research in Optics Congress Student Presentation Award Winners! Sponsored by OSA

ICUSD - Denis Anielski, Max Planck-Institut fur Kernphysik, Germany
Time-Resolved Photoelectron Diffraction on Laser-Aligned Molecules, JT2A.38

HILAS - Bastian Borchers, Max Born Inst., Germany
Carrier-envelope Phase Double Stabilization Setup with sub-10 Attosecond Timing Jitter, HW3C.5

QIM - Shlomi Kotler, Weizmann Inst. of Science, Israel
Single-ion Quantum Lock-in Amplifier, QM2A.3

Special Events

Student Event: Site-Seeing Tour of Potsdam
Sunday, 18 March, 14:00
Thursday, 22 March, 11:00
OSA, the Student Chapter Potsdam, and the Berlin Optik Student Chapter are offering a free guided tour for students to the famous palaces and parks around Potsdam. It was the city of residence for the Prussian kings and is a town of unique and stunning beauty. Large areas of the city were awarded official UNESCO World Heritage status in 1990. The tour will take about two hours and feature many of the most important sites within the city. For more information and to sign-up, contact Jonas Gortner

Welcome Reception
Monday, 19 March
17:00-21:00
Hall 13, Messe Berlin
This Reception brings together all of the three meetings, HILAS, ICUSD, and QIM, within the congress for a fun evening of networking with light appetizers and drinks. This event will take place on the Laser Optics Berlin show floor and is a great opportunity to learn about the latest products and innovations. Complimentary to full Technical attendees.

Joint Poster Session  
Tuesday, 20 March  
10:30 - 12:30  
Exhibit Hall 12, Messe Berlin  
The Joint Poster session is an integral part of the technical program and offer a unique networking opportunity, where presenters can discuss their results one-to-one with interested parties. Each author is provided with a 4 ft. x 8 ft. (1.22 m x 2.44 m) board on which to display the summary and results of his or her paper. This event will be held on the Laser Optics Exhibit Floor. The posters will be displayed all three days of the conference.

Special Student Workshop "How to Start Your Own Company"  
Tuesday, 20 March  
19:00 - 20:00  
Syndey, Messe Berlin  
Featuring: Wolfgang Gries, CEO/Managing Director and Founder of DirectPhotonics Industries GmbH, Germany  
Learn directly from an expert in the industry and gain insight from his experiences. He will offer practical advice on starting your business that will help young professionals and students starting on their career path. This program is sponsored by the Berlin Optik Student Chapter and OSA.

Postdeadline Session  
Tuesday, 20 March  
19:00 - 21:00  
Madrid, Messe Berlin  
The postdeadline session will give participants the opportunity to hear new and significant material in rapidly advancing areas. Only those papers judged to be truly excellent and compelling in their timeliness were accepted. More information, including the schedule and location, will be posted in the weeks preceding the conference.

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Sponsored by: OSA

Research in Optical Sciences is collocated with:

The Berlin region is one of the most important technology centers for the Optical and Microsystems industry. Science and business will profit from ideal conditions for intelligent networking at Laser Optics Berlin, which takes place March 19-21, 2012. The combination of congress, trade fair and experts' forums makes Laser Optics Berlin the top platform for exhibitors from the entire industry. In 2012 the congress will be organized by the Optical Society of America (OSA) for the very first time.

Another first: microsys berlin will take place within the scope. As a combination of exhibition and lecture program, microsys berlin concentrates on the interface between optical technologies and microsystems technology.

With its compact format and diverse synergies, Laser Optics Berlin offers exhibitors customized presentation opportunities. From the economically priced table-top displays to trade fair stands of every size, you can individually configure your trade fair presence. We are happy to advise you. www.laser-optics-berlin.de  
Contact: laser-optics@messe-berlin.de
High Intensity Lasers and High Field Phenomena (HILAS)

Conference Program

The program for High Intensity Laser and High Field Phenomena (HILAS) topical meeting will be held 19 - 21 March 2012. No events are scheduled for Sunday, 18 March 2012; however participants may register and pick up their materials on Sunday afternoon.

About HILAS and Topic Categories
Download Pages from the Program
Invited Speakers
Special Events
Call for Papers
Schedule-at-a-Glance
Online Conference Program

About High Intensity Lasers and High Field Phenomena (HILAS)
The High Intensity Lasers and High Field Phenomena (HILAS) meeting highlights the dramatic recent advances in research on high field optical science and high intensity sources. The aim of the High-Intensity Sources and High-Field Phenomena meeting is to assemble a multi disciplinary group of participants to present and exchange breakthrough ideas relating to the physics and applications of high field sources, and related developments in high intensity lasers and related technology. Conference topics include both fundamental science and applications of high field phenomena, as well as technical aspects related to source development. The latest research results in terawatt/petawatt lasers, amplification of a few cycle pulses, laser fusion technologies, EUV and X-ray sources based on lasers, plasmas in ultra high fields, advances in attosecond science and relativistic nonlinear phenomena are among the topics to be discussed.

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**Invited Speakers**

- **High Harmonic Spectroscopy of Molecular Isomers**, Ravi Bhardwaj, *University of Ottawa, Canada*

- **Carrier-envelope Phase Double Stabilization Setup with sub-10 Attosecond Timing Jitter**, Bastian Borchers, *Max Born Inst., Germany*

- **Science on the Texas Petawatt Laser and Technology Development Toward an Exawatt Laser**, Markus Drescher, *Univ. of Hamburg, Germany*

- **XUV-driven Electronic Correlation Probed with Strong THz Light Fields**, Todd Ditmire, *Univ. of Texas at Austin, USA*

- **When does an Electron Exit a Tunneling Barrier?**, Nirit Dudovich, *Weizmann Institute of Science, Israel*

- **Towards Complete Space-time Reconstruction of Attosecond Pulses**, Eugene Frumker, *Joint Laboratory of Attosecond Science of Ottawa and NRC, Canada*

- **Attosecond Physics with Sub-Optical-Cycle Waveforms of Light**, Eleftherios Gouliemakis, *Max-Planck-Institut for Quantum Optics, Germany*

- **Two-color Pumped OCPA System with ÅμJ Pulse Energy and a Spectral Bandwidth of 1.5 octaves from VIS to NIR**, Anne Harth, *Universität Hannover, Germany*

- **A Mid-IR, High Repetition Rate, Few-Cycle Laser Source for High-Field Physics Experiments**, Michael Hemmer, *ICFO - The Institute of Photonics Sciences, Spain*

- **Attosecond Strong-field Electron Wavepacket Interferometry**, Markus Kitzler, *Vienna Univ. of Technology, Austria*

- **Attosecond Electron Emission and Acceleration from Nanoparticles in Strong Fields**, Mathias Kling, *MPQ, Germany*

- **High Repetition Rate Few-cycle OCPA for Generation of Isolated Attosecond Pulses**, Manuel Krebs, *Friedrich-Schiller-Universität Jena, Germany*

- **Optical Field Waveform Generation and Characterization**, Andy Kung, *Inst of Atomic and Molecular Science, Taiwan*

- **FEL induced molecular dynamics: time-resolved and in 3D**, Robert Moshammer, *Max-Planck-Institut for Quantum Optics, Germany*

- **Attosecond Lighthouses: A New Tool for Ultrafast Science and Metrology**, Fabien Quere, *CEA Saclay, France*

- **Protein Crystal Structure Determination and Radiation Damage at a Dose of 3 GGy using a Free-Electron Laser**, Ilme Schlichting, *Max-Planck-Institut for Quantum Optics, Germany*

- **Collimated-Beam Third- and Fifth-Harmonic Generation by Mid-Infrared Ultrashort Pulses**, Aleksei Zheltikov, *Moscow State Univ., Russia*
Welcome to the 2012 OSA Optics & Photonics Research in Optical Science Congress! This year, we have three topical meetings collocated together to form this Congress. The three meetings are High Intensity Lasers and High Field Phenomena (HILAS), International Conference on Ultrafast Structural Dynamics (ICUSD) and Quantum Information and Measurement (QIM).

The aim of the High-Intensity Sources and High-Field Phenomena meeting is to assemble a multi-disciplinary group of participants to present and exchange breakthrough ideas relating to the physics and applications of high field sources, and related developments in high intensity lasers and related technology. The conference topics include both fundamental science and applications of high field phenomena, as well as technical aspects related to source development. We have scheduled 15 invited and 45 contributed oral presentations, together with 11 poster presentations, for you to attend.

The field of structure research in the ultrafast time domain is new and rapidly developing. The goal is for the International Conference on Ultrafast Structural Dynamics (ICUSD) to serve as a platform for discussing the latest development in the field and for new connections to be made, while hearing from early stage researchers. We have scheduled 4 tutorials, 12 invited and 40 contributed oral presentations, together with 19 poster presentations, for you to attend. The program highlights most recent advances in electron and x-ray diffraction as well as ultrafast spectroscopy addressing transient structures.

Quantum information and measurement (QIM) is an exciting, rapidly growing area of scientific interest and development, attracting cutting-edge theoretical and experimental research worldwide. Entanglement is a key resource for quantum information, communication, and quantum computing, whereas decoherence is the main adversary. Optical methods play a key role in quantum information research and in emerging quantum measurement applications. We have scheduled 2 plenary, 24 invited and 83 contributed oral presentations, together with 32 poster presentations, for you to attend.

We all are very pleased to have you join us and we look forward to a great meeting!

**HILAS**
Jon Marangos, Imperial College London, UK, General Chair
Joachim Ullrich, Max-Planck-Institut fur Kernphysik, Germany, General Chair
Andrius Baltuska, TU Vienna, Austria, Program Chair
Jens Biegert, ICFO, Spain, Program Chair

**ICUSD**
Thomas Elsaesser, Max Born Inst., Germany, General Chair
Majed Chergui, École Polytechnique Federale de Lausanne, Switzerland, General Chair

**QIM**
Robert Boyd, Univ. of Ottawa, Canada, and Univ. of Rochester, USA, General Chair
Alexander Sergienko, Boston Univ., USA, General Chair
Janos Bergou, CUNY Hunter College, USA, Program Chair
Saverio Pascazio, Univ. of Bari, Italy, Program Chair
Program Committee

High Intensity Lasers and High Field Phenomena (HILAS)

General Chairs
Joachim Ullrich, Max-Planck-Institut für Kernphysik, Germany
Jon Marandos, Imperial College London

Program Chairs
Andrius Baltuska, TU Vienna, Austria
Jens Biegert, ICFO, Spain

Committee Members
Sterling Backus, Colorado State Univ., USA
Giulio Cerullo, Politecnico di Milano, Italy
Eric Cormier, CELIA, France
Sandro DeSilvestri, Politecnico di Milano, Italy
John Dudley, Univ. Franche-Comté, France
Takao Fuji, IMS Okazaki, Japan
Simon Hooker, Oxford Univ., UK
Jason Jones, Univ. of Arizona, USA
M. Krishnamurthy, TIFR - Tata Institute of Fundamental Research, India
Ruxin Li, Shanghai Inst. of Optics and Fine Mech, China
Yasuo Nabekawa, RIKEN, Japan
Chang Hee Nam, KAIST, Korea
Günter Steinmeyer, Max Born Inst., Germany
Amelle Zair, Imperial College London, UK

International Conference on Ultrafast Structural Dynamics (ICUSD)

Chairs
Thomas Elsaesser, Max Born Inst., Germany
Majed Chergui, École Polytechnique Fédérale de Lausanne, Switzerland

Committee Members
Shin-ichi Adachi, High Energy Accelerator Research Organization (KEK), Japan
Roger Falcone, Lawrence Berkeley National Lab., USA
Peter Hamm, Univ. of Zurich, Switzerland
Jon Marangos, Imperial College London, London
M. Garcia, Universität Kassel, Germany
Dwayne Miller, Univ. of Toronto, Canada; Univ. of Hamburg, Germany
Ilme Schlichting, Max-Planck-Institut, Germany

Quantum Information and Measurement (QIM)

General Chair
Robert Boyd, Univ. of Ottawa, Canada, and Univ. of Rochester, USA
Alexander Sergienko, Boston Univ., USA

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Saverio Pascazio, Univ. of Bari, Italy
Janos Bergou, CUNY Hunter College, USA

Committee Members
Harald Weinfurter, Univ. of Munich, Germany
Eugine Polzik, Univ. of Kopenhagen, Denmark
Aephraim Steinberg, Univ. of Toronto, Canada
Jeremy O’Brien, Univ. of Bristol, UK
Paul Kwiat, UIUC, USA
Hans Bacher, Australian National Univ., Canberra, Australia
Jean-Michel Raimond, Univ. of Paris, France
Andrew Shields, Cambridge Univ., Toshiba Europe, UK
Vladimir Buzek, Univ. of Bratislava, Slovakia
Sergei Kilin, Institute of Physics, Minsk, Belarus
Wolfgang Schleich, Univ. of Ulm, Germany
Luigi Lugato, Univ. of Insbruck, Italy
Paul Lett, NIST, USA
Claude Fabre, Univ. Pierre et Marie Curie, France
Oliver Benson, Univ. of Berlin, Germany
Paolo Villoresi, Univ. of Padova, Italy
Jürgen Eschner, Univ. of Saarland, Germany
Rosario Fazio, Scuola Normale Superiore, Pisa, Italy
Tommaso Calarco, Univ. of Ulm, Germany
Viktor Zadkov, Moscow State Univ., Russia
Kazuya Yuasa, Waseda Univ., Japan
Jian-Wei Pan, Hefei NLPSM, China
Special Events

Welcome Reception
Monday, 19 March, 17:00–21:00
Exhibit Hall 13

This Reception brings together all of the three meetings, HILAS, ICUSD, and QIM, within the congress for a fun evening of networking with music, light appetizers and drinks. This event will take place on the Laser Optics Berlin show floor and is a great opportunity to learn about the latest products and innovations. Complimentary to all full technical attendees.

Poster Presentations
Tuesday, 20 March, 10:30–12:30
Exhibit Hall 12

Poster presentation offer an effective way to communicate new research findings and provide an opportunity for lively and detailed discussion between presenters and interested viewers. HILAS, ICUSD and QIM’s posters will be presented during this session.

Postdeadline Papers Presentations
Tuesday, 20 March, 19:00–21:00
Madrid

Please see the update sheet for information concerning the Postdeadline Sessions. The purpose of the postdeadline session is to give participants the opportunity to hear new and significant materials in rapidly advancing areas. Only those papers judged to be truly excellent and compelling in their timeliness were accepted.

OSA Student Paper Competition

OSA is pleased to recognize the winners of the Research in Optical Sciences Congress best student paper awards, as selected by the Program Committees. Each of the three winners will be recognized in their session and presented with a certificate and an iPad2. Congratulations to:

Denis Anielski, Max Planck-Institut für Kernphysik, Germany
Time-Resolved Photoelectron Diffraction on Laser-Aligned Molecules, JT2A.38

Bastian Borchers, Max Born Inst., Germany
Carrier-envelope Phase Double Stabilization Setup with sub-10 Attosecond Timing Jitter, HW3C.5

Shlomi Kotler, Weizmann Inst. of Science, Israel
Single-ion Quantum Lock-in Amplifier, QM2A.3

Student Events
(time and location is printed in the update sheet)

On Tuesday, 20 March, the Berlin Opticsk Student Chapter and OSA will host two events for all students.

- 1-hour session on starting a photonics business with Wolfgang Gries, CEO/Managing Director and Founder of Direct-Photonics Industries GmbH
- Student Networking Party

Laser Optics Berlin - International Trade Fair and Congress

As a platform for introducing forward-looking ideas, technical trends and world's firsts, the event offers trade visitors from research, development and production comprehensive insight into the innovative power of the optical technologies. Research and science are a significant part of the overall concept.

The heart of the event is the Scientific-Technical Congress, which takes place in parallel. In 2012, the congress will be organized by The Optical Society (OSA).

Starting in 2012 the industry forums Laser Optics Berlin and microsys berlin will be taking place under one roof. This will be the first business platform among German trade fairs to mirror the products and services of both the optical technology and microsystem technology industries. As another first, Laser Optics Berlin is presenting Warsaw as its official partner city in 2012.

Exhibit Hall Hours

<table>
<thead>
<tr>
<th>Date</th>
<th>Hours</th>
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<tbody>
<tr>
<td>19–20 March</td>
<td>10:00–17:00</td>
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<tr>
<td>21 March</td>
<td>10:00–16:00</td>
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</table>

OSA Booth

Stop by The Optical Society’s booth #702 at Laser Optics Berlin to receive great giveaways and free copies of Optics and Photonics News magazine. Discover our “Publish-Present-Network” initiative and learn about individual and corporate membership, publications, meetings, our philanthropic foundation, and other OSA activities. OSA staff will be there to answer your questions.
Map of Messe Berlin

Congress rooms
Congress registration
Coffee breaks

Hall 13
- Opening
- Welcome Reception
- Congress restaurant (Lunch)

Hall 12 - OSA Poster session

Messe Berlin GmbH - Messedamm 22 · 14055 Berlin
Telefon +49(0)30 3038-2056 Telefax +49 (0)30 3038-2291
www.messe-berlin.de · laser-optics@messe-berlin.de
## Agenda of Sessions — Monday, 19 March

<table>
<thead>
<tr>
<th>Time</th>
<th>Madrid</th>
<th>Sydney</th>
<th>Hong Kong</th>
<th>Istanbul</th>
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<tbody>
<tr>
<td>07:00–16:30</td>
<td>Registration, Grosser Stern</td>
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<tr>
<td>08:15–8:30</td>
<td>QIM Opening Remarks</td>
<td>HILAS Opening Remarks</td>
<td>ICUSD Opening Remarks</td>
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<tr>
<td>08:30–10:00</td>
<td>QM1A • Quantum Measurement</td>
<td>QM1B • Quantum Atom-Photon Interaction</td>
<td>HM1C • Short Wavelength Sources</td>
<td>IM1D • X-ray Scattering</td>
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<tr>
<td>10:00–11:00</td>
<td>Coffee Break, Grosser Stern</td>
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<tr>
<td>11:00–13:00</td>
<td>QM2A • Quantum Information and Measurement with Atoms and Ions</td>
<td>HM2C • Short Wavelength Sources and Applications</td>
<td>IM2D • X-ray Diffraction</td>
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<tr>
<td>13:00–14:30</td>
<td>Exhibit Hall / Lunch, Hall 13</td>
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<tr>
<td>14:30–16:30</td>
<td>QM3A • Novel Systems for Quantum Measurement</td>
<td>QM3B • Quantum Information and Measurement with Photons I</td>
<td>HM3C • HHG1</td>
<td>IM3D • Electronic Excitations</td>
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<tr>
<td>17:00–21:00</td>
<td>Welcome Reception, Hall 13</td>
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### Explanation of Session Codes

The first letter of the code designates the meeting (For instance, H= High Intensity Lasers and High Field Phenomena, I= International Conference on Ultrafast Structural Dynamics, Q= Quantum Information and Measurement, J=Joint). The second element denotes the day of the week (Monday= M, Tuesday= T, Wednesday= W). The third element indicates the session series in that day (for instance, 1 would denote the first parallel sessions in that day). Each day begins with the letter A in the fourth element and continues alphabetically through a series of parallel sessions. 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 QT1A.4 indicates that this paper is part of Quantum Information and Measurement (Q) and is being presented on Tuesday (T) in the first series of sessions (1), and is the first parallel session (A) in that series and the fourth paper (4) presented in that session.

