High Intensity Lasers and High Field Phenomena (HILAS)

19 March - 21 March 2012, Laser Optics Berlin, Berlin, Germany

View Schedule **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 Ullrich, *Max-Planck-Institut fur Kernphysik, Germany*

Program Chairs

Andrius Baltuska, *TU Vienna, Austria*
Jens Biegert, *ICFO, Spain*

Research in Optical Sciences is collocated with:

LaserOptics Berlin
International Trade Fair and Congress
19 – 21 March 2012

Sponsored by: OSA

Research in Optical Sciences Congress

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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:

LASER OPTICS BERLIN
International Trade Fair and Congress
19 – 21 March 2012

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 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 OPCPA System with ÂµJ 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 OPCPA 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*

High Intensity Lasers and High Field Phenomena (HILAS)

International Conference on Ultrafast Structural Dynamics (ICUSD)

Quantum Information and Measurement (QIM)

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

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 fur 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*

Program Chairs

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 Bachor, *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 Lugiato, *Univ. of Insubria, 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.

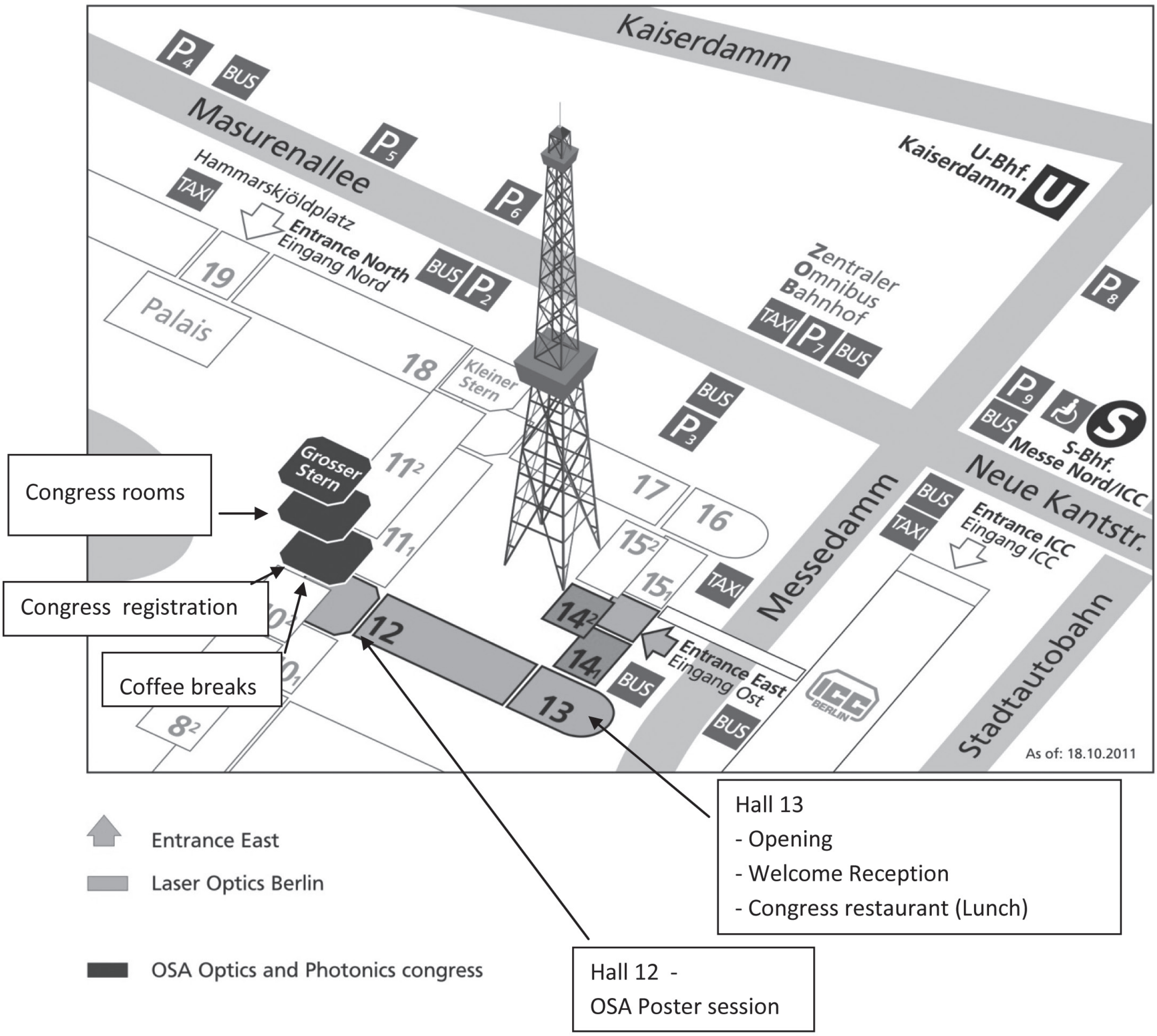
Exhibit Hall Hours

19–20 March	10:00–17:00
21 March	10:00–16:00

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



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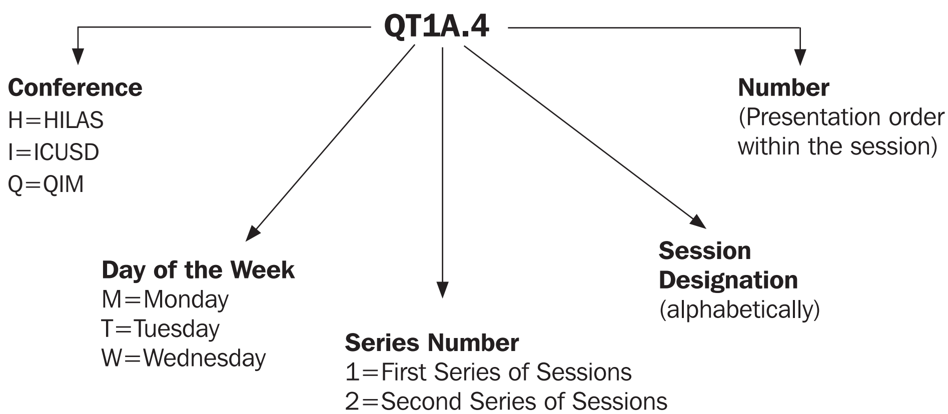
Messe Berlin

Agenda of Sessions — Monday, 19 March

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

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