### Key to Conference Abbreviations

- **HILAS**  High Intensity Lasers and High Field Phenomena
- **ICUSD**  International Conference on Ultrafast Structural Dynamics
- **QIM**  Quantum Information and Measurement
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<tr>
<td>08:00–10:00</td>
<td>QT1A • Quantum Light and Matter Interaction</td>
<td>QT1B • Quantum Gaussian Light</td>
<td>HT1C • Lasers, OPA, OCPA</td>
<td>IT1D • X-ray Diffraction II</td>
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<tr>
<td>10:00–10:30</td>
<td>Coffee Break, Grosser Stern</td>
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<tr>
<td>10:30–12:30</td>
<td>JT2A • Joint QIM, HILAS, ICUSD Poster Session, Exhibit Hall 12</td>
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<td>12:30–14:00</td>
<td>Exhibit Hall / Lunch, Hall 13</td>
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<tr>
<td>14:00–16:00</td>
<td>QT3A • Photon Entanglement</td>
<td>QT3B • Quantum Information</td>
<td>HT3C • OCPA and Waveform Synthesis</td>
<td>IT3D • Electron Diffraction</td>
</tr>
<tr>
<td>16:00–16:30</td>
<td>Coffee Break, Grosser Stern</td>
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<tr>
<td>16:30–18:30</td>
<td>QT4A • Quantum Communication I</td>
<td>QT4B • Quantum Imaging</td>
<td>HT4C • HHG2</td>
<td>IT4D • THz Spectroscopy</td>
</tr>
<tr>
<td>19:00–21:00</td>
<td>Joint QIM &amp; HILAS Postdeadline Paper Session, Madrid</td>
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## — Wednesday, 21 March

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<td>QW1A • Quantum Communication II</td>
<td>QW1B • Novel Quantum Information and Measurement Techniques I</td>
<td>HW1C • Electronic Dynamics</td>
<td>IW1D • Structure Probes and Methods</td>
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<td>10:00–10:30</td>
<td>Coffee Break, Grosser Stern</td>
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<td>10:30–12:30</td>
<td>QW2A • Quantum Communication III</td>
<td>QW2B • Quantum Entanglement</td>
<td>HW2C • Electronic Dynamics and Attosecond Physics</td>
<td>IW2D • X-ray Absorption</td>
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<td>12:30–14:00</td>
<td>Exhibit Hall / Lunch, Hall 13</td>
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<td>14:00–16:00</td>
<td>QW3A • Quantum Information and Measurement with Photons II</td>
<td>QW3B • Quantum State Engineering I (starts at 14:45)</td>
<td>HW3C • NL and Extreme NL Optics</td>
<td>IW3D • 2D-IR</td>
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<td>16:00–16:30</td>
<td>Coffee Break, Grosser Stern</td>
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<td>16:30–18:00</td>
<td>QW4A • Novel Quantum Information and Measurement Techniques II</td>
<td>QW4B • Quantum State Engineering II</td>
<td>HW4C • Atomic and Molecular Physics (ends at 18:15)</td>
<td>IW4D • Phonon &amp; Vibrational Probes</td>
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### Key to Conference Abbreviations

- **HILAS**: High Intensity Lasers and High Field Phenomena
- **ICUSD**: International Conference on Ultrafast Structural Dynamics
- **QIM**: Quantum Information and Measurement

Research in Optical Sciences • 19–21 March 2012
is entanglement useful for metrology? Heisenberg's original limit wrong? When and how the limitations on quantum measurement. Was Canada. with a sensitivity higher than the shot-noise limit. and prove their applicability for phase estimation entangled states useful for quantum metrology a general criterion to identify multi-photon We experimentally demonstrate di Trento, Italy. Krischek1,2, Witlef Wieczorek3, Wieslaw Laskowski4, Physik, Universität Wien, Austria; 4Inst. for Quantum Optics, Germany; 3Facultät für Experimental Tradeoffs in Quantum Measure-ment: Uncertainty Relations, Weak Measure-ment and Quantum Metrology, Aephraim Steinberg1, Dylan Mahler1, Lee Rozema1, Ardavan Darabi2, Amir Feizpour1, Xingxing Xing1, Yasaman Soudagar1, Alex Hayat1; 1Physics, Univ. of Toronto, Canada. I will present an overview of several recent and ongoing experiments investigating the limitations on quantum measurement. Was Heisenberg's original limit wrong? When and how is entanglement useful for metrology?

### QMIA • Quantum Measurement

**QMIA.1 • 08:30**

**Invited**

Experimental Tradeoffs in Quantum Measurement: Uncertainty Relations, Weak Measurement and Quantum Metrology, Aephraim Steinberg1, Dylan Mahler1, Lee Rozema1, Ardavan Darabi2, Amir Feizpour1, Xingxing Xing1, Yasaman Soudagar1, Alex Hayat1; 1Physics, Univ. of Toronto, Canada. I will present an overview of several recent and ongoing experiments investigating the limitations on quantum measurement. Was Heisenberg's original limit wrong? When and how is entanglement useful for metrology?

**QMIA.2 • 09:00**

Multi-Photon Entanglement for Sub Shot-Noise Sensitivity, Christian Schwemmer1,2, Roland Krischek1, Wim van der Wiel1, Wiesław Łukowski1, Philipp Hyllus1, Harald Weinfurter1, Augusto Smerzi1, Luca Pezzè1; 1Faculty of Physics, Ludwig-Maximilians Universität, Germany; 2Max-Planck-Institut für Quantenoptik, Germany; 3Facultat für Physik, Universität Wien, Austria; 4Faculty of Physics and Astrophysics, University of Gdansk, Poland. We experimentally demonstrate a general criterion to identify multi-photon entangled states useful for quantum metrology and prove their applicability for phase estimation with a sensitivity higher than the shot-noise limit.

**QMIA.3 • 09:15**

Withdrawn

### QMIB • Quantum Atom-Photon Interaction

**QMIB.1 • 08:30**

**Invited**

Strong Atom-Photon Coupling in Free Space, Gerda Leuchs1, Robert Matyja1,3, Andreas Golla1, Martin Fischer1, Renato Chalopin1, Marianne Bader1, Simon Heugel1, Markus Sondheim1,2; 1Department of Physics, Univ. of Erlangen, Germany; 2Max Planck Inst. for the Science of Light, Germany. The limit of strong coupling can be reached without resonators or near-field antennas by exciting a single atom in free space with a properly designed dipole mode.

**QMIB.2 • 09:00**

Generation of a Macroscopic Singlet State in an Atomic Ensemble, Nisnnevich Bebhoor1, Mario Napolitano1, Giorgio Collangelo1, Bryce Dubost1, Silvana Palacios-Abram1, Robert J. Sewell1, Geza Toth2, Morgan W. Mitchell2; 1ICFO-Institut de Ciencies Fotòniques, Spain; 2Universitat Paris Diderot et CNRS, France; 3The Univ. of the Basque Country, Spain; 4ICREA-Instituto Catalana de Recerca i Estudis Avancats, Spain. We report on an experiment for generating singlet states in a cold atomic ensemble. We use quantum nondemolition measurement and feedback control to produce a macroscopic spin state with total spin zero and reduced spin fluctuations.

**QMIB.3 • 09:15**

Superadiabatic and Speed Limited Quantum Driving of Bose-Einstein Condensates in Optical Lattices, Donatella Ciampini1,2; 1Dipartimento di Fisica, Università di Pisa, Italy; 2Dipartimento di Fisica “E. Fermi”, University & Pisa, Italy. We implement optimal control schemes that approach the quantum speed limit as well as superadiabatic driving, achieving nearly perfect fidelity for a two-level quantum system realized with BECs in optical lattices.

### X-ray Scattering

**HMIC.1 • 08:30**

**Invited**

Attosecond Lighthouses: A New Tool for Ultrafast Science and Metrology, Fabien Quaire1, Henri Vincenti1,2; 1CEA, France. The attosecond lighthouse effect provides an unprecedentedly simple way of generating isolated attosecond pulses, and provides new opportunities for ultrafast measurements. It is analyzed theoretically, and first experimental evidence of this effect is presented.

**HMIC.2 • 09:00**

Generation of Coherent Radiation in the Water Window, Luy P. Dau1,2; 1CQU, Nanyang Technological University, Singapore; 2Australian Research Council Centre of Excellence for Coherent X-Ray Science, Australia. We report on experiments which evidence the generation of a coherent X-ray wavepacket by multiple optical excitation of a thin film transducer. The decay time of these phonon pulses is ~ 140 ps.

**HMIC.3 • 09:15**

Withdrawn

### X-ray Scattering

**IMID.1 • 08:30**

**Invited**

Time-resolved X-ray Scattering from Phonons, David A. Reis1,2; 1Photon Science, Stanford PULSE Inst., SLAC Nat. Accelerator Lab., USA; 2Photon Science and Applied Physics, Stanford Univ., USA. Advances in X-ray sources are enabling the study of material dynamics with unprecedented resolution down to the atomic scale. We present first-time- and momentum-resolved diffuse scattering measurements of nonequilibrium phonons in photexcited semiconductors.

**IMID.2 • 09:00**

Cross-Correlation Based 3D Structure Determination from Multi-Particle Scattering Images, Bill Pedrini1,2; 1SwissFEL, Paul Scherrer Inst., Switzerland. A large set of X-ray scattering images on multiple identical gold nanoparticles (350 nm) in random orientation was used to determine the 2D structure of the nanoparticle template at 20 nm resolution applying the cross-correlation method.
QM1A • Quantum Measurement—Continued

QM1A.4 • 09:30 Invited
Quantum Interferometry, Augusto Smerzi1; 1INO-CNR, Italy. Entanglement can increase the sensitivity of an interferometer well beyond the classical shot-noise limit. We discuss the last theoretical developments and a recent experiment demonstrating sub shot-noise with twin-Fock states created with trapped Bose-Einstein condensates.

QM1B • Quantum Atom-Photon Interaction—Continued

QM1B.4 • 09:30 Invited
Emission and Absorption of Single Photons by Single Atoms, Jürgen Eschner1,2, Jan Hauer1,2, Jörg Gühne1,2, Nicolas Piro1, François Dubé1, Michael Schug1, Christoph Kurz1, Philipp Müller1, José Brito1; 1Experimentalphysik, Universität des Saarlandes, Germany; 2ICFO - Institut de Ciències Fotoniques, Spain. For quantum networking, we show high-rate single-mode emission of bandwidth-tunable single photons from a single ion, and heralded absorption by the ion of single photons from SPDC photon pairs. The heralded absorption preserves entanglement.

HM1C • Short Wavelength Sources—Continued

HM1C.4 • 09:30
Bright Femtosecond X-ray Beams from Betatron Radiation and Thomson Backscattering, Cedric Thaury1, Sebastien Corde1, Victor Malka1, Antoine Rousse1, Kim Tapiauc1; 1Laboratoire d’Optique Appliquée, École Polytechnique, France. Bright femtosecond x-ray beams, with controlled features and energy up to a few hundreds of keV, have been produced by wiggling relativistic electrons, from a laser plasma accelerator, in a plasma wigglter and an electromagnetic wave undulator.

HM1C.5 • 09:45
Monochromatised XUV Pulses for Ultrafast Science at the Artemis Facility, Emma Springate1, Cephise Cacho1, Edmond Turcu1, Fabio Frassetto1, Paolo Villarri1, Luca Paoletti1, Will Bryan1, Russell Minter1, Jonathan Underwood1, Jesse Peterson1,2, Stefan Kaiser1, Nicky Dwee1, Alberto Simoncig6, Haiyan Lin1, Adrian Cavalieri6, Sarnjeet Dhesi7, Helmut Berger8; 1STFC Central Laser Facility, UK; 2National Research Council of Italy - Inst. of Photonics and Nanotechnologies, Italy; 3Department of Information Engineering, Univ. of Padova, Italy; 4Department of Physics, Swansea Univ., UK; 5Department of Physics, Univ. of Oxford, UK; 6Max Planck Department for Structural Dynamics, Centre for Free Electron Laser Science, Germany; 7Diamond Light Source, UK; 8École Polytechnique Fédérale de Lausanne, Switzerland. XUV pulses produced through high harmonic generation can probe electron dynamics in complex solid materials and in gas-phase atoms and molecules. This is demonstrated in gas-phase and condensed matter experiments at the Artemis facility.

10:00–11:00 Coffee Break, Grosser Stern
11:00–13:00 QM2A • Quantum Information and Measurement with Atoms and Ions
Alexander Sergienko; Boston Univ., USA, Presider

QM2A.1 • 11:00 Plenary
Quantum Information Processing and Quantum Simulations with Trapped Ions, Rainer Blatt1,2, Institute of Experimental Physics, Univ. of Innsbruck, Austria; Institute for Quantum Optics and Quantum Information, Austrian Academy of Sciences, Austria. The use of trapped ions for quantum information processing is reviewed. Quantum simulations employ well controlled quantum systems to make predictions on another quantum system under investigation. With trapped ions quantum relativistic effects and spin systems are simulated.

Rainer Blatt graduated in physics from the Univ. of Mainz in 1979. He finished his doctorate in 1981 and worked as a research assistant. He received the “venia docendi” in experimental physics in 1988 at the Univ. of Hamburg, became professor of physics at the Univ. of Göttingen in 1994 and was appointed a chair at the Univ. of Innsbruck in 1995. Since 2003 Blatt holds the position of Scientific Director at the Institute for Quantum Optics and Quantum Information (IQOQI) of the Austrian Academy of Sciences (ÖAW). Rainer Blatt's research focuses on trapped ions as a means to address fundamental questions in quantum optics, spectroscopy, and quantum information science.

QM2A.2 • 11:45 Invited
Quantum Feedback Experiments with Atoms and Cavities, Jean-Michel Raimond1, Clément Sayrin1, Igor Dutko1, XinXing Zhou1, Bruno Pasudarczef1, Tho Rybarczyk1, Sebastien Gleyzes1, Michel Brune1, Jean-Paul Brichet1, Sergei Patchkovskii2, Michael Spanner2, Physics, Univ. of Ottawa, Canada; National Research Council, Canada. High harmonic generation in unaligned molecular isomers is shown to be distinguishable and is attributed to differences in angle dependent sub-cycle ionization yields.

11:00–13:00 HM2C • Short Wavelength Sources and Applications
Jon Marangos, Imperial College London, UK, Presider

HM2C.1 • 11:00 Invited
Protein Crystal Structure Determination and Radiation Damage at a Dose of 3 GGy using a Free-Electron Laser, Ilme Schlichting1, Lukas Lamb1,2, Thomas R. Barends1,2, Department of Biomedical Mechanisms, Max Planck Inst. for Medical Research, Germany; Max Planck Advanced Study Group, Center for Free Electron Laser Science, Germany. Radiation damage induced by 2 keV femtosecond X-ray pulses was studied in protein microcrystals as a function of pulse length and fluence. Dose and dose rate dependent effects were observed, suggesting the occurrence of “hotspots” for damage.

HM2C.2 • 11:30 Invited
High Harmonic Spectroscopy of Molecular Isomers, Ravi Bhardwaj1, Michael Wong1, Jean-Paul Brichet1, Sergei Patchkovskii2, Michael Spanner2, Physics, Univ. of Ottawa, Canada; National Research Council, Canada. High harmonic generation in unaligned molecular isomers is shown to be distinguishable and is attributed to differences in angle dependent sub-cycle ionization yields.

11:00–13:00 IM2D • X-ray Diffraction
David Reis, Stanford PULSE Inst., SLAC Nat. Accelerator Lab., USA, Presider

IM2D.1 • 11:00 Tutorial
Controlling and Probing Atomic, Electronic and Magnetic Structural Dynamics in Complex Oxides, Andrea Cavalleri1, Max Planck Department for Structural Dynamics, Germany. In this tutorial, we will discuss key advances in control and probing of atomic structures, of electronic and magnetic order and of transient band structures in strongly correlated electron systems. These dynamics are typically controlled with near and far infrared radiation and probed with ultrashort-x-ray scattering, spectroscopy and with time and angle resolved photo-emission.

IM2D.2 • 11:45 Invited
Ultrafast Structural Dynamics in Manganites Associated with Phase Transitions, Paul Beaud1, Andrin Caviezel1, Steven L. Johnson2, Urs Staedt1, Simon O. Mariager1, Shih-Wen Huang3, Christopher J. Milne3, Ekaterina Mokr-Vorobeva1, Sebastian Gruber1, Jeremy A. Johnson1, Gerhard Ingold1, Swiss Light Source, Paul Scherrer Institut, Switzerland; Institute for Quantum Electronics, ETH, Zurich, Switzerland; Laboratoire de Spectroscopie Ultrarapide, EPFL, Switzerland. We use femtosecond x-ray diffraction to study the structural dynamics in three dimensional manganites accompanying photo-induced phase transitions. Initial dynamics of the phase transition are found to be significantly faster than 200 fs.

In this tutorial, we will discuss key advances in control and probing of atomic structures, of electronic and magnetic order and of transient band structures in strongly correlated electron systems. These dynamics are typically controlled with near and far infrared radiation and probed with ultrashort-x-ray scattering, spectroscopy and with time and angle resolved photo-emission.
QM2A • Quantum Information and Measurement with Atoms and Ions—Continued

QM2A.3 • 12:15
Single-ion Quantum Lock-in Amplifier, Shlomi Kotler1, Nitzan Akerman1, Yinnon Glickman1, Anna Keidar1, Roei Ozeri1; 1Physics of Complex Systems, Weizmann Inst. of Science, Israel. We implement a quantum analogue to the classical lock-in amplifier. With this method we reach a measurement sensitivity two order of magnitude better than with other single spin probe technologies.

QM2A.4 • 12:30
Microtrap Arrays On Magnetic Film Atom Chips For Quantum Information Science, Vanessa Leung2, Atef Tauschinsky1, Klaasjan van Druten1, Robert Spreeuw1; 1Inst. of Physics, Univ. of Amsterdam, Netherlands. We discuss two approaches for developing a quantum information science platform, based on microtrap arrays on a magnetic-film atom chip. One uses Rydberg mediated interactions, the other simulates the Hubbard model in sub-wavelength lattices.

QM2A.5 • 12:45
Atomic Quantum Metrology with Polarization-Entangled States of Light, Florian Wolzgramm1, Chiara Vitelli2, Federica A. Bedin1, Nicolas Godbout1, Morgan W. Mitchell1; 1CPH, The Inst. of Photonics Science, Spain; 2Dipartimento di Fisica, Universita’ Sapienza di Roma, Italy; 3CPL, Departement de Gisite Physique, Ecole Polyteh- nique de Montreal, Canada; 4ICREA-Institucio Catalana de Recerca i Estudis Avancats, Spain. We report on the first use of quantum entanglement to improve non-destructive measurement of a delicate system: We use narrowband NOON states to break the standard quantum limit in an optical magnetometer.

QM2B • Quantum Information and Measurement with Atoms and Ions

HM2C • Short Wavelength Sources and Applications—Continued

HM2C.3 • 12:00
Results of Recent Experiment at (x-Ray) Free Electron LASERS on Carbon-like Materials, Shahgol Dastjani Farahani1, A. London1, C. Bostedt1, S. Hau-Riege1, S. Moeller1, J. Bzotek1, H. Chapman1, K. Tiedtke1, S. Tolek1, H. Wahn1itz1, K. Sobierajski1, M. Jurk1, M. Stormer1, A.J. Glasson1, J. Chalupsky1, T. Buriak1, L. Vya1, L. Juh1, H. Sinn1, Th. Tschentscher1, J. Gaudin1; 1European XFEL, Germany; 2Inst. of Physics, Academy of Sciences of the Czech Republic, Czech Republic; 3CCRL, Daresbury Laboratory, UK; 4GKSS-Forschungszentrum Geesthacht GmbH, Max-Planck-Strasse, Germany; 5Center for Free-Electron Laser Science, Germany; 6HASYLAB/ DESY, Germany; 7Lawrence Livermore National Laboratory, USA; 8SLAC National Accelerator Laboratory, USA; 9Inst. of Physics, Polish Academy of Sciences, Poland. Carbon based materials have been irradiated by FELs x-ray pulses. The damage threshold is determined for hv = 25, 91, 177 and 830 eV. The irradiated material is characterized ex-situ by AFM, µ-Raman and photoemission spectroscopy.

HM2C.4 • 12:15
Pulse Width Dependent Damage Testing of Critical Components in Vacuum for Petawatt Class Short Pulse Lasers, Enam Chowdhury1, Patrick Poole1, Rebecca Daskalova1, Richard Freeman1, Douglas Smith1; 1The Ohio State Univ., USA; 2Plymouth Grating Laboratory, USA. Vacuum damage testing of novel pulse compression gratings and mirrors have been damage tested with a 30 fs - 200 fs, 800 nm laser, and found that damage threshold increases weakly as pulse duration shortens.

HM2C.5 • 12:30
XUV-driven Electronic Correlation Probed with Strong Ti:s 000 Light Fields, Markus Drescher, Univ. of Hamburg, Germany. Strong (~ 1 MV/ cm) Ti:s 000 fields steer the motion of XUV-ionized photo- and Auger-electrons in an atomic potential, revealing an intrinsic time-dependent non-linear spectral chirp of the correlated particles.