Agenda of Sessions — Tuesday, 20 March

	Madrid	Sydney	Hong Kong	Istanbul
	QIM	**QIM**	**HILAS**	**ICUSD**
07:00–18:30	**Registration,** *Grosser Stern*			
08:00–10:00	**QT1A • Quantum Light and Matter Interaction**	**QT1B • Quantum Gaussian Light**	**HT1C • Lasers, OPA, OPCPA**	**IT1D • X-ray Diffraction II**
10:00–10:30	**Coffee Break,** *Grosser Stern*			
10:30–12:30	**JT2A • Joint QIM, HILAS, ICUSD Poster Session,** *Exhibit Hall 12*			
12:30–14:00	**Exhibit Hall / Lunch,** *Hall 13*			
14:00–16:00	**QT3A • Photon Entanglement**	**QT3B • Quantum Information**	**HT3C • OPCPA and Waveform Synthesis**	**IT3D • Electron Diffraction**
16:00–16:30	**Coffee Break,** *Grosser Stern*			
16:30–18:30	**QT4A • Quantum Communication I**	**QT4B • Quantum Imaging**	**HT4C • HHG2**	**IT4D • THz Spectroscopy**
19:00–21:00	**Joint QIM & HILAS Postdedline Paper Session,** *Madrid*			

— Wednesday, 21 March

	Madrid	Sydney	Hong Kong	Istanbul
	QIM	**QIM**	**HILAS**	**ICUSD**
07:00–18:00	**Registration,** *Grosser Stern*			
08:00–10:00	**QW1A • Quantum Communication II**	**QW1B • Novel Quantum Information and Measurement Techniques I**	**HW1C • Electronic Dynamics**	**IW1D • Structure Probes and Methods**
10:00–10:30	**Coffee Break,** *Grosser Stern*			
10:30–12:30	**QW2A • Quantum Communication III**	**QW2B • Quantum Entanglement**	**HW2C • Electronic Dynamics and Attosecond Physics**	**IW2D • X-ray Absorption**
12:30–14:00	**Exhibit Hall / Lunch,** *Hall 13*			
14:00–16:00	**QW3A • Quantum Information and Measurement with Photons II**	**QW3B • Quantum State Engineering I** (starts at 14:45)	**HW3C • NL and Extreme NL Optics**	**IW3D • 2D-IR**
16:00–16:30	**Coffee Break,** *Grosser Stern*			
16:30–18:00	**QW4A · Novel Quantum Information and Measurement Techniques II**	**QW4B • Quantum State Engineering II**	**HW4C • Atomic and Molecular Physics** (ends at 18:15)	**IW4D • Phonon & Vibrational Probes**