IM2D • X-ray Diffraction—Continued

IM2D.3 • 12:15
Lattice and Magnetic Dynamics of a Laser Induced Phase Transition in FeRh, Simon O. Marisager1, F. Presusaco, Gerhard Ingold3, Andrin Caviezel2, Ekaterina Möhr-Vorobeva1, Paul Beaud1, Steven L. Johnson3, Christopher J. Milne1, Robert Fiedrahns3, C. Back3, Christoph Quintsmann3; 1Swiss Light Source, Paul Scherrer Institut, Switzerland; 2Fakultät für Physik, Univ. of Regensburg, Germany; 3Inst. for Quantum Electronics, ETH Zürich, Switzerland; 4Ecole Polytehnic Fédrale Lausanne, Switzerland; 5Niels Bohr Inst., Univ. of Copenhagen, Denmark. We study the two coupled components of the laser induced phase transition in FeRh. We compare structural and magnetization dynamics measured with respectively time-resolved x-ray diffraction and magneto optical Kerr effect.

IM2D.4 • 12:30
Following Strain-Induced Mosaicity Changes of PbZr0.2Ti0.8O3 Thin Films by Ultrafast Reciprocal Space Mapping, Daniel Schick1, André Bojahr2, Marc Herzig1, Peter Gaal1, Mathias Bargeveld1; 1Institut für Physik & Astronomie, Universität Potsdam, Germany. We present first results on mosaicity changes in a ferroelectric PbZr0.2Ti0.8O3 thin film on a timescale utilizing a new ultrafast reciprocal space mapping technique.

IM2D.5 • 12:45
Femtosecond X-Ray Powder Diffraction on LiBH4, Flavio Zamponi1, Johannes Sting2, Benjamin Freyer1, Michael Wörner1, Thomas Elsässer1, Andreas Borghse2,1 Max Born Inst., Germany; 2Laboratory for Hydrogen and Energy, EMPA, Switzerland. We report the first femtosecond x-ray diffraction experiments on LiBH4. During off-resonant excitation with 800-nm pulses we observe a purely electronic modification of the transient diffraction pattern, followed by coherent atomic motions.
Quantum Optomechanics: A Mechanical Platform for Quantum Foundations and Quantum Information, Markus Aspelmeyer\textsuperscript{1,2}, Univ. of Vienna, Austria. Quantum optical control over the motion of nano- and micromechanical resonators has now become possible in a broad variety of architectures. We will present the status, prospects and challenges of this emerging field of quantum optomechanics.

Integrated Quantum Photonics, Jeremy O’Brien\textsuperscript{1}, Univ. of Bristol, UK. We have developed an integrated waveguide approach to photonic quantum circuits for high performance, miniaturisation and scalability. Here we report high-fidelity silica-on-silicon integrated optical realizations of key quantum photonic circuits, including two-photon quantum interference and a controlled-NOT logic gate. Finally, we give an overview of our recent work on fundamental aspects of quantum measurement and diamond and nonlinear photon sources.

Optomechanical systems are approach- ing the quantum regime. We show that mechanical systems can be efficiently interfaced to atoms, and how dissipative coupling can be achieved in a Michelson-Sagnac Interferometer.

Optomechanical systems as Single Photon Routers, Sumei Huang\textsuperscript{1,2}, Univ. of Erlangen, Germany. We show how EIT in cavity optomechanical systems can be used to produce a switch for a probe field in a single photon Fock state using very low pumping powers of few microwatt.

High Resolution Measurement of Polarization Mode Dispersion in Discrete Telecom Devices using Quantum Interferometry, Alexander Ser- gensen\textsuperscript{1}, Andrew Freame\textsuperscript{1}, Olga Mineva\textsuperscript{1}, David Si- man\textsuperscript{1}, Roman Egorov\textsuperscript{1}, Dept. of ECE/ENG, Boston Univ, USA. A quantum interferometric technique for measuring polarization mode dispersion (PMD) of commercial telecommunication wavelength selective switch (WSS) demonstrates advantages of quantum optical technology over conventional measurement.

Optimal Multi-photon Phase Sensing with a Single Interference Fringe, Guoyong Xiang\textsuperscript{1,2}, Key Lab of Quantum Information, Univ. of Science & Technology of China, China; 2Graduate School of Advanced Sciences of Matter, Hiroshima Univ., Japan; IST Japan. The maximally-entangled NOON state does not achieve optimal phase sensitivity when N > 4, rather, the Holland-Burnett state is optimal. We experimentally demonstrate this enhanced sensitivity using the six-photon Holland-Burnett state.

Polarization Gating in Plasmon-assisted Low-intensity High Harmonic Generation, Anton Husakou\textsuperscript{1,2}, Freek Kelkensberg\textsuperscript{2}, Joachim Hauer\textsuperscript{2}, Marc J. Vrakking\textsuperscript{1,2}, Max Born Inst., Germany; 2Institute of Applied Optics and Precision Engineering, Germany. We present high harmonic generation at MHz repetition rate performed with a fiber CPA system. Up to 5.7 µW are converted to a single harmonic at 49 nm. Additionally, further scaling potential is presented.

Efficiency Scaling of High Harmonic Generation Driven by a Tunable Optical Parametric Amplifier in the Visible, Giovanni Cirone\textsuperscript{1}, Chien-Jen Lai\textsuperscript{1}, Eduard Grandesso\textsuperscript{1}, Shu-Wei Huang\textsuperscript{1}, Phillip Keatley\textsuperscript{1}, Alexander Sell\textsuperscript{1}, Franz Ka¨rner\textsuperscript{2}; 1Dept. of Electrical Engineering and Computer Science and Research Laboratory of Electronics, MIT, USA; 2Center for Free-Electron Laser Science, DESY and Univ. of Hamburg, Germany; IKERBASQUE, Basque Foundation for Science, Spain. High Harmonic Generation efficiency increases for short driver wavelengths. We study experimentally the driver wavelength dependence around 32 eV by driving the process with a tunable Optical Parametric Amplifier in the visible range.

Two-Dimensional Optical Spectroscopy of Charge Transfer, Tomas Mancal\textsuperscript{1}, Niklas Milet\textsuperscript{1}, Frank van Mourik\textsuperscript{1}, Majed Chergui\textsuperscript{1}; 1Laboratory of Ultrafast Spectroscopy, EPFL, Switzerland. We present a broadband UV two dimensional transient absorption setup (70–80 nm excitation, 80–100 nm probe, centered at 310 nm). Data on different systems will be shown and the capabili- ties of the setup discussed.

Polarization Gating in Plasmon-assisted Low-intensity High Harmonic Generation, Anton Husakou\textsuperscript{1,2}, Freek Kelkensberg\textsuperscript{2}, Joachim Hauer\textsuperscript{2}, Marc J. Vrakking\textsuperscript{1,2}, Max Born Inst., Germany; 2Institute of Applied Optics and Precision Engineering, Germany. We present high harmonic generation at MHz repetition rate performed with a fiber CPA system. Up to 5.7 µW are converted to a single harmonic at 49 nm. Additionally, further scaling potential is presented.

Efficiency Scaling of High Harmonic Generation Driven by a Tunable Optical Parametric Amplifier in the Visible, Giovanni Cirone\textsuperscript{1}, Chien-Jen Lai\textsuperscript{1}, Eduard Grandesso\textsuperscript{1}, Shu-Wei Huang\textsuperscript{1}, Phillip Keatley\textsuperscript{1}, Alexander Sell\textsuperscript{1}, Franz Ka¨rner\textsuperscript{2}; 1Dept. of Electrical Engineering and Computer Science and Research Laboratory of Electronics, MIT, USA; 2Center for Free-Electron Laser Science, DESY and Univ. of Hamburg, Germany; IKERBASQUE, Basque Foundation for Science, Spain. High Harmonic Generation efficiency increases for short driver wavelengths. We study experimentally the driver wavelength dependence around 32 eV by driving the process with a tunable Optical Parametric Amplifier in the visible range.

Two-Dimensional Electronic Spectroscopy for Vibrational Wavepacket Analysis and Electronic Structure Determination, Niklas Christenson\textsuperscript{1}, Tomas Mancal\textsuperscript{1}, Niklas Milet\textsuperscript{1}, Oliver Bixner\textsuperscript{1}, Harald F. Kauflmann\textsuperscript{1}, Jürgen Hauer\textsuperscript{1}; 1Faculty of Physics, Univ. of Vienna, Austria; 2Faculty of Mathematics and Physics, Charles Univ. in Prague, Czech Republic. We discuss two unconventional studies in two-dimensional electronic spectroscopy. First, it aids vibrational wavepacket analysis in a solvated molecule near the zero-phonon line. Second, it refines the electronic energy level scheme of β-carotene.
Monday, 19 March

17:00–21:00 Welcome Reception, Hall 13

QM3A • Novel Systems for Quantum Measurement—Continued

QM3A.4 • 15:30
Optimal Mass-sensing with a Nano-mechanical Resonator, Daniel Braun1,2; 1Univ. Toulouse Paul Sabatier, France. 2report the quantum Cramér-Rao bound on the sensitivity of mass-sensing with a nano-mechanical resonator as function of its quantum state and identify the quantum states which allow the largest sensitivity for given maximum energy.

QM3A.5 • 15:45
Withdrawn

QM3A.6 • 16:00
A Reversible Optical to Microwave Quantum Interface, David Vital1,2, Shabir Barzanjeh3, Mehdi Abdé1, Paolo Tamborini1, Gerard J. Milburn1; 1Physics Division, Univ. of Camerino, Italy; 2Centre for Engineered Quantum Systems, School of Physical Sciences, Univ. of Queensland, Australia. We describe a quantum interface between an optical and a microwave field based on their common interaction with a nano-mechanical resonator, which is an effective source of optical-microwave two-mode squeezing.

QM3A.7 • 16:15
High-Sensitivity Absolute Atomic Gravimeter, Christine Guerret1, Tristan Farah1, Anne Louchet-Chauvet1, Sébastien Merlet1, Franck Freinaux2; 1LNE-SYRTE, CNRS-Observatoire de Paris, France. Our cold atom free fall interferometer measures the acceleration of gravity with performances comparable to the best classical absolute gravimeters. Current developments to overcome these state-of-the-art limits include the use of ultracold atoms.

QM3B • Quantum Information and Measurement with Photons—I—Continued

QM3B.4 • 15:30
Invited
Quantum Information Processing with Integrated Optics and Pulsed Light, Christine Silvera1, 2; 1Univ. of Padua, Italy; 2Univ. of Paderborn, Germany. We present our latest results on photonic quantum systems using integrated optics and pulsed states of light. Our approach offers distinct features for the implementation of advanced quantum devices and networks, and ‘compressed’ information encoding.

QM3B.5 • 16:00
Integrated Photonic Quantum Information Processing based on Polarization Encoding, Fabio Scaerema1, Linda Sansoni2, Paolo Mataloni2, Andrea Crespi2,3, Roberta Ramponi2, Roberto Osellame2,3; 2Dipartimento di Fisica, Sapienza Università di Roma, Italy; 3Istituto di Fotonica e Nanotecnologie, Consiglio Nazionale delle Ricerche, Italy. 3Dipartimento di Fisica, Politecnico di Milano, Italy. Integrated photonics has a strong potential for quantum information processing. We demonstrate an integrated Controlled-NOT gate for polarization encoded qubits and investigate how the particle statistics influences a two-particle quantum walk.

QM3B.6 • 16:15
Beating the Classical Resolution Limit via Multi-photon Interferences of Independent Light Sources, Steffen Oppel1, Thomas Baunten1, Pietro Kok1, Joachim von Zanthier1,2; 1Institut für Optik, Information and Photonik, Friedrich-Alexander-Universität Erlangen-Nürnberg, Germany; 2Erlangen Graduate School in Advanced Optical Technologies (SAOT), Friedrich-Alexander-Universität Erlangen-Nürnberg, Germany. We discuss multi-photon interferences up to fifth-order between indistinguishable photons emitted by independent light sources. For certain detector positions we observe an interference pattern which beats the classical resolution limit.

QM3B.7 • 16:30
High-Order Harmonic Generation in Stabilized Plasma Plumes Using the 800 and 1300 nm Femtosecond Pulses, Bashid Gareev1, C. Hutchinson1,2, A. Zait1,2, T. Witting1, F. Frank1, S. Weber1, W. A. Ockel1, W. Tisch1, J. P. Manzinger1,2; 1Imperial College London, UK. We show the advantages of using the rotating targets for plasma harmonic generation, which allowed the dramatic improvements of harmonic stability in the case of resonance enhancement and application of 1300 nm radiation.

QM3C • HHG1—Continued

HM3C.5 • 15:30
High-field Nonlinear Fiber Optics, Kafan Mak1, John C. traviers1, Philipp Hoeker1, Woenkun Chang1, Nicolas Y. July1,2, Mohammed F. Salhi1, Fabio Biancalana1, Philip Russell1,2; 2Max Planck Inst. for the Science of Light, Germany. 3Univ. of Erlangen-Nuremberg, Germany. Soliton compression of few-μJ fs-pulses leads to ionization in gas-filled photonic crystal fiber, and the emission of blue-shifting solitons. By pressure-tuning the dispersion we observe the transition between plasma and Kerr induced propagation.

HM3C.6 • 15:45
Low- and high-order Harmonic Generation Inside an Air Filament, Tobias Vockeroth1,2, Daniel Steingrube1,2, Emilia Schulz1,2, Martin Kretschmar1, Uwe Morgner1,2, Milutin Kovacev1,2; 1Inst. of Quantum Optics, Leibniz Universitaet Hannover, Germany; 2QUEST Centre of Quantum Engineering and Space-Time Research, Germany. Third- and high-order harmonic generation inside a self-guided femtosecond filament in air is demonstrated. We observe broadband ultraviolet radiation with a Fourier-limited pulse durations below 5fs and conversion up to the 25th harmonic order.

HM3C.7 • 16:00
Phase-matching Aspects in High-Order Harmonic Generation from Liquid Water Droplets, Milutin Kovacev1,2, Uwe Morgner1,2, Daniel Steingrube1,2, Heiko G. Kurz1,2, Delev-Ristov1, Manfred Lenk1,2; 1Leibniz Univ. Hannover, Germany; 2QUEST Centre for Quantum Engineering and Space-Time Research, Germany; 3Laser Zentrum Hannover e.V., Germany. We report on phase-matching aspects during high-order harmonic generation from micrometer-sized liquid water droplets. Phase-matching effects are studied by variation of the focal position and the density of the target.

HM3C.8 • 16:15
Third-order and high-order harmonic generation inside a self-guided femtosecond filament in air is demonstrated. We observe broadband ultraviolet radiation with a Fourier-limited pulse durations below 5fs and conversion up to the 25th harmonic order.

IM3B • Electronic Excitations—Continued

IM3B.4 • 16:00
Fast Recombination After Electron Photo-Detachment of Hydroxide in H-bonded Liquids, Robert Broy1,2, Matyas E Fischer1,2, Alfred Laubereau1, Brista Igler1, Physics, E11, TU Munich, Germany. PREP spectroscopy on OH– in H-bonded liquids reveals an ultralatinate geminate recombination channel. The process is assigned to formation of short-lived OH–e- pairs facilitated by the inhomogeneous local H-bonding environment of OH–.

IM3C • Quantum Information and Measurement

IM3C.4 • 15:30
Multimode Quantum Optics, Invited, Andrea Cavalcanti, Francesco Pirei1, Thomas Feurer1, Ahmad Odeh1, Frank van Mourik1, Majed Chegri2, Davide Espe1, Maria Laura Mercari1, Luca Pilla1, Angela Serpe1, Paola Deplano1, Antonio Vliek1; 1Inst. of Applied Physics, Univ. of Bern, Switzerland; 2Laboratoire de Spectroscopie Ultrarapide, Ecole Polytechnique Fédérale de Lausanne, Switzerland; 3Dipartimento di Chimica Inorganica ed Università di Cagliari, Italy; 4Queen Mary Univ., UK. Here we present our first results on the fs to ps relaxations in a series of square-planar d8 metal mixed-ligand dithiolene complexes, investigated with fs time resolved broadband transient absorption spectroscopy.

IM3D • Quantum Information Processing

IM3D.6 • 16:00
Heterodyne Detected Transient Grating UV/VIS-pump IR-probe Measurements of Energy Transport through Proteins, Hallina Stražalk1, Shabir Barzanjeh3, Paul M. Donahou1, Peter Hann1; 1PCL, Universität Zürich, Switzerland. The transient grating technique is applied to UV/VIS-pump IR-probe measurements to obtain a background free transient infrared signal. In comparison with conventional UV/VIS-pump IR-probe measurements the S/N is enhanced by a factor of 25.
QT1A • Quantum Light and Matter Interaction
Shigeki Takeuchi; Hokkaido Univ., Japan, Presider

QT1A.1 • 08:00
Invited Quantum Networking with Individual Qubits of Light and Matter, Gerhard Rempe1; ‘Max-Planck Inst. of Quantum Optics, Germany. Two remote atoms permanently trapped in two optical resonators and reversibly connected by single photons constitute an elementary version of a scalable quantum network with the ability to send, retrieve, store and process quantum information.

QT1A.2 • 08:30
Coherent Storage and Retrieval of an Image using a Gradient Echo Memory in an Atomic Vapor, Jeremy B. Clark1,2, Quartin Giroiroux1, Alberto Martine1, Paul D. Lett1, ‘Univ. of Maryland, USA; ‘JQI, USA. We experimentally demonstrate the storage of an image in the long-lived ground state coherence of a warm atomic rubidium ensemble using a gradient echo memory.

QT1A.3 • 08:45
Realization of Nonlinear Interferometer using the Four Wave Mixing in Hot Rubidium Vapor, Jietai Jing1; Cunjin Liu1,2, Zhihao Zhou1, Florian Hulde1, Z. Y. Ou1,2, Weiping Zhang1, ‘State Key Lab of Precision Spectroscopy, Department of Physics, East China Normal University, China; ‘Department of Physics, Indiana Univ.-Purdue Univ. Indianapolis, USA. We experimentally realized a nonlinear interferometer which has a visibility close to 1 and can result in an enhancement of phase sensitivity with a factor of 2G2 compared to the linear interferometer.

QT1B • Quantum Gaussian Light
Daniel Gauthier; Duke Univ., USA, Presider

QT1B.1 • 08:00
Invited Ultimate Sensitivity in Precision Optical Measurements using Intense Gaussian Quantum Light: A Multi-Modal Approach, Claude Fabre1; Olivier Pelle1, Pa Juan1, Nicola Treps1, Julien Fabe1, Daniel Braun1; ‘Laboratoire Kastler Brossel, France; ‘Institut de Physique de Rennes, France; ‘Laboratoire de Physique Théorique, France. We study the Quantum Cramer Rao limit in parameter estimation when the parameter is encoded in intense Gaussian quantum light. It can be reached without entanglement, just by squeezing a single well-defined light mode.

QT1B.2 • 08:30
Generation of non-Gaussian Pulsed States by Conditional Measurements, Alessia Allevi1, Stefano Olivares1, Matteo G. A. Paris1, Maria Bondani1; ‘Dipartimento di Scienze e Alta Tecnologia, Università degli Studi dell’Insubria, Italy; ‘C.N.I.S.M. U.d.R. Como, Italy; ‘Dipartimento di Fisica, Università degli Studi di Trieste, Italy; ‘CNISM U.d.R. Milano Statale, Italy; ‘Dipartimento di Fisica, Università degli Studi di Milano, Italy; ‘Istituto di Fotonica e Nanotecnologia, C.N.R., Italy. Non-Gaustianity is a resource for Quantum Information. By performing conditional measurements on classically and quantum correlated optical states with different photoreolving detectors we generated non-Gaussian states in the mesoscopic regime.

QT1B.3 • 08:45
Experimental Preparation of Eight-partite Cluster State with Continuous Variable Entanglement, Xiaolong Su1,2, Xiangyun Zhao1, Shufang Hao1, Changde Xie1, Ruichi Peng1; ‘State Key Laboratory of Quantum Optics and Quantum Optics Devices, Inst. of Opto-electronics, Shanxi Univ., China. Cluster state is the essential resource for one-way quantum computing. Here, we present the latest experimental achievement on the preparation of eight-partite linear and continuous diamond shape cluster states with continuous variable entanglement.