Key to Conference Abbreviations

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

Madrid	Sydney	Hong Kong	Istanbul
Quantum Information and Measurement		High Intensity Lasers and High Field Phenomena	International Conference on Ultrafast Structural Dynamics

07:00 – 16:30 Registration, *Grosser Stern*

8:15–8:30
Opening Remarks

08:30–10:00
QM1A • Quantum Measurement
Saverio Pascazio; *Universita degli Studi di Bari, Italy, Presider*

QM1A.1 • 08:30 Invited
Experimental Tradeoffs in Quantum Measurement: Uncertainty Relations, Weak Measurement and Quantum Metrology, *Aephraim Steinberg[1], Dylan Mahler[1], Lee Rozema[1], Ardavan Darabi[1], Amir Feizpour[1], Xingxing Xing[1], Yasaman Soudagar[1], Alex Hayat[1]; [1]Physics, 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?

QM1A.2 • 09:00
Multi-Photon Entanglement for Sub Shot-Noise Sensitivity, *Christian Schwemmer[1,2], Roland Krischek[1,2], Witlef Wieczorek[3], Wieslaw Laskowski[4], Philipp Hyllus[5], Harald Weinfurter[6], Augustro Smerzi[7], Luca Pezze[1]; [1]Faculty of Physics, Ludwig-Maximillians Universitat, Germany; [2]Max-Planck-Inst. for Quantum Optics, Germany; [3]Facultät für Physik, Universität Wien, Austria; [4]Inst. of Theoretical Physics and Astrophysics, Univ. of Gdansk, Poland; [5]Dep. of Theor. Physics, Univ. of the Basque Country, Spain; [6]Laboratoire Charles Fabry, Univ. Paris-Sud, France; [7]Dipartimento di Fisica, Univ. di Trento, Italy.* 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.

QM1A.3 • 09:15
Withdrawn

08:30–10:00
QM1B • Quantum Atom-Photon Interaction
Markus Aspelmeyer; *Univ. of Vienna, Austria, Presider*

QM1B.1 • 08:30 Invited
Strong Atom-Photon Coupling in Free Space, *Gerd Leuchs[1,2], Robert Maiwald[1,2], Andrea Golla[1,2], Martin Fischer[1,2], Benoit Chalopin[1,2], Marianne Bader[1,2], Simon Heugel[1,2], Markus Sondermann[1,2]; [1]Department of Physics, Univ. of Erlangen, Germany; [2]Max Planck Inst. for the Science of Light, Germany.*The limit of strong coupling can be reached without resonators or near-field antennae by exciting a single atom in free space with a properly designed dipole mode.

QM1B.2 • 09:00
Generation of a Macroscopic Singlet State in an Atomic Ensemble, *Naeimeh Behbood[1], Mario Napolitano[1], Giorgio Colangelo[1], Brice Dubost[1,2], Silvana Palacios Á lvarez[1], Robert J. Sewell[1], Geza Tóth[3], Morgan W. Mitchell[1,4]; [1]ICFO-Institut de Ciencies Fotoniques, Spain; [2]Universièt Paris Diderot et CNRS, France; [3]The Univ. of the Basque Country, Spain; [4]ICREA-Institucio Catalana de Recerca i Estudis Avancats, Spain.*We report on an experiment for generating singlet states in a cold atomic ensemble. We use quantum non-demolition measurement and feedback control to produce a macroscopic spin state with total spin zero and reduced spin fluctuations.

QM1B.3 • 09:15
Superadiabatic and Speed Limited Quantum Driving of Bose-Einstein Condensates in Optical Lattices, *Donatella Ciampini[1,2]; [1]Dipartimento di Fisica "E.Fermi", Università di Pisa, Italy; [2]INO-CNR & CNISM UdR Dipartimento di Fisica "E.Fermi", 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.

8:15–8:30
Opening Remarks

08:30–10:00
HM1C • Short Wavelength Sources
Simon Hooker; *Univ. of Oxford, UK, Presider*

HM1C.1 • 08:30 Invited
Attosecond Lighthouses: A New Tool for Ultrafast Science and Metrology, *Fabien Quere[1], Henri Vincenti[1]; [1]CEA, 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.

HM1C.2 • 09:00
Generation of Coherent Radiation in the Water Window, *Lap V. Dao[1,2]; [1]CAOUS, Swinburne Univ. of Technology, Australia; [2]Australian Research Council Centre of Excellence for Coherent X-Ray Science, Australia.* The phase-matched harmonic radiation down to the water window region (~ 4.4 nm) is obtained and exhibits a good beam profile and high spatial coherence using a 1 kHz infrared pulses at 1400 nm.

HM1C.3 • 09:15
Withdrawn

8:15–8:30
Opening Remarks

08:30–10:00
IM1D • X-ray Scattering
Majed Chergui; *Ecole Polytechnique Federale de Lausanne, Switzerland, Presider*

IM1D.1 • 08:30 Invited
Time-resolved X-ray Scattering from Phonons, *David A. Reis[1,2]; [1]Photon Science, Stanford PULSE Inst., SLAC Nat. Accelerator Lab., USA; [2]Photon 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 photoexcited semiconductors.

IM1D.2 • 09:00
Cross-Correlation Based 2D Structure Determination from Multi-Particle Scattering Images, *Bill Pedrini[1]; [1]SwissFEL, 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.

IM1D.3 • 09:15
Detection of Photoexcited High-frequency Monochromatic Phonon Pulses by Ultrafast x-ray Diffraction, *Marc Herzog[1], André Bojahr[1], Jevgenij Goldshteyn[2], Wolfram Leitenberger[1], Ionela Vrejoiu[3], Dmitry Khakhulin[4], Michael Wulff[4], Roman Shayduk[2], Peter Gaal[1], Matias Bargheer[1,2]; [1]Institut für Physik und Astronomie, Universität Potsdam, Germany; [2]Helmholtz-Zentrum Berlin für Materialien und Energie GmbH, Germany; [3]Max-Planck-Institut für Mikrostrukturphysik, Germany; [4]European Synchrotron Radiation Facility, France.* We present time-resolved XRD experiments which evidence the generation of a tunable high-frequency monochromatic phonon wavepacket by multiple optical excitation of a thin film transducer. The decay time of these phonon pulses is ~ 140 ps.

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Quantum Information and Measurement		High Intensity Lasers and High Field Phenomena	International Conference on Ultrafast Structural Dynamics

QM1A • Quantum Measurement—Continued

QM1A.4 • 09:30 Invited

Quantum Interferometry, *Augustro Smerzi[1]; [1]INO-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 Eschner[1,2], Jan Huwer[1,2], Joyee Ghosh[1,2], Nicolas Piro[2], Francois Dubin[2], Michael Schug[1], Christoph Kurz[1], Philipp Müller[1], José Brito[1]; [1]Experimentalphysik, Universität des Saarlandes, Germany; [2]ICFO - Institut de Ciencies 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 Thaury[1], Sebastien Corde[1], Victor Malka[1], Antoine Rousse[1], Kim Taphuoc[1]; [1]boratoire d'Optique Appliquee, Ecole 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 wiggler and an electromagnetic wave undulator.

HM1C.5 • 09:45

Monochromatised XUV Pulses for Ultrafast Science at the Artemis Facility, *Emma Springate[1], Cephise Cacho[1], Edmond Turcu[1], Fabio Frassetto[2], Paolo Villoresi[2,3], Luca Poletto[2], Will Bryan[1,4], Russell Minns[1,10], Jonathan Underwood[1,9], Jesse Petersen[5,6], Stefan Kaiser[6], Nicky Dean[5], Alberto Simoncig[6], Haiyun Liu[6], Adrian Cavalieri[6], Sarnjeet Dhesi[7], Helmuth Berger[8]; [1]STFC Central Laser Facility, UK; [2]National Research Council of Italy- Inst. of Photonics and Nanotechnologies, Italy; [3]Department of Information Engineering, Univ. of Padova, Italy; [4]Department of Physics, Swansea Univ., UK; [5]Department of Physics, Univ. of Oxford, UK; [6]Max Planck Department for Structural Dynamics, Centre for Free Electron Laser Science, Germany; [7]Diamond Light Source, UK; [8]École Polytechnique Fédérale de Lausanne, Switzerland; [9]Univ. College London, UK; [10]Southampton Univ., UK.* 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.