HT1C • Lasers, OPA, OPCPA
Tobias Witting; Imperial College London, UK, Presider

HT1C.1 • 08:00
Science on the Texas Petawatt Laser and Technology Development Toward an Exawatt Laser, Todd Ditmire1; ‘Univ. of Texas at Austin, USA. I will review recent experiments on the 150 fs, 180 J Texas Petawatt laser including cluster fusion, wakefield acceleration and proton-heated, warm dense matter experiments. I will also discuss recent technology work toward an exawatt laser.

HT1C.2 • 08:30
Contrast Enhancement for Astra-Gemini Laser, Yunxin Tang1, Chris J. Hooker1, Bryn Parry2, Oleg Chklovski1, Steve Hawkes1, Klaus Erdel1, Rajeev Pattathil1, John L. Collier1; ‘Central Laser Facility, Rutherford Appleton Lab., UK. We report on the contrast enhancement for Astra-Gemini laser following identifying the major source of coherent contrast, in conjunction with plasma mirrors. Replica prepulses were suppressed or eliminated by employing the wedged optics.

HT1C.3 • 08:45
A Cryogenic Gas Cooled Multi-Slab Yb:YAG Amplifier Producing 6.4 J at 10 Hz, Klaus Erdel1, Saumyabrata Banerjee1, Paul D. Mason1, Paul J. Phillips1, Cristina Hernandez-Gomez1, John L. Collier1; ‘Central Laser Facility, STFC Rutherford Appleton Laboratory, UK. We present preliminary results for DiPOLE, a cryogenic Yb:YAG DPSSL amplifier using a temporary extraction architecture. Measured average powers and optical-to-optical efficiencies already compare favourably to existing systems.

IT1C • X-ray Diffraction II
Andrea Cavalleri; Max Planck Department for Structural Dynamics, Germany, Presider

IT1C.1 • 08:00
Time-resolved Laue Diffraction at High Positional Accuracy and the Optimizing of Time-Resolution at Synchrotron Beamlines, Philip Coppens1; Chemistry, Univ. at Buffalo, The State Univ. of New York, USA. Modification of the Laue technique to allow high-accuracy pump-probe experiments will be discussed. They include the RATIO method which eliminates the wavelength dependence of the results. A method to increase the time-resolution below the length of the synchrotron X-ray pulse will be described.

Dr. Philip Coppens received his Ph.D from the Univ. of Amsterdam in 1960 on the basis of solid-state photochemistry research done at the Weizmann Inst. of Science. He continued his research at Brookhaven National Laboratory before moving to the State Univ. of New York at Buffalo, where he is currently SUNY Distinguished Professor of Chemistry. After extensive work on electron density mapping by accurate X-ray diffraction he returned to his earlier interest in photo-induced chemical changes in molecular crystals including reactions in supramolecular solids and time-resolved studies of species with lifetimes of microseconds and less by pulsed laser-pump/X-ray probe experiments. For more information see harker.chem.buffalo.edu.

IT1D • X-ray Diffraction
Benjamin Freyer1, Johannes Stingl1, Flavio Zampini2, Michael Woerner3, Thomas Elser4; ‘Max-Backen, Berlin, Germany. We demonstrate the rotating-cryystal method in femtosecond x-ray diffraction. A pump-probe scheme maps structural dynamics of a photoexcited bismuth crystal via changes of the diffracted intensity on a multitude of Bragg reflections.

IT1D.1 • 08:45
The Rotating Crystal Method in Femtosecond X-Ray Diffraction, Benjamin Freyer1, Johannes Stingl1, Flavio Zampini2, Michael Woerner3, Thomas Elser4; ‘Max-Backen, Berlin, Germany. We demonstrate the rotating-crystal method in femtosecond x-ray diffraction. A pump-probe scheme maps structural dynamics of a photoexcited bismuth crystal via changes of the diffracted intensity on a multitude of Bragg reflections.
Laser cooling and trapping group, NIST, macroscopic number of electron spins in the form of vacuum Rabi oscillations, between a superconducting artificial atom (flux qubit) and a flux qubit to an Electron Spin Ensemble in Coherent Coupling of a Superconducting Artificial Atom.

Matter Interaction—Continued

Coherent Coupling of a Superconducting Flux Qubit to an Electron Spin Ensemble in Coherent Coupling of a Superconducting Artificial Atom.

Multiparticle Photonic Entanglement Generated from Polarization Squeezing at 795 nm, Federviva A. Bedani,

Fundamental Limit to Qubit Control with Coherent Field, Kazuhiro Igeta,

Storing Quantum States in a Slow Light Cavity, Stefán Kríll,

Superluminal Twin Beams, Superluminal Images and the Arrival Time of Spatial Information in Optical Pulses with Negative Group Velocity, Ulrich Vogl,

High average-power, Self-CEP Stable Few-cycle Pulses at 2.1 µm Through Collinear OPA in BiB3O6, with an energy of 3.36J centered at 800nm was generated with pump of 35J. After compression, the pulse duration was 44.3fs.

1.5 Octaves from VIS to NIR, Anne Harts, Marcel Schultz,

Ultrafast x-ray Studies of Ferroelectric Materials, Aaron Lindenbery,

Ultrafast Structural Dynamics

Coherent Field, Stefan Kück,

Ultrafast Optical Parametric Amplification in Yttrium Calcium Oxyborate, Xiaoyan Liang,

Experimental investigation of the coupling of coherent Eg mode of bismuth created by intense laser excitation. Coherent amplitudes on the order of 0.1 pm are observed.

Watching Femtosecond Symmetry Breaking in Bismuth with X-Ray Diffraction, Jerome Faure,

Ultrafast Structural Dynamics

Coherent Gaussian Light—Continued

Probing Multimode Squeezing with Correlation Functions, Andreas Christ,

Studying Photon Antibunching of Bunched Emitters, Silke Peters,

High average-power, Self-CEP Stable Few-cycle Pulses at 2.1 µm Through Collinear OPA in BiB3O6, with an energy of 3.36J centered at 800nm was generated with pump of 35J. After compression, the pulse duration was 44.3fs.

Superluminal Twin Beams, Superluminal Images and the Arrival Time of Spatial Information in Optical Pulses with Negative Group Velocity, Ulrich Vogl,

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1.5 Octaves from VIS to NIR, Anne Harts, Marcel Schultz,

Ultrafast x-ray Studies of Ferroelectric Materials, Aaron Lindenbery,

Ultrafast Structural Dynamics

Coherent Field, Stefan Kück,
JT2A.1 Perturbative Treatment of Up-conversion Detection of Pulsed-shaped Entangled Photons, André Stepanov1, Bane Bosnjak2, Christof Bernhard2, Thomas Feurer1; 1Institute of Applied Physics, Univ. of Bern, Switzerland. We perturbatively describe the sum frequency generation of broadband and entangled photons in a non-linear crystal and use this to explain the results of the implementation of different interferometric setups with an SLM.

JT2A.2 A Non-Gaussian Master Equation for the Optomechanical Strong Coupling Regime, Nils Lohse1; 1Institute for Quantum Optics and Quantum Information and Max Planck Inst. for Gravitational Physics, Germany. We derive a non-Gaussian master equation for the strong coupling regime (\(g^2\ll 1\)) of an optomechanical system and aim to describe quantum phenomena such as negativity in the mechanical Wigner function analytically.

JT2A.3 Experimental Study of Free-space Beam Propagation for Single-photon Quantum Communications, Giuseppe Vallone1, Paolo Villoresi2, Ivan Capraro1, Alberto Dall' Arche1, Andrea Tomaello1, Francesco Gerlin1; 1Department of Information and Advanced Optical Technologies (SAOT), Univ. of Padova, Italy. We report on the study the propagation of a laser beam over a 144 free-space link. We report on the losses of the channel, the temporal scintillation of the intensity and, by attenuating the beam, the statistic of arrival of single photons.

JT2A.4 Decomposition of Rank-two Mixed States and Quantum State Discrimination, Luis Roa2; 1Department of Physics, Universidad de Concepción, Chile; 2Department of Physics, National Tsing Hua Univ., Taiwan. We investigate the two charge qubits subject to telegraph noise. In order to study the effect of the telegraph noise on the entanglement we adopt the concurrence. We show that the telegraph noise led to complete disentanglement.

JT2A.5 Conclusive Entanglement Modification by a Local Non-unitary Operation, Luis Roa1; 1Department of Physics, Universidad de Concepción, Chile; 2Department of Physics, National Tsing Hua Univ., Taiwan. We describe how the entanglement of formation of a family of bipartite 2x2-dimensional mixed states which are obtained from tripartite 2x2x2 pure states.

JT2A.6 Entanglement for 2xd-dimensional systems, Luis Roa1,2; Departamento de Fisica, Universidad de Concepcion, Chile. We calculate analytically the entanglement of formation for a family of bipartite 2xd-dimensional mixed states which are obtained from tripartite 2x2x2 pure states.

JT2A.7 Quantum Interference and Entanglement of Photons which Do Not Overlap in Time, Ralph Wagner1, Christopher Völkel1, Joachim von Zanthier2,3, Girish Agarwal1; 1Inst. for Optics, Information and Photonics, Univ. Erlangen-Nuremberg, Germany; 2Erlangen Graduate School in Advanced Optical Technologies (SAOT), Univ. Erlangen-Nuremberg, Germany; 3Department of Physics, Oklahoma State Univ., USA. We report on quantum interferences and entanglement of photons which exist at different intervals of time. The corresponding entanglement correlation function is shown to violate Bell's inequalities.

JT2A.8 Electrooptical Method for Generating of Optical Vortices, Iurii Khvat1,2, Varyu Vazko1, Rostyslav Vishni1; 1Inst. of Physical Optics, Ukraine. We have shown that the conically shaped electric field created in electrooptic crystals can lead to appearance of orbital angular momentum in the outgoing light beam. It is verified experimentally on Bi2GeO4 crystals.

JT2A.9 Quantum Correlation Assists State Discrimination, Luis Roa1; 1Departamento de Fisica, Universidad de Concepcion, Chile. We study the roles of quantum correlations, entanglement, discord, and dissonance needed for performing unambiguous quantum state discrimination assisted by an auxiliary system.

JT2A.10 Towards High Sensitivity Rotation Sensing Using an Atom Chip, Carlos L. Garrido Alzar1, Weina Liu; 1, Arnaud Landragin2; 2SYRTE, CNRS-Observatoire de Paris, France. We propose to develop a new generation of compact high sensitivity gyroscopes using guided matter-waves on atom chips, able to fulfill the requirements of metrological applications.

JT2A.11 Effect of Telegraph Noise on the Entanglement of Two Charge Qubits, Aft Ayuk1; 1Physique, Faculté des Sciences de Tunis, Tunisia. We investigate the dynamics of two charge qubits subject to telegraph noise. In order to study the effect of the telegraph noise on the entanglement we adopt the concurrence. We show that the telegraph noise led to complete disentanglement.

JT2A.12 Atom-light Interactions at High Densities and High Magnetic Fields, Lee Weller1; 1Physics Department, Durham Univ., UK. We present the physics underlying the transmission of light through a dense atomic vapour, accounting for self-broadening and the application of a large axial magnetic field.

JT2A.13 Spectral Effects in Polarization-Entanglement Swapping, Daniel Erenso1,2, Daniel Bonior1, Benja-min Baranoff1, Jonathan Bentley1, Hannah Norris1; 1Physics & Astronomy, Middle Tennessee State Univ, USA. Polarization entanglement swapping in spectrally correlated photons produced by a spontaneous parametric down conversion and photons entangled by a beam splitter is studied. The concurrence is used to investigate the spectral effects in the swapping.

JT2A.14 Decoherence, Entanglement Decay and Equili-tration Produced by Chaotic Environments, Himadri S. Dhar1; 1School of Physical Sciences, Jawaharlal Nehru Univ., India. We investigate the quantum entanglement properties in spin-1/2 Heisenberg ladder are influenced by the pseudo-2D geometry. Such non-intuitive qualitative manifestations can have important implications in the application of information processing tasks.

JT2A.15 Nonlinear Coherent Loss for Generating Non-classical States, Alexander B. Mikhailichev1, Dmitrii S. Mogilevskii2, Sergei Y. Khilin3, B. I. Stepanov; 1Inst. of Physics of NASB, Belarus. We discuss exploiting artificially designed nonlinear coherent loss for generating non-classical states of a bosonic mode. We show how to generate Fock states superpositions and estimate generated states purity and maximal achievable fidelity.

JT2A.16 Study of the Temporal-Evolution of a Star-like Quantum State of Light Through the Wigner Function, Jhony Lopez Carreño1,2, Juan P. Betit-pe-Cuartas1, Herbert Vinck-Posada1; 1Universidad Nacional de Colombia, Colombia; 2Universidad de Antioquia, Colombia. In this work, the temporal evolution of the interaction between a two-energy level atom and a star-like quantum state of light and the entanglement of these states were studied using the Wigner quasiprobability function.

JT2A.17 Optimal Binary Codes and Measurements for Classical Communication over Qubit Channels, Nicola Della Pezzza1, Nicola Laurenz1, Francesco Tucci2; 2Department of Information Engineering (DEI), Univ. of Padova, Italy. Developing a suitable geometric representation, we provide algorithmic solutions to the problem of finding pairs of states and measurements that optimize either error probability or mutual information for a given arbitrary qubit channel.

JT2A.18 Geometry Versus Entanglement in a Quantum Spin System, Hamadi S. Dhar1; 1School of Physical Sciences, Jawaharlal Nehru Univ., India. We report that quantum entanglement properties in spin-1/2 Heisenberg ladder are influenced by the pseudo-2D geometry. Such non-intuitive qualitative manifestations can have important implications in the application of information processing tasks.

JT2A.19 Withdrawn

JT2A.20 Withdrawn

JT2A.21 Perfect Probabilistic Transformations between Symmetric Sets of Quantum States, Erika An-co-Cuartas2, Herbert Vinck-Posada1; 1Universidad Nacional de Colombia, Colombia; 2Universidad de Antioquia, Colombia. In this work, we investigate the topological structure of entangled qudits under unitary local operations. As a main result, we predict a fractional topological phase for cyclic evolutions. This result is potentially useful for implementations of quantum gates.

JT2A.22 Information Transfer and Randomness in Quantum Measurements, Sergey Maparov1; 1Lebedev inst. of Physics, Russian Federation. Information transfer and capacity in measuring systems studied. It's shown that information about measured state purity can't be transferred to information receiver, so it stipulates randomness in individual events.

JT2A.23 Incoherent Light As a Control Resource, Alexander Peluc1; 2Chemical Physics, Weizmann Inst. of Science, Israel; 2Mathematical Physics, Steklov Mathematical Inst., Russian Academy of Sciences, Russian Federation. We discuss the use of incoherent light as a resource for controlling the atomic dynamics and review the method for engineering arbitrary pure and mixed atomic states using a special combination of incoherent and coherent light.

JT2A.24 Nonlinear Process in Atomic Coherent System, Junxiang Zang1; 1Shanxi Univ., Inst. of Opto-Electronics, China. We investigate the efficient Four-Wave Mixing in EIA system. The reflection is explained as the result of enhancement by the quantum coherence and the compensation of phase mismatch from anomalous dispersion of EIA.

JT2A.25 Beamlike Polarization Entangled Photons Generation by 2x2 Fiber, Hsin-Pin Lin1,2, Atsushi Yabushita3, Chih-Wei Lui1, Pochung Chen2, Takayoshi Kobayashi3; 1Department of Physics, National Taiwan Univ., Taiwan; 2Department of Electrooptics, National Chiao-Tung Univ., Taiwan; 3Core Research for Evolutional Science and Technology, Japan Science and Technology Agency, Japan. Beamlike photon pairs generated by pumping the Type-II BBO crystal. Then inserting into the 2x2 fiber, the polarization entangled photons be measured from the output.

JT2A.26 Withdrawn

JT2A.27 Quantum Holograms based on the Faraday Interaction. Spontaneous Emission in Such Systems, Demy Vialyi1; 1Inst for Theoretical Physics, Inst. for Gravitational Physics, Leibniz-Univ. Hannover, Germany. We present a scheme for parallel spatially multimode quantum memory for light based on Faraday interaction in spin polarized atomic ensembles. Also we study decoherence processes which appear due to spontaneous emission in such systems.

JT2A.28 Fractional Topological Phase for Entangled Qudits, Antonio Z. Khoury1, Luis E. Ocampo2; 1Instituto de Fisica, Universidade Federal Fluminense, Brasil. We investigate the topological structure of entangled qudits under unitary local operations. As a main result, we predict a fractional topological phase for cyclic evolutions. This result is potentially useful for implementations of quantum gates.

JT2A.29 Coherence and Entanglement Created by a Finite-Size Atomic Ensemble in a Ring Cavities, Li-hui Sun1,2, Gao-xiang Li1,2, Wen-ju Gu1, Zbig-niew Freck1; 1Department of Physics, Huazhong Normal Univ., China; 2College of Physical Science and Technology, Yangtze Univ., China; 3National Centre for Mathematics and Physics, KASTE, Saudi Arabia. We report several new interesting aspects of coherence and entanglement behavior that emerge in the interaction of an atomic ensemble with field modes of a ring cavity when the size of the atomic ensemble is not taken to the thermodynamic limit.
**Joint Quantum Information and Measurement / High Intensity Lasers and High Field Phenomena / International Conference on Ultrafast Structural Dynamics Poster Session**

**Exhibit Hall 12**

**Tuesday, 20 March**

**JT2A.30** Bright Beam High-gain States, Aziz Kolikan1; 2; 2Electrical and electronics eng, Gedei Univ, Turkey

**JT2A.31** Multi-pulse Entanglement of Nanomechanical Resonators, Mahmoud Abd-Aty 1, 2; 1Science, Univ. of Bahrain, Bahrain; 2Mathematics, Sohag Univ, Egypt

**JT2A.32** Ultrafast All Optical Switching in Paramagneto-optical Crystals, Guoshong Ma1; 2Electrical and electronics eng, Gedei Univ, Turkey

**JT2A.33** Control of Quantum Fluctuation of Atomic Displacements by Femtosecond Laser Pulses, Jianbo Hu1; 2; Oleg V. Misochko1, Kazutaka G. Nakamura1, 2; 1Materials and Structures Laboratory, Tokyo Inst. of Technology, Japan; 2JST-CREST, Japan

**JT2A.34** Coherent and Squeezed Phonon States Generated by Off-resonant Impulsive Two Pump–One Probe Technique, We have characterized by time-resolved hard X-ray diffraction measurements for ultrafast optical control of system multitermrois.

**JT2A.35** Displacively excited coherent phonons in infinite BN nanotubes, Bernd Bauerhenne1; 2Bernd Bauerhenne, Germany; 3Max-Planck-Institut für Kernphysik, Germany

**JT2A.36** Time-resolved photoelectron diffraction on laser-aligned molecules, Demi Asteridou1; 2Demi Asteridou, Greece; 3Max-Planck-Institut für Kernphysik, Germany

**JT2A.37** Laser-induced Nonthermal Melting in Si, Tobias Zier1; 2Tobias Zier, Germany; 3Max-Planck-Institut für Kernphysik, Germany

**JT2A.38** 2D-IR Spectroscopy of Intermolecular Ion-Water Coupling, Joanna Borek1; 2Joanna Borek, Germany; 3Max-Planck-Institut für Kernphysik, Germany

**JT2A.39** Ultrafast Tr-ARPS with Artemis XUV Beamline, Cephas Catch1; 2Cephas Catch, Germany; 3Max-Planck-Institut für Kernphysik, Germany

**JT2A.40** Model-free Investigation of Ultrafast Bimolecular Chemical Reactions: Bimolecular Photoion-Catalyzed Electron Transfer, New photodissociation experiments at the CaF–Xe2CF2–Ar target for ultrafast melting of Mott and charge order in Ta2X2 will be presented.