IM1D • X-ray Scattering—Continued

IM1D.4 • 09:30 Invited

Ultrafast Coherent Diffractive Imaging Using a Lab-Based Soft X-ray Source, *Hamed Merdji[1]; [1]IRAMIS/SPAM, CEA Saclay, France.* We demonstrate femtosecond coherent imaging of nanometric objects using table-top soft X-ray laser harmonics source. We present applications in ultrafast nano-magnetism and control of azobenzene-based nanoparticles isomerization.

10:00–11:00 Coffee Break, *Grosser Stern*

Quantum Information and Measurement

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 Blatt[1,2], [1]*Inst. of Experimental Physics, Univ. of Innsbruck, Austria;* [2]*Inst. 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 Raimond[1], Clément Sayrin[1], Igor Dotsenko[1], XingXing Zhou[1], Bruno Peaudecerf[1], Theo Rybarczyk[1], Sebastien Gleyzes[1], Michel Brune[1], Serge Haroche[2];* [1]*LKB, UPMC, ENS, CNRS, France;* [2]*Collège de France, France.* We deterministically prepare and stabilize Fock states in a superconducting cavity by real-time quantum feedback using information provided by circular Rydberg atoms to react on the field and compensate the quantum jumps due to decoherence.

High Intensity Lasers and High Field Phenomena

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 Schlichting[1,2]; Lukas Lomb[1,2], Thomas R. Barends[1,2],* [1]*Department of Biomolecular Mechanisms, Max Planck Inst. for Medical Research, Germany;* [2]*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 Bhardwaj[1], Michael Wong[1], Jean-Paul Brichta[1], Sergeui Patchkovskii[2], Micheal Spanner[2];* [1]*Physics, Univ. of Ottawa, Canada;* [2]*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.

International Conference on Ultrafast Structural Dynamics

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 Cavalleri[1];* [1]*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 ultrafast 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 Beaud[1], Andrin Caviezel[1], Steven L. Johnson[2], Urs Staub[1], Simon O. Mariager[1], Shih-Wen Huang[1], Christopher J. Milne[3], Ekaterina Möhr-Vorobeva[1], Sebastian Grübel[1], Jeremy A. Johnson[1], Gerhard Ingold[1];* [1]*Swiss Light Source, Paul Scherrer Institut, Switzerland;* [2]*Inst. for Quantum Electronics, ETH, Zürich, Switzerland;* [3]*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.

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QM2A • Quantum Information and Measurement with Atoms and Ions—Continued

QM2A.3 • 12:15
Single-ion Quantum Lock-in Amplifier, *Shlomi Kotler[1], Nitzan Akerman[1], Yinnon Glickman[1], Anna Keselman[1], Roee Ozeri[1]; [1]Physics 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 Leung[1], Atreju Tauschinsky[1], Klaasjan Van Druten[1], Robert Spreeuw[1]; [1]Inst. 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 Wolfgramm[1], Chiara Vitelli[2], Federica A. Beduini[1], Nicolas Godbout[3], Morgan W. Mitchell[1,4]; [1]ICFO - The Inst. of Photonic Sciences, Spain; [2]Dipartimento di Fisica, Universita "Sapienza" di Roma, Italy; [3]COPL, Departement de Genie Physique, Ecole Polytechnique de Montreal, Canada; [4]ICREA-Institució Catalana de Recerca i Estudis Avançats, 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.