**JT2A.41** Ultrafast Dynamics of the OH Stretching Vibration in Aqueous Hydrates, Jasper C. Werhahn1; 2Jasper C. Werhahn, Germany; 3Max-Planck-Institut für Meteorologie, Germany

**JT2A.42** Saturation Behavior of Femtosecond Laser Ablation in Silicon-on-insulator, Hao Zhang1; 2Hao Zhang, China; 3Max-Planck-Institut für Kernphysik, Germany

**JT2A.43** Ultrafast Ablation in Silicon-on-insulator, Hao Zhang1; 2Hao Zhang, China; 3Max-Planck-Institut für Kernphysik, Germany

**JT2A.44** Joint Quantum Information and Measurement / High Intensity Lasers and High Field Phenomena / International Conference on Ultrafast Structural Dynamics Poster Session
JT2A.52 Probing Femtosecond Filamentation via High-order Harmonics, Daniel Stengruber1, Emilie Schulz1, Martin Kreitschas1, Thomas Bihmmer1, Mette Garde1, Arnaud Coustanot1, Uwe Morner2, Milutin Kovacev1,2, Leibniz Universität Hannover, Institut für Quantenoptik, Germany; 3Quest, Centre for Quantum Engineering and Space-Time Research, Germany; 4VENTEON Laser Technologies GmbH, Germany; Department of Physics and Astronomy, Louisiana State Univ., USA; 5PULSE Inst., SLAC National Accelerator Laboratory, USA; 6Centre de Physique Théorique, Ecole Polytechnique, France. High-order harmonic radiation generated by intensity spikes inside a femtosecond filament is measured. We demonstrate the potential of our setup for probing the nonlinear filamentation dynamics and present a simpleatto-second light source.

JT2A.53 Above-threshold Ionization (ATI) from Non-planar Asymmetric Molecules. Leonid Alexandrov1, Mikhail Emelin1, Mikhail Ryabikin1, Institute of Applied Physics, RAS, Russian Federation. Results of numerical simulations of molecular gas ionization by femtosecond laser pulses are presented. It is shown that the value of residual current and efficiency of its excitation can be significantly increased by the use of asymmetric molecules.
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<th>Time</th>
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<th>Speaker(s)</th>
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<tr>
<td>14:00–16:00</td>
<td>Madrid</td>
<td>Quantum Information and Measurement</td>
<td>John Howell; Univ. of Rochester, USA, Presider</td>
<td>Griffith Univ., Australia; 4Department of Physics, Univ., Australia; 3Centre for Quantum Dynamics, Harmonic Oscillators, Erika Andersson</td>
</tr>
<tr>
<td>QT3A.1 • 14:00</td>
<td>Madrid</td>
<td>Experimental Observation of the Ultra-narrow Temporal Entanglement of Twin Beams by Means of Frequency Up-conversion</td>
<td>Ottavia Jakubiec2, Jean-Luc Blanchet1, Alessandra Gatti1, Enrico Brambilla1, Luigi A. Lugli1, Paolo De Tarantil1, 2Dipartimento di Scienza e Alta Tecnologia, Università dell’Insubria, Italy; 3Istituto di Fotonica e Nanotecnologia, CNR, Italy. We report here about the experimental observation of an ultra-narrow temporal correlation 6.7 fs FWHM of twin beams produced by a type I BBO crystal, detected by means of the inverse process of sum frequency generation.</td>
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<tr>
<td>QT3A.2 • 14:15</td>
<td>Madrid</td>
<td>Dissipation-boosted Entanglement of Coupled Harmonic Oscillators</td>
<td>Erika Andersson1, Chaitanya Joshi1, Michael J W Hall1, Mats Janson1, Patrik Ohberg1, 2Physics, Heriot-Watt Univ., UK; 3Theoretical Physics, RSPE, Australian National Univ., Australia; 4Centre for Quantum Dynamics, Griffith Univ., Australia; 5Department of Physics, Univ. of Gothenburg, Sweden. We show that entanglement in initially classical states of coupled harmonic oscillators, caused by squeezing, is enhanced by dissipation. The enhancement vanishes if the oscillator baths are identical, suggesting that ‘heat flow’ may be necessary.</td>
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<tr>
<td>QT3A.3 • 14:30</td>
<td>Madrid</td>
<td>Photon Pairs from Cavity-Enhanced Parametric Down-Conversion with Tunable Bandwidth for Quantum Interfaces</td>
<td>Andreas Ahlrichs1, Lars Kael1, Martin Kerbach1, Oliver J. Benzen1, 2Institut Physik, Humboldt-Univers- of Berlin, Germany, Nano-Ops Group, Germany. An optical parametric oscillator is used to generate photon pairs with tunable bandwidth. These photons can be made indistinguishable from photons generated by quantum dots allowing for quantum inference of photons from dissimilar sources.</td>
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<tr>
<td>QT3A.4 • 14:45</td>
<td>Madrid</td>
<td>Two-Photon Interference and Polarization Entanglement of Photon Pair Beam by Path Overlap Scheme</td>
<td>Atsushi Yabushita1, 2Department of Applied Physics, The University of Tokyo, Japan; 3Institute for Molecular Nano-Science, Japan. We report here about the experimental observation of an ultra-narrow temporal correlation 6.7 fs FWHM of twin beams produced by a type I BBO crystal, detected by means of the inverse process of sum frequency generation.</td>
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<tr>
<td>14:00–16:00</td>
<td>Hong Kong</td>
<td>High Intensity Lasers and High Field Phenomena</td>
<td>Takao Fuji; Inst. for Molecular Science, Japan, Presider</td>
<td>Griffith Univ., Australia; 4Department of Physics, Univ., Australia; 3Centre for Quantum Dynamics, Harmonic Oscillators, Erika Andersson</td>
</tr>
<tr>
<td>HT3C.1 • 14:00</td>
<td>Hong Kong</td>
<td>High Repetition Rate Few-cycle OPCPA for Generation of Isolated Attosecond Pulses</td>
<td>Matthias Hemmer1, Alexandre Thay1, Matthias Baudisch1, Lars Kael1, Martin Kerbach1, Oliver J. Benzen1, 2Institut Physik, Humboldt-Univers- of Berlin, Germany, Nano-Ops Group, Germany. An optical parametric oscillator is used to generate photon pairs with tunable bandwidth. These photons can be made indistinguishable from photons generated by quantum dots allowing for quantum inference of photons from dissimilar sources.</td>
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<tr>
<td>HT3C.2 • 14:30</td>
<td>Hong Kong</td>
<td>Optical Quantum Information Processing using Forced Fermion-like Behavior of Photonic Quibits</td>
<td>Todd Pittman1, James Franson1, 2Physics, UMBC, USA. We review a new paradigm for optical quantum logic gates that relies on forced ‘fermion-like’ behavior of photonic quibits, and describe experimental work on demonstrating these gates with entangled photons from a parametric down-conversion source.</td>
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<tr>
<td>14:00–16:00</td>
<td>Istanbul</td>
<td>International Conference on Ultrafast Structural Dynamics</td>
<td>Thomas Elsaesser; Max Born Inst., Germany, Presider</td>
<td>Griffith Univ., Australia; 4Department of Physics, Univ., Australia; 3Centre for Quantum Dynamics, Harmonic Oscillators, Erika Andersson</td>
</tr>
<tr>
<td>IT3D.1 • 14:00</td>
<td>Istanbul</td>
<td>MeV Ultrastar Electron Diffraction</td>
<td>Xijie Wang1, 2Photon Science, Brookhaven National Laboratory, USA. A MeV UED facility with sub-100 fs time resolution is developed at BNL; single-shot electron diffraction is realized for a 180-nm Al film with 10^5 electrons, and super-lattice of TaSe2 was observed with SRN of 408.</td>
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<tr>
<td>IT3D.2 • 14:30</td>
<td>Istanbul</td>
<td>Femtosecond Electron Diffraction for the Study of Charge Density Waves, German Scains1, Maximilian Eichberger1, Hanjo Schäfer1, Marina Krumova1, Markus Beyr1, Helmut Berger1, Gustavo Moriena1,2, Jure Demsar3,5, Dwayne Miller1,2, 3Max Planck Research Department for Structural Dynamics, Univ. of Hamburg, Germany; Chemist and Physics, Univ. of Toronto, Canada; Physics Department and Center of Applied Photonics and Zukunftskolleg, Univ. of Konstanz, Germany; Chemistry, Univ. of Konstanz, Germany; Complex Matter Department, Jozef Stefan Inst., Slovenia; Physics, EPFL, Switzerland. We studied the dynamics of the periodic lattice distortion (PLD) in 1T-TaS2 by femtosecond electron diffraction. Coherent atomic motions in the nearly commensurate phase and the rotation of PLD have been revealed with increased photosensitivity.</td>
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The two paths. The period depends on the relative phase between how the two-photon correlation recurrence evolves of two-photon path-entangled states. We experimentally observe the rare-earth-ion doped crystals were entangled by converting a single photon into a delocalized excitation. The excitation was subsequently converted back into a photon and the entanglement revealed by an estimation of the concurrence.

Continued

Evolution of Two Photon Path Entangled States in Multimode Waveguides, Elion Poem, Yehunatan Gilad, Yaron Silverberg; Department of Physics of Complex Systems, Weizmann Inst. of Science, Israel. We experimentally observe the evolution of two-photon path-entangled states in a planar multimode waveguide, and show how the two-photon correlation recurrence period depends on the relative phase between the two paths.

Nano Optical Fibers for Photonic Quantum Information, Shogo Takasaki; Research Inst. for Electronic Science, Hokkaido Univ., Japan; The Inst. of Scientific and Industrial Research, Osaka Univ., Japan Application of ultra-thin tapered optical fibers to efficient single photon sources (1.7 million single photons coupled to a single mode fiber) and Realization of a fiber-microsphere cavity at cryogenic temperature are reported.

Directional Entanglement in Coupled Quantum-dot Photonic-bandgap Microwire Systems, Marc Andre Dupertuis, Raphael Faerber; Laboratory of Quantum Optoelectronics, EPFL, Switzerland; Laboratory of Physics of Nanostructures, EPFL, Switzerland. We investigate pair of isolated quantum dot excitons strongly coupled to microwire, and quantum dot biexciton, as sources of directional entanglement in photonic-bandgap microcircuit, and compare the results with polarisation entanglement.

Coherent Synthesis of Ultra-broadband Optical Parametric Amplifiers, Cristian Manzoni, Shu-Wei Huang, Giovanni Cermelli, Jeffrey Mason, Franz Kärtner, Giulio Cerdon; IHP-CNRS Photonics Lab, Milan, Italy; Department of Electrical Engineering and Computer Science and Research Laboratory of Electronics, MIT, USA; Center for Free-Electron Laser Science, DESY and Univ. of Hamburg, Germany. We report on coherent synthesis of two broadband optical parametric amplifiers, resulting in octave-spanning (500-1000 nm) spectra supporting sub-4-fs pulse duration. Synthesized pulse timing is locked to sub-300 as by a balanced cross-correlator.
Quantum Information and Measurement

16:30–18:30
QT4A • Quantum Communication I
Robert Thew; Univ. of Geneva, Switzerland, Presider

QT4A.1 • 16:30
Invited
Directions in Optical Implementations of Quantum Key Distribution, Norbert Lutkenhaus1; Inst. for Quantum Computing, Univ. of Waterloo, Canada. We will report on recent results that address side-channel aspects of quantum key distribution devices, the operation requirements of trusted repeater networks and also the security of protocols using phase-encoding.

QT4A.2 • 17:00
Invited
Quantum Key Distribution Using Hyperentanglement, Daniel Gauthier1, Hannah Gaibert2, Yunhui Zhu2, Meizhen Shi1, Kevin McCusker2, Bradley Christiansen1, Paul Kwiat1, Thomas Boughan1, Stephen M. Barnett3, Venkat Chandar4; 1Dept. of Physics, Duke University, USA; 2Department of Physics, Univ. of Illinois Urbana-Champaign, USA; 3Istituto di Fotonica e Nanotecnologia, Milano, Italy; 4Dept. of Physics, Duke University, USA. We have used four-wave mixing in hot atomic vapors to generate multispatial-mode entangled optical fields. I will review and discuss our recent progress in the construction of phase-sensitive and phase-insensitive amplifiers with this technique.

QT4A.3 • 17:30
Invited
Experimental Studies Toward the Quantum Communications with Orbiting Terminals, Paolo Villarejos1, Andrea Tommelleo1, Alberto Dall’Asta2, Francesco Gerli2, Ivan Capra2, Giuseppe Vallone2; 1Information Engineering, Univ. of Padova, Italy. Realization of Quantum Communications in Space requires a deep understanding of issues including link-budget, turbulence mitigation and single-photon terminal synchronization. Here we report on supporting novel experiments on very long-distance links and modeling.

QT4A.4 • 17:30
Quantum Imaging Using Entangled States by Mixing Quantum and Classical Light, Yonatan Israel1, Shumir Rosen2, Itai Afek1, Oron Ambar1, Yaron Silberberg1; 1Physics of Complex Systems, Weizmann Inst. of Science, Israel. We show that by mixing quantum spontaneous parametric down-conversion with the classical coherent state we can generate robust narrow features for quantum lithography, and high fidelity NOON states and correlated-photon-holes states.

QT4A.5 • 18:00
Spatially Entangled 4-photons States from a Periodically Poled KTP Crystal, Michael J. de Doof1, Cedric Yenalmez2, Alexander van der Torren1, Jolmer Renema1, Martin P. van Exter2; 1Leiden Inst. of Physics, Leiden Univ., Netherlands. We explore four-photon spatial entanglement created by stimulated emission of photon pairs in a 2 mm long periodically-poled KTP crystal. We vary the experimental conditions to explore and optimize the visibility of stimulated pairs.

Sydney

16:30–18:30
QT4B • Quantum Imaging
Claude Fabre; Univ. Pierre et Marie Curie, Presider

QT4B.1 • 16:30
Invited
Quantum Images from 4-Wave Mixing in Atomic Vapors, Paul D. Lett1,2, Neil Corzine2; 1Lincoln Laboratory MIT, USA; 2Joint Quantum Inst., USA; ‘Physics Department, Williams College, USA. We have developed a new four-wave mixing technique to generate a unique atomic quantum field for quantum imaging in a powerful atomic medium. We will discuss the properties of the quantum field used in the ghost-imaging protocol based on an entangled pair. We will also review and discuss our recent progress in the construction of phase-sensitive and phase-insensitive amplifiers with this technique.

QT4B.2 • 17:00
Ghost Imaging by Intense Multimode Twin Beam, Alessia Allerti1,2, Maria Bondani3,2; 1Dipartimento di Scienza e Alta Tecnologia, Università degli Studi dell’Insubria, Italy; 2CNISM, UdR, Como, Italy; 3Istituto di Fotonica e Nanotecnologie, Consiglio Nazionale delle Ricerche, Italy. We present the first experimental implementation of the ghost-imaging protocol based on an intense multimode spontaneous parametric down-conversion process. Temporal and spatial properties of the quantum field used in the protocol are also discussed.

QT4B.3 • 17:15
Quantum Imaging Using Entangled States by Mixing Quantum and Classical Light, Yonatan Israel1, Shumir Rosen2, Itai Afek1, Oron Ambar1, Yaron Silberberg1; 1Physics of Complex Systems, Weizmann Inst. of Science, Israel. We show that by mixing quantum spontaneous parametric down-conversion with the classical coherent state we can generate robust narrow features for quantum lithography, and high fidelity NOON states and correlated-photon-holes states.

Hong Kong

16:30–18:30
HT4C • HHG2
Eric Cormier; Univ. de Bordeaux CELIA, France, Presider

HT4C.1 • 16:30
Laser-matter Processes Driven by Non-homogeneous Fields: the High-order Harmonic Generation Case, Marcelo Ciappina1,2, Jeremy Biegert2,3, Romain Quidant2,3, Maciej Lewenstein1,2, QOT, IFCA, Spain; 3ICREA, Spain. We present theoretical studies of high-order harmonic generation (HHG) produced by nonhomogeneous fields. This kind of fields appears when a plasmonic nanostructure is illuminated by a short laser pulse.

HT4C.2 • 16:45
Efficient High Harmonic Generation in a Mixture of a Noble Gas and Metal Nanoparticles and on Rough Metal Surfaces, Antonio Huacana1, Joachim Herrmann1, Xuan Kyun Kim1, Max Born Inst., Germany. We investigate low-intensity high-harmonic generation enabled by the plasmonic electric field enhancement in a mixture of a noble gas with metal nanoparticles and in random rough surfaces. HHG efficiencies up to 10-6 are predicted.

HT4C.3 • 17:00
Attosecond Pulse Narrowing by Off-axis Detection, Carlos Hernandez-Garcia1, Luis Plaja1,2, Patricia Rambo1,2, Luis Plaja1; 1Física Aplicada, Universidad de Salamanca, Spain; 2IOT, ICFO, Spain. Our simulations of high harmonic generation and propagation predict a shortening of the width of the synthesized attosecond pulses, when selecting the radiation at angles off axis.

HT4C.4 • 17:15
High Field Terahertz Generation and Nonlinear THz Spectroscopy of Graphene, Pamela Bowlan1, Klaus Reimann1, Michael Woerner1, Thomas Elsaesser1, Max Born Inst., Germany. Charge transport in graphene is studied by femtosecond two-dimensional THz spectroscopy at frequencies around 2 THz. Pump-probe signals reveal an induced interband absorption followed by carrier thermalization while photo-echo signals are absent.

HT4C.5 • 17:30
Temporal Gating for Broadband Attosecond Pulse Generation, Peixiang Lu1, Wei Yi Hong2, 1School of Physics, Huazhong Univ. of Science and Technology, Wuhan National Lab for Optoelectronics, China. We propose several schemes to microscopically control the harmonic processes and form the temporal gate for HHG to produce the broadband supercontinuum. The macroscopic effects including the spectral, temporal and spatial properties are discussed.

Istanbul

16:30–18:30
IT4D • THz Spectroscopy
Michael Woerner; Max-Born Inst., Germany, Presider

IT4D.1 • 16:30
Tutorial
High Field Terahertz Generation and Nonlinear Terahertz Spectroscopy, Keith A. Nelson1; Chemistry, MIT, USA. Nonlinear THz spectroscopy is a growing subfield accessible with common tabletop laser systems. Methods for generation of intense THz pulses and recent nonlinear THz spectroscopy results from solid, liquid, and gas phase samples will be discussed.

IT4D.2 • 17:15
Invited
Two-dimensional THz Spectroscopy of Graphene, Pamela Bowlan1, Klaus Reimann1, Michael Woerner1, Thomas Elsaesser1, Max Born Inst., Germany. Charge transport in graphene is studied by femtosecond two-dimensional THz spectroscopy at frequencies around 2 THz. Pump-probe signals reveal an induced interband absorption followed by carrier thermalization while photo-echo signals are absent.
EPR-steering with entangled photon pairs. Tests, we demonstrate detection-loophole-free another party. Using new, arbitrarily loss-tolerant party to verify that he shares entanglement with will then show that compressive sensing can solve important problems in some applications of quantum imaging.

Arbitrarily Loss-tolerant Einstein-Podolsky-Rosen Steering Allowing a Demonstration Over 1–km of Optical Fiber with no Detection Loop-hole, Adam Bennett1, David A. Evans1, Dylan J. Saunders2,1, Cyril Branciard 3, Eric Cavalcanti 1,1. We present a new setup in which we near-deterministically separate all four photon Bell states by means of linearly concatenated Mach-Zehnder interferometers. Realistic proposals for implementations are given.

New Near-Deterministic All-Optical Teleportation, Superdense Coding, and Cryptography Scheme, Mladen Pantic, Uni of Zagreb, Kaciceva, Croatia. We present a new setup in which we near-deterministically separate all four photon Bell states by means of linearly concatenated Mach-Zehnder interferometers. Realistic proposals for implementations are given.
QW1A • Quantum Communication II
Harald Weinfurter; Univ. of Munich, Germany, Presider

QW1A.1 • 08:00
Invited
Advanced Quantum Communication via Hyperentanglement, Paul Kwiat1, Univ. of Illinois at Urbana-Champaign, USA. Photons created via spontaneous downconversion may be simultaneously entangled in multiple degrees of freedom. This ‘hyperentanglement’ enables advanced capabilities in quantum communication, including multi-bit per photon quantum cryptography and superdense quantum teleportation.

QW1A.2 • 08:30
Detection Loophole Free Quantum Steering with Photons, Till Weinhold1, Devin Smith1, Geoff Gilliet1, Marcelo de Almeida1, Alessandro Fedrizzi1, Cyril Branciard2, Brice Calkins3, Adriana White1; 1Centre for Engineered Quantum Systems of Queensland, Australia; 2School of Mathematics and Physical Sciences, Univ. of Cambridge, UK; 3National Inst. of Standards and Technology, USA. Quantum steering allows the verification of shared entanglement even with an untrusted measurement device. We show the first photonic “detection loophole free” violation of a steering inequality by 48 standard deviations.

QW1A.3 • 08:45
Thwarting the Photon Number Splitting Attack with Entanglement Enhanced BB84 Quantum Key Distribution, Christopher D. Richardson1, Carl Sabotbe1, Jonathan Dowling1, Petr Anisimov2, Ulvi Vartanian2, Ania Lamas2, Hearne Inst. for Theoretical Physics, Louisiana State Univ., USA; 1Metall Research Group, Stony Brook Univ., USA; 2MathSense Analytics, MathSense Analytics, USA; 3Department of Physics and Astronomy, National Univ. of Singapore, Singapore. We develop an improvement to the BB84 scheme for quantum key distribution utilizing entanglement to improve the security of the scheme and enhance its resilience to the photon number splitting attack.

QW1B • Novel Quantum Information and Measurement Techniques I
Wolfgang Schleich; Universität Ulm, Germany, Presider

QW1B.1 • 08:00
Invited
Adaptive Quantum Measurement via Swarm Intelligence, Machine Learning, Barry C. Sanders1, Alexander Heinrich2; 1Inst for Quantum Information Science, Univ. of Calgary, Canada. We construct an algorithm that learns through trial-and-error training how to devise optimal feedback-based single-shot phase estimation in interferometry. Our algorithm is robust against experimental imperfections, losses and decoherence.

QW1B.2 • 08:30
Interaction-based Quantum Metrology Showing Scaling Beyond the Heisenberg Limit, Mario Napolitano1, Marco Kocbach2, Brice Dubost3, Nacimiéh Behboud1, Robert Sewell1, Morgan W. Mitchell2; 1ICFO, Spain; 2Department of Physics, Univ. of Cambridge, UK; 3Laboratoire Matériaux et Nanosciences Quantiques, Université Paris Diderot, France; ICREA, Institució Catalana de Recerca i Estudis, Spain. Atom-mediated optical nonlinearities, within an atom-light quantum interface, allow spin measurement with sensitivity scaling better than the Heisenberg limit. This demonstrates the use of interactions as a new resource for quantum metrology.

QW1B.3 • 08:45
Nanodiamonds for Integrated Quantum Technology: Charm and Challenge, Janik Wolters1, Dezafany Sadiak1, Tim Schröder1, Andreas W. Schöler1, Nikola Sadowski1, Tim Schröder2, 1Max Planck Inst. for Quantum Optics, Germany; 2Max Planck Inst. of Quantum Optics, Germany. Nitrogen-vacancy (NV) centers in nanodiamonds are attractive for solid state quantum technology. We report on integrating NV-centers into photonic hybrid-devices, point out future applications and address possible obstacles, like spectral distortion.

QW1C • Electronic Dynamics
Robert Moshammer; MPI fuer Kernphysik, Germany, Presider

QW1C.1 • 08:00
Invited
Attosecond Electron Emission and Acceleration from Nanoparticles in Strong Fields, Matthias Klög1,2, 1Max Planck Inst. of Quantum Optics, Germany; 2Physics Department, Kansas State Univ., USA. We studied attosecond electron emission and acceleration from isolated dielectric and metallic nanoparticles in strong waveform-controlled 4-fs laser fields. Nano-focusing in large nanoparticles allows for an efficient acceleration of electrons towards the laser propagation direction.

QW1C.2 • 08:30
Attosecond Physics with Sub-optical-cycle Waves of Light, Eleftherios Gouliemakis1, Eleftherios Gouliemakis2, 1Max Planck Inst. of Quantum Optics, Germany; 2Technische Universität München, Germany. We present synthesis of intense light transients for Medical Research, Germany; 3PULSE Inst., University of California, USA; 4Linac Coherent Light Source, SLAC National Accelerator Laboratory, USA; 5Max Planck Inst. for Biophysical Chemistry, Germany; 6pp’Sensor, Germany; 7Max Planck Inst. for Medical Research, Germany; 8PULSE Inst., SLAC National Accelerator Laboratory, USA; 9Max Planck Inst. for Biophysical Chemistry, Germany; 10pp’Sensor, Germany; 11Max Planck Inst. for Semiconductor Laboratory, Germany; 12Max Planck Inst. for Nuclear Physics, Germany; 13Linac Coherent Light Source, SLAC National Accelerator Laboratory, USA; 14DESY, Germany; 15Lund Univ., Sweden. Resonant x-ray emission spectroscopy with x-ray pulses from the LCLS was used to probe the nonequilibrium electron dynamics in CdTe. Time dependent emission intensity reflects the evolution of the nonequilibrium electron distribution function.

QW1C.3 • 08:45
Ultrafast Conformational Changes in Biomolecules Studied by Time-resolved Circular Dichroism, François Hauché1, Lucille Mendale2, Mai-Thu Khuc1; 1ASG, Max-Planck-ASG Forschungsverbund, Hamburg, Germany; 2ASG, Max-Planck-ASG Forschungsverbund, Hamburg, Germany. Structural changes in biological processes are investigated thanks to a full set of time-resolved circular dichroism experiments. Ultrafast conformational changes in proteins and microsecond protein denaturation in polypeptides have been studied.
QW1A • Quantum Communication II—Continued

QW1A.4 • 09:00
The Secure Information Capacity of Photons Entangled in High Dimensions, Eliot Bolduc1, Jonathan Leach1, Robert Boyd2; 1Physics, Univ. of Ottawa, Canada; 2Univ. of Rochester, USA. High-dimensional entanglement is a key resource for quantum cryptography. We experimentally realize the criterion for secure quantum key distribution when using photons entangled in the orbital angular momentum and angle degrees of freedom.

QW1A.5 • 09:15
Experimental Demonstration of Quantum Digital Signatures, Robert J. Collins1, Patrick J. Clarke1, Vedran Dunjko2, John Jeffers1, Erika Andersson3; 1School of Engineering and Physical Sciences, Heriot-Watt Univ., UK; 2School of Informatives, Edinburgh Univ., UK; 3Department of Physics, Univ. of Strathclyde, UK. We have built and tested the first experimental demonstration of a quantum digital signature test-bed system. We will present a case for quantum digital signatures, overview of the protocol, description of the system and results.

QW1A.6 • 09:30
Invited
Single Photons, Entanglement Swapping and Heralded Photon Amplification for Device Independent Quantum Key Distribution, Robert Thew1, Clara I. Osorio1, Natalia Bruno1, Heralded Photon Amplification for Device Single Photons, Entanglement Swapping and 2School of Informatics, Edinburgh Univ., UK; 3Department of Physics, Univ. of Strathclyde, UK.

QW1B • Novel Quantum Information and Measurement Techniques I—Continued

QW1B.4 • 09:00
Exploiting the Quantum Advantage, Andrew White; 1Physics, Univ. of Queensland, Australia. Quantum correlations in both space and time allow a clear advantage over classical approaches: we discuss our recent results in engineering correlations for simulating quantum chemistry, emulating quantum materials, and performing semi-device-independent QKD.

QW1B.5 • 09:30
Quantum Reading Capacity, Cosmo Luque1, Stefano Pirandola1, Vittorio Giovannetti1, Stefano Mancini1, Samuel L. Braunstein1; 1Physics Division, School of Science and Technology, Univ. of Cambridge, Italy; 2Computer Science, Univ. of York, UK; 3Next, Scuola Normale Superiore and Istituto Nazionanco-CNR, Italy; 4INFN, sezione di Pescara, Italy. The maximum readout rate of a classical memory defines its reading capacity. We prove the advantages of employing nonclassical states of light (including squeezing and entanglement) for extracting information from optical memories, e.g., CDs, DVDs.

QW1B.6 • 09:45
Programmable Virtual Quantum Networks, Seiji Armstrong1, Yiri Jian2, Boris Hage1, Jean-Francois Moriena1, Hans Baech1, Ping Koy Lam1; 1Quantum Science, Australian National Univ., Australia; 2Applie Phys., The Univ. of Tokyo, Japan; 3Laboratoire Kaistar Brussels, Universite Pierre et Marie Curie, France. We report on the experimental preparation of various multi-mode entangled states, with the ability to switch between them in real-time. Up to N-mode entanglement is measured with just one detector, here N = 8.

QW1C • Electronic Dynamics—Continued

QW1C.3 • 09:00
Mid-infrared Photoelectron Emission and Acceleration at Metallic Nanotips, Georg Herrmann1, Daniel R. Solf1, Max Guilde1, Claus Roepstorff1; 1Courant Research Center Nano-Spectroscopy and X-Ray Imaging, Univ. of Goettingen, Germany. We present localized photoemission from metallic nanotips using few-cycle pulses at near- and mid-infrared wavelengths ranging from 0.8-8µm. Photoelectron energies up to hundreds of eV are observed, and a sub-cycle acceleration regime is reached.

QW1C.4 • 09:15
Double Ionization Dynamics of Ethylenes in a Strong Laser Field, Xinshua Xie1, Stefan Reitberger1, Markus Schöfler1, Daniil Kartashov1, Li Zhang2, Erik Lötstedt2, Atsuhiro Ikushiki1, Kaoru Yamashita1, Andras Balbuena3, Markus Kittler1; 1Physics Institute, ETH Zurich, Switzerland; 2Department of Physics, School of Science, The Univ. of Tokyo, Japan. Dependence of ethylene double ionization on laser pulse duration and intensity was studied by Coulomb explosion imaging technique. It was found that multiple molecular orbitals are involved in the strong field double ionization of ethylene.

QW1C.5 • 09:30
Quantum Interference, Excitation and Multiple Orbitals in Atomic and Molecular High-harmonic Generation and Nonsequential Double Ionization, Carla Farria1,2,3; 1Physics and Astronomy, Univ. of Toronto, Canada; 2Max Planck Department for Structure Dynamics, DESY, Germany; 3Canadian Light Source, Canada. Arrival time jitter and pulse duration is measured using ponderomotive scattering for dense femtosecond electron bunches compressed by a 3 GHz RF cavity. We report 65 fs RMS jitter over 2 hours.

QW1C.6 • 09:45
Phase Dependence of Electron Localization in the Laser-Driven Dissociation of HeH+2+2, Kunlong Liu1, Peixiang Li1, Wuhan National Laboratory for Optoelectronics, China. We theoretically study the electron localization in the laser-driven dissociation of HeH+2+2. The upward shift and suppression of the localization probability are observed. The phenomena are found to be associated with the molecular structure.

QW1D • Structure Probes and Methods—Continued

QW1D.4 • 09:00
Non-Adiabatic Ionization in Circularly Polarized Laser Fields, Ingo Barth1, Olga Smirnova1; 1Max-Born-Institut, Germany. In contrast to theoretical predictions based on adiabatic tunneling picture, the accurate analytical ionization rates for p±p± orbitals in circularly polarized laser field differ by an order of magnitude for typical experimental conditions.

QW1D.5 • 09:15
Time-Resolved x-Ray Absorption, Emission, and Scattering Probes of Molecular Dynamics, Stephen H. Sauthoff1, Anne Marie March2, Gilles Doumy1, Elliot F. Kanter1, Linda Young1, Bertold Kraeutsl1, Phuy J. He1, Dipawal Ray2, Robert W. Dunford1, Christian Buth1; 1Argonne National Laboratory, USA. We report on laser-pump/x-ray-probe investigations of photoexcitation and photodissociation dynamics of solvated molecules using high-repetition-rate techniques at the Advanced Photon Source.

QW1D.6 • 09:30
Direct Observation of Arrival Time Jitter for RF Compressed Femtosecond Electron Bunches by Ponderomotive Scattering, Meng Gao1,2, Hubert Jean-Ruel1,2, Ryan R. Cooney1,2; 1Physics and Astronomy, Univ. of Toronto, Canada; 2Max Planck Department for Structure Dynamics, DESY, Germany; 3Canadian Light Source, Canada. Arrival time jitter and pulse duration is measured using ponderomotive scattering for dense femtosecond electron bunches compressed by a 3 GHz RF cavity. We report 65 fs RMS jitter over 2 hours.

QW1D.7 • 09:45
An Ultracold Electron Source for Ultrafast Electron Diffraction Experiments, Wouter Engelen1, Nicola Debernardi1, Edgar Vredenbregt2, Jom Luimen1; 1Eindhoven Univ. of Technology, Netherlands. We create ultrahot, ultracold electron bunches by accelerating electrons which are created by near-threshold photoionization of a cloud of laser-cooled atoms. With these bunches we can perform diffraction experiments of crystals of macromolecules.
Wednesday, 21 March

Madrid

Quantum Information and Measurement

10:30–12:30

QW2A • Quantum Communication III

Sergei Klinov; B. I. Stepanov; Inst. of Physics of NASB, Belarus, Presider

QW2A.1 • Time–10:30
Quantum Key Distribution Enhanced by Quantum Relays with Quantum Memories: Performances and Requirements; Silvestre Abruatto; Sylvia Bratzik; Hermann Kampermann; Dagmar Bruus; Inst. for Theoretical Physics III, Heinrich–Heine University; Germany. Quantum relays with quantum memories are proposed as a possible solution for increasing the distance of quantum key distribution. We consider a particular setup where only linear optics and heralding devices.

QW2A.2 • Time–10:45
The Implementation of a Quantum Key Distribution Scheme based on the Frequency-Time Uncertainty; Matthias Leifgen; Inst. of Physics of NASB, Belarus, Presider

QW2A.3 • Time–11:00
Influence of Atmospheric Turbulence on the Performance of a High Dimensional Quantum Key Distribution System using Spatial Mode Encoding; Brandon Rodenburg, Mehul Malik, Robert Eslamb, Olivier J. Benson, Colja Schubert; 'Physics, AG Nano-Optics, Humboldt Universität Berlin, Germany;' Photonic Networks and Systems, Fraunhofer Inst. for Telecommunications Heinrich Hertz Institut, Germany. The implementation of a new quantum key distribution scheme based on frequency-time uncertainty is presented, which uses mainly standard telecom components and offers strong robustness against decoherence in the transmission line.

QW2A.4 • Time–11:15
Polarization–Stable Long–Distance Interference of Independent Photons for Quantum Communication; Thiego Ferreira da Silva, Douglas Vitorelli, Guilherme B. Xavier; 'Center for Telecommunication Studies, Pontifical Catholic Univ. of Rio de Janeiro, Brazil;' Optical Metrology Division, National Inst. of Metrology, Quality and Technology, Brazil; 'Departamento de Ingeniería Eléctrica, Universidad de Concepción, Chile;' 'Center for Optics and Photonics, Universidad de Concepción, Chile.' Interference between fully-independent faint laser sources over two 8.5 km full polarization-controlled fiber links was performed, with stable visibility of 47.8%, an essential step towards practical implementation of quantum communication protocols.

QW2A.5 • Time–11:30
Integrating Long–Distance Quantum Key Distribution Networks: Towards Practical Applications; Daniel de Concepción; Catholic Univ. of Rio de Janeiro, Brazil.

Sydney

Research in Optical Sciences

10:30–12:30

QW2B • Quantum Entanglement

Paul Kwiat; Univ. of Illinois at Urbana-Champaign, USA, Presider

QW2B.1 • Time–10:30
Bringing Entanglement to the High Temperature Limit; Fernando Galve; IFISC (CSIC-UB), Spain. Decoherence typically restricts quantum phenomena to very low temperatures. We report a nonequilibrium state for two coupled, parametrically driven, dissipative harmonic oscillators which has stationary entanglement at very high temperatures.

QW2B.2 • Time–10:45
Quantum State Characterization of High–dimensionally Entangled Photons; Jonathan Leach; Megan Agnew; Melanie McLaren, Stef Rausz; Robert Boyd; Univ. of Ottawa, Canada; Inst. of Optics, USA; CSRI National Laser Centre, South Africa. We reconstruct the high-dimensionally entangled quantum state produced by parametric downconversion. Our results precisely characterize the entanglement, thus establishing the suitability of such states for applications in quantum information.

QW2B.3 • Time–11:00
Invited
Entangling Two Remote Rb–87 Atoms, Harald Weinfurter, Werner Rosenfeld, Julia Hofmann; Norbert Origiel; Ralf Krup, Lea Gerand; Florian Henkel; Markus Weber; 'Faculty of Physics, Ludwig–Maximilians University, Germany;' 'Max–Planck–Inst. for Quantum Optics, Germany.' We report on entanglement of two Rb–87 atoms which are independently trapped in two laboratories 20 meter apart.

QW2B.4 • Time–11:15
Multiband Contributions in N2 Harmonic Phase Measurements; Roland Guichard; 'LCMNR, UPMC, France.' We will present and analyze High Order Harmonic spectra (amplitude and phase) obtained in aligned nitrogen molecules at various laser intensities, evidencing a control over multichannel contributions involving the nuclear motion.

QW2B.5 • Time–11:30
Simulations of Ground and Excited State X–ray Absorption Spectra for Molecules in Solution: The Role of the Solvent, Thomas Penfold; Brandon Rodenburg, Ivano Tavernelli, Rafael Abela, Ursula Rothlisberger; 'Max–Planck–Inst. for Quantum Optics, Germany;' 'Laboratoire de spectroscopie ultrarapide, EPFL, Switzerland;' 'Laboratoire de chimie et biochimie computationnelles, EPFL, Switzerland;' 'SwissFEL, PSI, Switzerland.' For the XAS of molecules in solution it is important to include the solvent in the analysis of the spectra. Here we present a theoretical investigation of the spectra for PtPOP [1,2,3] and Cu(dmipa)2 [4,5].

Hong Kong

High Intensity Lasers and High Field Phenomena

10:30–12:30

HW2C • Electronic Dynamics and Attosecond Physics

Amelle Zair; Imperial College London, UK, Presider

HW2C.1 • Time–10:30
When Does an Electron Exit a Tunneling Barrier?; Nirav Dudovich; 'Weizmann Inst. of Science, Israel.' We probe the dynamics of tunnel ionization via high harmonic generation. We first characterize the ionization dynamics in helium atoms, and then apply our approach to resolve subtle differences in ionization from the different orbitals of a CO2 molecule.

HW2C.2 • Time–11:00
On the Wavelength Dependence of the Suppressed Ionization of Molecules in Strong Laser Fields; Judith Dun; Alexander Grau; Philipp Bater; Stephen M. Teichmann; Thorsten Englert; Arne Senftleben; Thomas Pflüger; Claus Dieter Schroeter; Robert Moshhammer; Joachim Ulbricht; Agnieszka Janin-Becker; Andreas Becker; Jens Biegert; 'AttoScience and Ultrafast Optics, ICFD–The Inst. of Photonics Sciences, Spain;' 'Max Planck Institut für Kernphysik, Germany;' 'JILA and Department of Physics, Univ. of Colorado, USA;' 'IKERBIDE–Instituto Catalán de Recerca i Estudis Avancats, Spain.' We study ionization of molecules and atoms with same IP by intense laser field from 0.6–10 nm. A trend from ionization-suppression to non-suppression is found for many molecules as a function of wavelength.

HW2C.3 • Time–11:15
Invited
Ornamental Chemistry in Solutions Investigated with Time–resolved X–ray Spectroscopy, Ning Hu; Hana Cho, Matthew L. Strader; Tae Kyu Kim; Robert W. Schoenlein; 'Max Planck Research Department for Structural Dynamics, Univ. of Hamburg–Center for Free Electron Laser Science, Germany;' 'Department of Chemistry, Pusan National Univ., Republic of Korea;' 'Chemical Sciences Division, Lawrence Berkeley National Laboratory, USA;' 'Materials Sciences Division, Lawrence Berkeley National Laboratory, USA.' Transient X-ray spectroscopy provides a detailed picture of rearranging molecular orbitals and atoms and is well suited to study organic ornamental chemistry in solution which is of importance in organic synthesis, catalysis and materials science.

Istanbul

International Conference on Ultrafast Structural Dynamics

10:30–12:30

IW2D • X–Ray Absorption

Steven Johnson; ETH Zurich, Switzerland, Presider

IW2D.1 • Time–10:30
Time–Resolved X–Ray Spectroscopies and Scattering, Christian Breslau; European XFEL, Germany. We present our new results exploiting simultaneously picosecond and femtosecond x–ray emission spectra in concert with x–ray diffuse scattering patterns, which provide complementary information to x–ray absorption studies. Key systems presented include a photocatalytic compound.

IW2D.2 • Time–11:00
Organometallic Chemistry in Solutions Investigated with Time–resolved X–ray Spectroscopy, Nilo Hu; Hana Cho, Matthew L. Strader; Tae Kyu Kim; Robert W. Schoenlein; 'Max Planck Research Department for Structural Dynamics, Univ. of Hamburg–Center for Free Electron Laser Science, Germany;' 'Department of Chemistry, Pusan National Univ., Republic of Korea;' 'Chemical Sciences Division, Lawrence Berkeley National Laboratory, USA;' 'Materials Sciences Division, Lawrence Berkeley National Laboratory, USA.' Transient X-ray spectroscopy provides a detailed picture of rearranging molecular orbitals and atoms and is well suited to study organic ornamental chemistry in solution which is of importance in organic synthesis, catalysis and materials science.
Quantum Communication III—Continued

QW2A • Quantum Correction of Photon-scattering Errors, Nitzan Ackerer1, Shlomi Keidar1, Yin-Non Gluckman1, Boaz Ozeri1; ‘Physics of Complex Systems, Weizmann Inst. of Science, Israel. Using a single trapped ion, we implement a quantum correction protocol for spontaneous photon-scattering error. Owing to ion-photon entanglement, measuring the photon polarization and emission time allows reversing the scattering process.

QW2A.5 • 11:30

Invited

Revival of Silenced Echo for Optical Quantum Memories: Efficiency and Noise Level, Matthias Bonarota1, Yiannye Diamon1, Thierry Chemelle1, Jean-Louis Le Gouët1; ‘Laboratoire Aimé Cotton, France. We present a novel quantum memory protocol inspired by the two photon echo that overcomes the main drawbacks of the latter, namely, contamination of the retrieval pulse by spontaneous emission and free induction decay.

QW2A.6 • 11:45

Qubit, Probing a Many-particle System Using a Single Qubit, Thomas Busch1,2, Thomas Fogarty1, Nicola Lo Giallo1, John Gould1, Mauro Paternostro1; ‘Physics Department, Univ. College Cork, Ireland; ‘Quantum Systems Unit, Okinawa Inst. of Science and Technology, Japan; ‘Clarendon Laboratory, Univ. of Oxford, UK; ‘Centre for Theoretical Atomic, Molecular and Optical Physics, Queens’s Univ., Belfast, UK. We theoretically investigate the behaviour of a single qubit coupled to a low-dimensional, ultra-cold quantum gas and show that the properties of the many-particle system can be deduced from the dynamics of the qubit.

QW2A.7 • 12:00

Invited

Complementarity Revisited, Wolfgang P. Schleich1; ‘Institut für Quantenphysik and Center for Integrated Quantum Science and Technology (IQst), Universität Ulm, Germany. We analyze two recent double-slit experiments using twin photons demonstrating the simultaneous observation of “which-slit” information and interference. They suggest new aspects of Niels Bohr’s principle of complementarity.

QW2A.8 • 12:15

Quantum Measurements As a Control Resource, Alexander Pechen1,2; ‘Chemical Physics, Weizmann Inst. of Science, Israel; ‘Mathematical Physics, Stoklov Mathematical Inst., Russian Academy of Sciences, Russian Federation. We discuss the use of back-action of quantum measurements as a resource for controlling quantum systems and review its application to optimal approximation of quantum anti-Zeno effect.

QW2B • Quantum Entanglement—Continued

QW2B.4 • 11:30

Invited

Attosecond Strong-field Electron Pulse Interferometry, Markus Kitzler1, Xinhua Xie1, Stefan Böhm1, Daniel Kartschitz1, Emil Persson1, Diego G. Arichi1, Li Zhang1, Steffen Gräfe1, Markus Schöffler1, Joachim Burgdörfer1, Andreas Baltuška1; ‘Photonic Inst., Vienna Univ. of Technology, Austria; ‘Inst. for Theoretical Physics, Vienna Univ. of Technology, Austria; ‘Inst. for Astronomy and Space Physics - IAFE (FCEN-UBA Conicet), Argentina. We demonstrate self-referenced wavefunction retrieval of a valence electron wavepacket during its creation by strong-field ionization with sub-10-attosecond precision, based on a distinct separation of interferences arising at different time-scales.

QW2B.5 • 11:45

Encoding of Higher Dimensional States in the Time-energy Degree of Freedom, Daniel Richter1,2; ‘Laser Spectroscopy, Max Planck Institut Quantum Optics, Germany; ‘Ludwig Maximilian Universität, Germany. We present experimental results on the preparation of higher dimensional time-energy entangled states. We performed measurements on suited entanglement and dimensional witnesses of the encoded states for dimensions of up to 4 x 4.

QW2B.6 • 12:00

Vectorial Phase Retrieval for Linear Characterization of Attosecond Pulses, Oren Raz1, Nirit Dudovich1, Ivan Wahlmeier1; ‘Complex Systems, Weizmann Inst. of Science, Israel; ‘Physics, University College London, UK. We propose a new linear alloptical method for attosecond pulses characterization. Our scheme is based only on spectral and polarization measurements. We demonstrate this method numerically on pulses generated from aligned CO2 25 molecules.

QW2B.7 • 12:15

Atomic Photoionization and Stabilization with Relativistically Intense Circularly Polarized Light: Magnetic Field Effects Revisited, Mikhail Emel’1, Lev Smirnov1, Mikhail Ryabikin1; ‘Inst. of Applied Physics, RAS, Russian Federation. Results of three-dimensional numerical simulations of strong-field atomic stabilization in circularly polarized light are presented. These calculations resolve recent contradictions in the literature related to the role of magnetic field.

QW2B.8 • 12:15

Research in Optical Sciences • 19–21 March 2012

High Intensity Lasers and High Field Phenomena

HW2C • Electronic Dynamics and Attosecond Physics—Continued

HW2C.4 • 11:30

Invited

Molecular Structural Dynamics in Solution Revealed by Picosecond Time-Resolved XAFS, Shin-ichi Adachi1,2, Takanobu Saito1, Shunshke Nozawa1; ‘Photon Factory, High Energy Accelerator Research Organization (KEK), Japan; ‘PRESTO, Japan Science and Technology Agency (JST), Japan. We have examined transient electronic and structural modifications of metal complexes coupled with spin-state dynamics by time-resolved hard X-ray spectroscopy at Photon Factory Advanced Ring (PF-AR), KEK.

HW2C.5 • 12:00

X-ray Absorption—Continued

HW2C.6 • 12:15

Structural Dynamics Studies on Photoinduced Interfacial Electron Transfer using Ultrafast X-ray Spectroscopy, Xiaoyi Zhang1, Grigory Smolentsev1, Sophie Cantor1, Jianchang Guo3, Villy Sundstrom1, Lin Chen1,2, Klaus Attelken1, Guy Jennings1, Charles Kurz3; ‘X-ray Science Division, Argonne National Laboratory, USA; ‘Department of Chemical Physics, Lund Univ., Sweden; ‘Chemical Sciences and Engineering Division, Argonne National Laboratory, USA; ‘Department of Chemistry, Department of Chemistry, USA. We have used X-ray transient absorption spectroscopy to probe transient structures during interfacial electron transfer between dyes and TiO2 nanoparticles. Electronic and structural changes of dyes in charge-separated state have been observed.

Wednesday, 21 March
Wednesday, 21 March

14:00–16:00 QW3A • Quantum Information and Measurement with Photons II
Robert Boyd; Univ. of Ottawa, Canada, Presider

14:00–14:30 Plenary
Elements of a Practical Quantum Network,
Ian A. Walmsley; Univ. of Oxford, UK. A scalable photonic quantum network requires a means to perform deterministic quantum operations at the single-photon level. This can be accomplished by means of linear optics, measurement by photodetectors, and quantum memory. We discuss progress in these components, and indicate some practical thresholds in device performance for some useful network operations.

14:30–16:00 QW3B • Quantum State Engineering I
Paolo Villegrosi; Univ. of Padova, Italy, President

14:30–14:45 Invited
Maximizing the Dimensionality of Orbital Angular Momentum in Parametric Down-conversion,
Jacqui Romero1,2, Daniele Giovannini1, Filippo M. Miatto2, Stephen M. Barnett1, Miles J. Padgett1; School of Physics and Astronomy, Univ. of Glasgow, UK; Department of Mechanical and Aerospace Engineering, Universita di Firenze, Italy; 2Max Planck Group for Atomically Resolved Dynamics, Centre for Free Electron Laser Science, Univ. of Hamburg, Germany.

14:45–16:00 QW3B • Quantum State Engineering II

Sydney

14:00–16:00 HW3C • NL and Extreme NL Optics
Gunter Steinmeyer; Max Born Inst., Germany, President

14:00–14:30 Invited
Collimated-Beam Third- and Fifth-Harmonic Generation by Mid-Infrared Ultrashort Pulses, Aleksei Zheltikov3,4; 1Inst. for Molecular Science, Japan; 2Kagawa Univ., Japan; 3Moscow State Univ., Russian Federation; 4Texas A&M Univ., USA. We show that the stationary state of single-qubit laser is a phase-averaged nonlinear coherent state, provide super convergent iterations method for its finding and investigate characteristic quantum properties of the state.

14:30–14:45 Invited
Phase-stable 0.74-cycle pulses in the mid-infrared region was generated by using four-wave mixing through filamentation. The pulse duration was measured as 10.8 fs at 4.4 um carrier wavelength through filamentation. The pulse duration was measured as 10.8 fs at 4.4 um carrier wavelength. This can be accomplished by means of linear optics, measurement by photodetectors, and quantum memory. We discuss progress in these components, and indicate some practical thresholds in device performance for some useful network operations.

14:45–16:00 HW3C • NL and Extreme NL Optics

Hong Kong

14:00–16:00 HW3C • NL and Extreme NL Optics
Gunter Steinmeyer; Max Born Inst., Germany, President

14:00–14:30 Invited
Collimated-Beam Third- and Fifth-Harmonic Generation by Mid-Infrared Ultrashort Pulses, Aleksei Zheltikov3,4; 1Inst. for Molecular Science, Japan; 2Kagawa Univ., Japan; 3Moscow State Univ., Russian Federation; 4Texas A&M Univ., USA. We report the first experimental observation of laser emission from a femtosecond mid-infrared laser filament in molecular nitrogen. Nanosecond pulses at 337 nm and 357 nm wavelengths with energies up to 3.5 microwatts are generated.

14:30–14:45 Invited
Phase-stable 0.74-cycle pulses in the mid-infrared region was generated by using four-wave mixing through filamentation. The pulse duration was measured as 10.8 fs at 4.4 um carrier wavelength through filamentation. The pulse duration was measured as 10.8 fs at 4.4 um carrier wavelength. This can be accomplished by means of linear optics, measurement by photodetectors, and quantum memory. We discuss progress in these components, and indicate some practical thresholds in device performance for some useful network operations.

14:45–16:00 HW3C • NL and Extreme NL Optics

Istanbul

14:00–16:00 IW3D • 2D-IR
Andrei Tokmakoff has been on the MIT faculty since 1998, and is currently Professor of Chemistry. His research group is recognized for studies of molecular dynamics in chemistry and molecular biophysics using ultrashort two-dimensional infrared spectroscopy, including descriptions of water hydrogen bond dynamics, protein conformational dynamics. His many awards and honors include the Alfred P. Sloan Research Fellowship, the Coblentz Award, the National Fresenius Award, and the Ernest K. Plyler Prize for Molecular Spectroscopy.

14:00–14:25 Invited
Watching Time-evolving Molecular Structures with 2D IR Spectroscopy,
Andrei Tokmakoff; MIT, USA. This tutorial will cover the use of equilibrium and transient 2D IR spectroscopy for studies of time-evolving molecular structures in chemical and biological dynamics, including experimental methods and modeling of the data.
QW3A.3 • 15:00
Dispersion-based Control of Spatial Modes for Parametric Down-conversion in a Multimode Waveguide, Michal Karpinski1, Cezłow Radziweisz2, Konrad Banaszek1; 1Faculty of Physics, Univ. of Warsaw, Poland. We demonstrate a scheme to control spatial characteristics of spontaneous parametric down-converted light in a multimode waveguide, based on intermodal dispersion. The down-converted photons are characterized by measurement beam quality factors.

QW3B.2 • 15:15
Experimental Study of the Decoherence of Biphonon Qutrits, Assaf Shulman1, Hagai Eisenberg2; 1Racah Inst. of Physics, The Hebrew Univ. of Jerusalem, Israel. We have generated various indistinguishable biphoton states, representing quantum trits. Their coherence was controllably changed and fully characterized by two-photon state tomography. Entanglement dynamics of the biphotons has also been studied.

QW3B.3 • 15:30
Observation of Electromagnetically Induced Transparency (EIT) in Rb-filled Hollow-core Fibre, Thomas M. Stace1,2; 1Physics, Univ. of Queensland, Australia. Filling the cores of a hollow-core optical fibre with Rb has proven challenging. Here we report on progress to this end, and give experimental and theoretical evidence of substantial electromagnetically induced transparency at room temperature.

QW3B.4 • 15:45
The Interference of Light with Orbital Angular Momentum at Photo-count Level and Boris’s Rule, Aleixos Jesu-Silva1, Eduardo Fonseca1, Jandir Hickmann1; 1Optics and Materials Group, Brazil. We use photons’ orbital angular momentum two-dimensional properties to obtain a triangular quantum interference pattern, confirming that only pairs contribute to the two-dimensional photon detection probability, as established by Boris’s rule.

QW3C.4 • 15:00
Filamentation of Few-Cycle Mid-Infrared Pulses in Gases, Daniil Kartashov1, Skirmantas Ališauskas1, Andrius Baltuška1, Alexander A. Voronin1, Aleksandr Zhitikov1,2, Massimo Petrozza3, Pierre Bejot4, Jerome Kasparian5, Audrins Pugzlys1; 1Vienna Univ. of Technology, Photonics Inst., Austria; 2Physics Department M.V. Lomonosov Moscow State Univ.; 3International Laser Center, Russian Federation; 4Department of Physics and Astronomy, Texas A&M Univ., USA; 5Université de Genève, Switzerland. We report the first generation of femtosecond mid-infrared filaments in argon and nitrogen gases. The new effect of self-focusing suppression in nitrogen and 350nm-5.5cm spectral continuum in argon are demonstrated.

QW3C.5 • 15:15
Carrier-envelope Phase Double Stabilization Setup with sub-10 Attosecond Timing Jitter, Bastian Barchers1, Sebastian Koke1, Gunter Steinmeyer1; 1Max Born Inst., Germany. We demonstrate a novel setup for carrier-envelope phase stabilization combining a feedback loop with a feed-forward type stabilization technique to push the residual timing down to 8 attoseconds, setting a new record in stabilization performance.

QW3C.6 • 15:45
Theoretical Explanation of the Soliton Self-frequency Blunting in Gas-filled Hollow Core Photonic Crystal Fibres, Fabio Biancalana1, Mohammad F. Saleh1, Philipp Hoelzer1, Wonkeun Chang1, John C. Travers1, Nicolas Y. Joly1, Philip Russell1; 1NPN, Max Planck Inst. for the Science of Light, Germany; 2Institut für Physikalische Chemie, Christian-Albrechts-Universität zu Kiel, Germany. The NH-stretching region of guanosine-cytidine base pairs in chloroform was investigated with 2D-IR and pump-probe spectroscopy. Structural motifs are correlated with spectral features through off-diagonal couplings and observation of energy transfer.
**Wednesday, 21 March**

**Quantum Information and Measurement**

**16:30–18:00**

**QWA4A • Novel Quantum Information and Measurement Techniques II**

Paul Lett; NIST, USA, Presider

**QWA4A.1 • 16:30**

Open Quantum Walks as a Tool for Dissipative Quantum Computing, Francesca Petruccione1, Ilya Sinayskiy2; 1UXZN, South Africa. Recently, open quantum walks (OQW) have been formulated as quantum Markov chains on graphs. It is shown that OQWs are a very useful tool for the formulation of dissipative quantum computing algorithms and for dissipative quantum state preparation.

**QWA4A.2 • 16:45**

The Quantum Zeno Paradox: A Matter of Information, Peter E. Toschek; 1Inst. f. Laser-Physik, Universität Hamburg, Germany. Observation of expectation values does not admit the demonstration of the quantum Zeno paradox. Rather, iterative detection of transition times of an individual quantum object provides necessary and sufficient evidence.

**QWA4A.3 • 17:00**

Heisenberg-limited Metrology without Entanglement, Daniel Braun1, John Martin2; 1Inst. f. Laser-Physik, Universität Hamburg, Germany; 2Kavli Inst. of Nanoscience, UNM, USA. We introduce new approach to complete space-time characterization of the pulse. Vibrational wave-packets motion due to the radial breathing, and the related coherent phonon generation is in-depth studied.

**QWA4A.4 • 17:15**

N-photon Autocorrelator with Picosedond Temporal Resolution, Zhi Zhou1, G. Fruch1, Saedeh Imamehmadjou1, F. Mattioli2, A. Gaggero2, R. Leoni2, A. Fiore1; 1COBRA Research Inst., Eindhoven Univ. of Technology, Netherlands; 2COBRA Research Inst., University of Perugia, Italy. We demonstrate an ultrafast autocorrelator with single-photon sensitivity based on superconducting nanodetectors. Its temporal resolution is only limited by the hottest relaxation time which has been directly measured to be ~20 ps.

**QWA4A.5 • 17:30**

Fabrication of Optical Nanofiber Cavity Using Focused Ion Beam Milling, Kali P. Nayak1, Yoshimasa Sugimoto2, Kohzo Hakuta2; 1Center for Photonic Innovations, Univ. of Electro-Communications, Japan; 2Nanotechnology Innovation Center, National Inst. for Material Science, Japan. We discuss the characteristics of optical nanofiber cavities fabricated using femtosecond FEL radiation will be presented along with first time-resolved results on the XUV-induced fragmentation dynamics of small molecules.

**19–21 March 2012**

**Research in Optical Sciences • 19–21 March 2012**
QW4A • Novel Quantum Information and Measurement Techniques II—Continued

QW4A.5 • 17:30
Ancilla-based Quantum Simulation, Katherine L. Brown1, Savarudra De1, Yiyi Kendal1, William J. Munro1,2; 1School of Physics and Astronomy, Univ. of Leeds, UK; 2National Inst. of Informatics, Japan; NTT Basic Research Laboratories, Japan. We show how using a continuous-variable ancilla to manipulate qubits can provide efficient quantum simulation, including a linear QFT and efficient phase estimation algorithm.

QW4B • Quantum State Engineering II—Continued

QW4B.5 • 17:30
Superradiance from Entangled Atoms, Ralph Wagner1, Joachim von Zanthier1; 1Grafenberg, Germany; 2Univ. Erlangen-Nuremberg, Germany; 3Institut für Optik, Information and Photonics, Univ. Erlangen-Nuremberg, Germany. We present the radiation properties of entangled atomic sources in comparison to sources in a separable state. We explain superradiance and subradiance of entangled sources in terms of interference among different photon quantum path ways.

QW4B.6 • 17:45
Optimal Measurement for the Discrimination of Inconclusive Outcomes, Janos A. Bergou1, Ramon Munoz-Tapia1, Emilio Bagan1,2, Georgina A. Olivares Renteria1; 1Physics and Astronomy, CUNY Hunter College, USA; 2Institut für Festkörper- und Fluiddynamik, Universität Erlangen-Nürnberg, Germany. We present optimal measurement results for the maximal success of quantum information and metrology, are mostly optimized for ideal error measurements for a general model of imperfect detection.

QW4C • Atomic and Molecular Physics—Continued

QW4C.3 • 17:30
Nanostructure-enhanced Atomic Line Emission from Noble Gases Driven by Low-Energy, Few-Cycle Laser Pulses, Murat Sivis1,2, Yaxing Liu1, Katrin Siefermann1,2, Bernd Abele1, Claus Ropers1; 1Center for Ultrafast Optoelectronics Research, CUNY Hunter College, USA; 2Institut für Festkörperforschung, Universität Erlangen-Nürnberg, Germany; 3Department of Physics, Oklahoma State Univ., USA. We discuss the radiation properties of entangled atomic sources in comparison to sources in a separable state. We explain super- radiance and subradiance of entangled sources in terms of interference among different photon quantum path ways.

QW4C.4 • 17:45
Complete Fragmentation of Hydrocarbon Molecules Probed by Few-cycle Laser Pulses, Stefan Rother1, 2, Xiaoliang Xu1, 2; 1Institut für Kernphysik, Universität Erlangen-Nürnberg, Germany; 2Institut für Theoretische Physik III, Universität Bayreuth, Germany. We study theoretically the fluctuation properties of LO phonons for a quantum dot excited by ultrashort pulses. For two pulses we analyze the excitation conditions to create squeezed phonons.

QW4C.5 • 18:00
Measurement of Electronic Structure in Molecular High Harmonic Generation, Michael C. Wong1, Jean-Franois Bruch1, Abdallah H. Alhamri1, Andrew E. Bogulavsky1, Ravi Bhardwaj1; 1Department of Physics of Complex Systems, Weizmann Inst. of Science, Rehovot, Israel; 2Physics, School of Science, The Univ. of Tokyo, Japan. We present results of attosecond time scale control of high harmonic generation in a series of complex, unaligned, polyatomic molecules and show that fingerprints of electronic structure are embedded in harmonic spectra.

QW4C.6 • 18:15
Quantum Control of Photodissociation Using Shaped Ultrafast Pulses, Uri Levi1, Leigh Graham2,3, Barry D. Bruner2,4, Adi Natan1,2,1,3,4, Rodrigo Lopez-Martens1, Antonin Borot1, Anaïs Malvache1, Xiaowei Chen1, Aurélie Jullien1, Yaron Silberberg1,1,2,1,2,1,3,4,5, 1Department of Physics, School of Science, The Hebrew University of Jerusalem, Israel; 2Department of Chemical Engineering, Technion, Israel Institute of Technology, Haifa, Israel; 3Paul Scherrer Institut, Villach, Switzerland; 4Department of Science, National University of Singapore, Singapore; 5Department of Physics, The City College of CUNY, New York, NY, USA. The structure and ultrafast dynamics of a catalysis protein are reported using 2D-IR spectroscopy and X-ray crystallography. These are combined with biochemical studies of functionality to gain new insights into the structure function relationship.

QW4C.7 • 18:30
Attosecond Control of Laser Driven Plasmas, Rodrigo Lopez-Martens1, Antonin Borot1, Anaïs Malvache1, Xiaowei Chen1, Aurélie Jullien1, Yaron Silberberg1,1,2,1,2,1,3,4,5, 1Department of Physics, School of Science, The Hebrew University of Jerusalem, Israel; 2Department of Chemical Engineering, Technion, Israel Institute of Technology, Haifa, Israel; 3Paul Scherrer Institut, Villach, Switzerland; 4Department of Science, National University of Singapore, Singapore; 5Department of Physics, The City College of CUNY, New York, NY, USA. We demonstrate the ability to control dissociation rates of H2+ molecules from targeted vibrational levels using strong (4×10^13 W/cm^2) laser fields and simple analytically designed ultrafast pulse shapes.
Tucker, Nicholas P-IW4D.6
Tünnermann, Andreas-HM3C.1, HT3C.1
Turcu, Edmond-HM1C.5, JT2A.43
Ullrich, Joachim-HW2C.2, HW4C.1, IW1D.2, HW4C.4
Underwood, Jonathan-HM1C.5
Usmani, Imam-QT3A.5
Vallone, Giuseppe-JT2A.3, QT4A.3
van der Torren, Alexander-QT4B.4
van der Veen, Renske M-IW2D.5, IW2D.6
Van Druten, Klaasjan-QM2A.4
van Exter, Martin P-QT3B.4, QT4B.4
van Mourik, Frank-IM3D.1, IM3D.4
van Thor, Jasper J-IM3D.5
Vasylkiv, Yuriy-JT2A.8
Vauthey, Eric-JT2A.44
Villoresi, Paolo-HM1C.5, JT2A.3, JT2A.43, QT4A.3, QW3A.3
Vincenti, Henri-HM1C.1
Vinck-Posada, Herbert-JT2A.16
Vitali, David-QM3A.6
Vitelli, Chiara-QM2A.5
Vitoreti, Douglas-QW2A.4
Vlček, Antonín-IM3D.4
Vlokh, Rostyslav-JT2A.8
Vogl, Ulrich-QT1A.6
Vohringer, Peter-IW3D.3
Volpi, Matthew-QW3A.5
von Zanthier, Joachim-JT2A.7, QM3B.6, QW4B.5
von der Weid, Jean Pierre-QW2A.4Vasilyev, Denis-JT2A.27
Voronin, Alexander A-HW3C.1, HW3C.3, HW3C.4
Vrakking, Marc J-HM3C.3
Vredenbregt, Edgar-IW1D.7
Vrejou, Ionela-IM1D.3, JT2A.49
Vysin, L.-HM2C.3
Wabnitz, H.-HM2C.3
Wall, Simon-IW4D.1
Walsley, Ian-HW2C.5, QW3A.1
Walsh, Martin A-IW4D.6
Waltermann, Christian-JT2A.58
Wang, Cheng-HT1C.4
Wang, Xijie-JT2A.53
Wang, Jing-Nuo-JT2A.20
Wolter, Till-QW1A.2
Weiner, Michael-IW1D.1
Welling, Till-JT2A.12
Wenk, Haidan-JT2A.36
Wesch, Christian-JT2A.45
Weyrauch, Michael-QT1B.7
White, Andrew-QW1A.2, QW1B.4
Wieczorek, Witold-QM1A.2
Wiegner, Ralph-JT2A.7, QW4B.5
Wigger, Daniel-IW4D.5
Wiseman, Howard M-QT4A.4
Witting, T.-HM3C.8
Woerner, Michael-IW2D.5, IT1D.2, IT4D, IT4D.2
Woggon, Ulrike-IW4D.3
Wolf, Martin-IW4D.1
Wolfgamm, Florian-QM2A.5
Wollenhaupt, Matthias-IT3D.3
Wolters, Janik-QW1B.3
Wong, Michael-HM2C.2
Wong, Michael C. H.-HW4C.5
Wu, Anhua-HT1C.4
Wu, Jing-Nuo-JT2A.20
Wulf, Michael-IM1D.3
Xanthas, Sotiris S-JT2A.45
Xavier, Guilherme B-QW2A.4
Xie, Guoyong-QM3B.2
Xie, Changde-QT1B.3
Xie, Xinhua-HW1C.4, HW2C.4, HW4C.4
Xing, Xingxing-HW1C.4
Xu, Huailiang-HW4C.4
Xu, Zhizhan-HT1C.4
Yabashi, Makina-IW1D.1
Yabushita, Atsushi-JT2A.25, QT3A.4
Yamanouchi, Kaoru-HW1C.4, HW4C.4
Yan, Wenhua-JT2A.10
Yang, Ming-IW3D.4
Yurulmaz, Cigdem-QT4B.4
Young, Linda-IW1D.5
Youning, Li-QW3A.5
Yu, Lianghong-HT1C.4
Yuasa, Kazuya-QT3B.5
Yuurtsever, Ulvi-QW1A.3
Zair, Amelle-HM3C.8, HW2C, JT2A.61
Zajfman, Daniel-HW4C.6
Zamponi, Flavio-QM2D.5, IT1D.2
Zair, Amelle-HT4C.8
Zbignen, Hugo-QW1A.6
Zerom, Petros-QT4B.5
Zhang, Dongfang-JT2A.47
Zhang, Hao-JT2A.46
Zhang, Junxiang-JT2A.24
Zhang, Li-HW1C.4, HW2C.4, HW4C.4
Zhang, Weiping-QT1A.3
Zhang, Xiaoyi-IW2D.7
Zhao, Tong-QW3A.5
Zhao, Ying-QT1B.3
Zheltikov, Aleksei-HW3C.1, HW3C.2, HW3C.3, HW3C.4
Zheng, Yanqing-HT1C.4
Zhong, Yin-Peng-IW1D.2
Zhong, Yin-Peng-IW1D.2
Zhou, Binbin-JT2A.60
Zhou, XingXing-QM2A.2
Zhou, Zhifan-JT2A.3
Zhou, Zhifan-JT2A.3
Zhou, Zili-QW4A.4
Zhu, Ding-QW1D.2
Zhu, Yunhui-QT4A.2
Zier, Tobias-JT2A.39
Zigler, Arie-HM1C.3
Zijlstra, Eeuwe Steeds-IW4D.4, JT2A.39
Zwiller, Valery-QW4B.3
Zwyer, Manfred-QT4B.5
Zwiller, Valery-QW4B.3
POSTDEADLINE PAPERS

Research in Optical Sciences

High Intensity Lasers and High Field Phenomena (HILAS)

International Conference on Ultrafast Structural Dynamics (ICUSD)

Quantum Information and Measurement (QIM)

Collocated with Laser Optics Berlin

ISBN 978-1-55752-941-1

19–21 March 2012
Laser Optics Berlin
Berlin, Germany
Postdeadline Sessions

HT5C • High Intensity Lasers and High Field Phenomena (HILAS) Postdeadline Session
Hong Kong, Messe Berlin
Tuesday, 20 March, 19:00 – 20:30
Jen Beigert; CFO - The Institute of Photonic Sciences, Spain, Presider

HT5C.1 • 19:00
Spectral Caustics in Attosecond Science, O. Roz¹, O. Pedatzur¹, N. Dudovich¹, B.D. Bruner¹; ¹Weizmann Inst. of Science, Israel. By exploiting singularities of the semiclassical model that describes high harmonic generation (HHG), we are able to demonstrate a new level of control over the emitted attosecond pulse, reaching a narrow tunable spectral enhancement.

HT5C.2 • 19:15
Controlling Ionisation and Fragmentation Processes in CO2 via Laser Driven Inelastic Electron Recollisions, M. Oppermann¹, S. Weber¹, L. Frasinski¹, J.P. Marangos¹; ¹Imperial College London, UK. For the first time, the angular dependence of nonsequential double ionisation and dissociation induced by laser driven inelastic electron rescattering was investigated experimentally in aligned CO2. A strong dependence on the recollision angle was found.

HT5C.3 • 19:30
Non-Adiabatic Ionization in Circularly Polarized Laser Fields, I. Barth¹, O. Smirnova¹; ¹Max-Born-Institut, Germany. In contrast to theoretical predictions based on adiabatic tunneling picture, the accurate analytical ionization rates for p+ and p- orbitals in circularly polarized laser fields differ by an order of magnitude for typical experimental conditions.

HT5C.4 • 19:45
Inhomogeneous High Harmonic Generation in Krypton Clusters, H. Ruf¹, C. Handschin¹, S. Petit¹, D. Descamps¹, E. Mével¹, E. Constant¹, B. Fabre¹, Y. Mairesse¹, R. Cireasa², N. Thiré², V. Blanchet²; ¹CELIA : Université Bordeaux, France; ²LCAR: Université de Toulouse, France. By performing high harmonic generation in a cluster and monomer mixture, we isolate the radiation originating from clusters. Surprisingly this radiation is depolarized. Our experiments show that it is produced by a new recollisional mechanism.

HT5C.5 • 20:00
Imaging the Kramers-Henneberger Atom, Felipe Morales Moreno, Thales Optronique SA; France. We present a two stages Ti:Sapphire amplifier system running at 1Hz reaching up to 65J supporting sub-30fs pulses. Extreme care have been taken on the beam profile quality as well as preventing transverse lasing.

HT5C.6 • 20:15
1Hz PetaWatt Class Laser for Laser Driven Wakefield Acceleration, Olivier Chalus¹²; ¹Max-Born-Institut, Germany; ²National Research Council of Canada, Canada. We provide a unified concept for understanding and imaging excited state dynamics in atoms and molecules in intense laser fields, including microscopic description of high order Kerr non-linearities and their role in laser filamentation.
QT5C • Quantum Information and Measurement (QIM) Postdeadline Session
Madrid, Messe Berlin
Tuesday, 20 March, 18:45 – 21:00
Andrew White; Univ. of Queensland, Australia Presider

QT5A.1 • 18:45
The Biaxial Nonlinear Crystal BiB3O6 as a Polarization Entangled Photon Source using Non-collinear Type-II Parametric Down-conversion,
A. Halevy¹, E. Megidish¹, L. Dovrat¹, H. Eisenberg¹, P. Becker², L. Bohaty³; ¹Racah Inst. of Physics, The Hebrew Univ. of Jerusalem, Israel; ²Inst. of Crystallography, Univ. of Cologne, Germany. We describe the full characterization of BiB3O6 as a polarization entangled photon source using non-collinear type-II parametric down-conversion and experimentally demonstrate entanglement generation with up to 2.5 times higher rates compared to beta-BaB2O4.

QT5A.2 • 19:00
Phase-controlled Switching between Incoherent Optical Images in a Double-Λ System, H. Kang¹, B. Kim¹, Y. Park¹; ¹GIST, Republic of Korea. Phase-controlled optical image switching with low light intensity was demonstrated in a double-Λ system. Switching by interference in a double-Λ system was observed as having a 90% switching depth between incoherent image pixels.

QT5A.3 • 19:15
Adaptive Measurement of the Spectral and Temporal Shape of Ultrashort Single Photons for Higher-Dimensional Quantum Information Processing, A. Zavatta¹, C. Polycarpou¹, M. Bellini¹, A. Zavatta², C. Polycarpou², G. Venturi², M. Bellini², K.N. Cassemiro³, K.N. Cassemiro⁴; ¹Istituto Nazionale di Ottica (INO-CNR), Italy; ²Università di Firenze, Italy; ³Universidade Federal de Pernambuco, Brazil; ⁴Max Planck Inst. for the Science of Light, Germany. We describe a new method, combining techniques from the fields of ultrafast and quantum optics, for gaining full access to the spectral and temporal information encoded in the wavepacket mode of single, ultrashort, photons.

QT5A.4 • 19:30
High-performance Narrowband Filter for Atom-resonant Quantum Light Generation, J. Zielinska¹, F.A. Beduini¹, M. Mitchell¹, N. Godbout³, M. Mitchell³; ¹ICFO - Institut de Ciencies Fotoniques, Spain; ²École Polytechnique de Montréal, Canada; ³ICREA, Spain. Spectral filters are indispensable elements in many quantum optics experiments. We present a Faraday anomalous dispersion filter based on optical properties of atomic vapor, which surpasses conventional interference filters in terms of key figures of merit.

QT5A.5 • 19:45
Polarization Entanglement Engineering at Telecom Wavelengths, F. Kaiser¹, L. Ngah¹, A. Issautier¹, O. Alibart¹, A. Martin¹, T. Sébastien¹; ¹Univ. of Nice - Sophia Antipolis, France. We report an efficient polarization entanglement engineering scheme based on a stabilized birefringent delay line. The scheme is capable of
handling ultra narrowband photons making it compatible for multiplexing and quantum memory based applications.

QT5A.6 • 20:00
Complete Measurement of the Two-Photon Wave Function using High Contrast Quantum Interference, R. Pomeranz, Y. Shaked, A. Pe'er, Bar Ilan Univ., Israel. Exploiting quantum pairwise interference, we measure the spectral phase of ultra-broadband entangled photon pairs. The nonclassical nature of the interference is manifested by observing the reduction of fringe contrast as linear loss is introduced.

QT5A.7 • 20:15
Experimental Demonstration of a Novel Superconducting Photon Number Resolving Detector, G. Frucci, Univ. of Technology Eindhoven, Netherlands. We report the experimental demonstration of a novel photon number resolving detector (PNR) structure which can exhibit a large dynamic range. It is based on the series connection of N superconducting nanowires.

QT5A.8 • 20:30
Quantum Storage of a Photonic Polarization Qubit in a Doped Crystal, M. Gundogan, P.M. Ledingham, A. Almasi, M. Cristiani, H. de Riedmatten, H. de Riedmatten; ICFO-Institut de Ciencies Fotoniques, Spain; ICREA-Institució Catalana de Recerca i Estudis Avançats, Spain. We report storage of photonic polarization qubits in a crystal. The average conditional fidelity of retrieved qubits exceeds 95% for a mean photon number $\mu=0.4$, higher than the classical benchmark proving the quantum nature of the storage.

QT5A.9 • 20:45
Entanglement between Photons that Never Co-existed, E. Megidish, A. Halevy, T. Shacham, T. Dvir, L. Dovrat, H. Eisenberg; Hebrew Univ., Israel. We entangle two photons, with the first detected even before the other is created, by using entanglement swapping between temporally-separated polarization-entangled photon pairs. This result shows the nonlocality of quantum mechanics in space time.
Program Additions:
New paper sessioned as  IT1D.1, **Multidimensional Stimulated Resonant Raman X-ray Spectroscopy of Molecules**, Shaul Mukamel, Jason D. Biggs, Yu Zhang and Daniel M. Healion, University of California at Irvine, USA. Valence excitations can be studied by watching wavepackets launched by sequences of attosecond x-ray pulses. This is demonstrated by simulations for trans-Nmethylacetamide (NMA) at the oxygen and nitrogen K-edges. A Super Magic Angle (SMA) combination of two measurements with specific pulse polarization configurations can simplify the interpretation of these signals. [See Postdeadline papers for a copy of the PDF summary]

Presenter Changes:
IM1D.4 will be presented by Mathieu Ducaosso, CEA Saclay, France; instead of Hamed Merdji
QM3B.1 will be presented by Jonathan Mathews, Univ. of Bristol, UK instead of Jeremy O’Brien

Withdrawn Papers and Poster:
QM1A.4, Quantum Interferometry (Augustro Smerzi)
HM2C.3, Results of Recent Experiment at (x-Ray) Free Electron LASERs on Carbon-like Materials (Shafagh Dastjani Farahani)
IT1D.1, Time-resolved Laue Diffraction at High Positional Accuracy and the Optimizing of Time-Resolutions at Synchrotron Beamlines (Philip Coppens)
JT2A.14, Decoherence, Entanglement Decay and Equilibration Produced by Chaotic Environments (Gabriela B. Lemos)
JT2A.22, Information Transfer and Randomness in Quantum Measurements (Sergey Mayburov)
JT2A.28, Fractional Topological Phase for Entangled Qudits (Antonio Z. Khoury)
JT2A.30, Bright Beam High-noon States (Aziz Kolkiran)
JT2A.59, Pulse Shortening by Spectral Gain Modulation in a Regenerative Yb:CaF2 Laser Amplifier (Fabian Röser)

Presider Changes:
Rodrigo Lopez-Martens of ENSTA - Ecole Polytechnique, France will preside over Electronic Dynamics and Attosecond Physics (HW2C) on Wednesday, 21 March from 10:30-12:30
**Student Events**

**How to Start your own Company, special session**
Tuesday, 20 March, 19:00-20:00  
*Sydney, Messe Berlin*
Featuring Wolfgang Gries, CEO/Managing Director and Founder, *Direct photonics Industries GmbH, Germany*
Sponsored by OSA and the Berlin Optik Student Chapter

**Student Party**
Tuesday, 20 March, 20:00-22:00  
*Hall 13, Messe Berlin*
Sponsored by OSA and the Berlin Optik Student Chapter.

**Site Seeing Tour of Potsdam**
*Thursday, 22 March, 11:00-13:00*
OSA, the Student Chapter Potsdam, and the Berlin Optik Student Chapter are offering a free guided tour to the famous palaces and parks around Potsdam to student attendees. Potsdam was the city of residence for the Prussian kings and is a town of unique and stunning beauty. Large areas of the city were awarded official UNESCO World Heritage status in 1990. The event will begin at 11.00 on Thursday, 22 March and take about two hours. It will feature many of the most important sites within the city. For more information and to sign-up, contact Jonas Gortner by email (gortner@opttech.tu-berlin.de) or phone (+49 151 2345 2800).

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