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, *Shafagh Dastjani Farahani[1], A. London[8], C. Bostedt[8], S.p. Hau-Riege[7], S. Moeller[7], J. Bozek[7], H. Chapman[5], K. Tiedtke[6], S. Toleikis[6], H. Wabnitz[6], R. Sobierajski[9], M. Jurek[9], M. Stormer[4], A.j. Glesson[3], J. Chalupsky[2], T. Burian[2], L. Vysin[2], L. Juha[2], H. Sinn[1], Th. Tschentscher[1], J. Gaudin[1]; [1]European XFEL, Germany; [2]Inst. of Physics, Academy of Sciences of the Czech Republic, Czech Republic; [3]CCRLC Daresbury Laboratory, UK; [4]GKSS-Forschungszentrum Geesthacht GmbH, Max-Planck-Strasse, Germany; [5]Center for Free-Electron Laser Science, Germany; [6]HASYLAB/DESY, Germany; [7]Lawrence Livermore National Laboratory,, USA; [8]SLAC National Accelerator Laboratory, USA; [9]Inst. 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 Chowdhury[1], Patrick Poole[1], Rebecca Daskalova[1], Richard Freeman[1], Douglas Smith[2]; [1]The Ohio State Univ., USA; [2]Plymouth 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 Invited
XUV-driven Electronic Correlation Probed with Strong THz Light Fields, Markus Drescher, *Univ. of Hamburg, Germany.* Strong (~ 1 MV/cm) THz fields steer the motion of XUV-ionized photo- and Auger-electrons in an atomic potential, revealing an intrinsic time-dependent nonlinear 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. Mariager[1], F. Pressacco[2], Gerhard Ingold[1], Andrin Caviezel[1], Ekaterina Möhr-Vorobeva[1], Paul Beaud[3,1], Steven L. Johnson[1], Christopher J. Milne[4], Robert Feidenhans'l[5], C. Back[2], Christoph Quitmann[1]; [1]Swiss Light Source, Paul Scherrer Institut, Switzerland; [2]Fakultät für Physik, Univ. of Regensburg, Germany; [3]Inst. for Quantum Electronics, ETH Zürich, Switzerland; [4]Ecole Polytechnique Fêdêrale Lausanne, Switzerland; [5]Niels 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 $PbZr_{0.2}Ti_{0.8}O_3$ Thin Films by Ultrafast Reciprocal Space Mapping, *Daniel Schick[1], André Bojahr[1], Marc Herzog[1], Peter Gaal[1], Matias Bargheer[1]; [1]Institut für Physik & Astronomie, Universität Potsdam, Germany.* We present first results on mosaicity changes in a ferroelectric PbZr0.2Ti0.8O3 thin film on a ps timescale utilizing a new ultrafast reciprocal space mapping technique.

IM2D.5 • 12:45
Femtosecond X-Ray Powder Diffraction on LiBH4, *Flavio Zamponi[1], Johannes Stingl[1], Benjamin Freyer[1], Michael Woerner[1], Thomas Elsaesser[1], Andreas Borgschulte[2]; [1]Max Born Inst., Germany; [2]Laboratory 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.

13:00–14:30 Exhibit Hall / Lunch, *Hall 13*

Madrid / Sydney

Quantum Information and Measurement

14:30–16:30
QM3A • Novel Systems for Quantum Measurement
Gerd Leuchs; *Univ. of Erlangen, Germany, Presider*

QM3A.1 • 14:30 Invited
Quantum-Optomechanics: A Mechanical Platform for Quantum Foundations and Quantum Information, *Markus Aspelmeyer[1]; [1]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. I will present the status, prospects and challenges of this emerging field of quantum optomechanics.

QM3A.2 • 15:00
Quantum Optomechanics, *Klemens Hammerer[1,2]; [1]Institut für Theoretische Physik, Leibniz Universität Hannover, Germany; [2]Institut für Gravitationsphysik, Leibniz Universität Hannover, Germany.* Optomechanical systems are approaching 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.

QM3A.3 • 15:15
Optomechanical Systems as Single Photon Routers, *Sumei Huang[1], Girish Agarwal[1]; [1]Oklahoma State Univ., USA.* 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.

14:30–16:30
QM3B • Quantum Information and Measurement with Photons I
Jürgen Eschner; *Saarland Univ., Germany, Presider*

QM3B.1 • 14:30 Invited
Integrated Quantum Photonics, *Jeremy O'Brien[1]; [1]Univ. Of Bristol, UK.*We have developed an integrated waveguide approach to photonic quantum circuits for high performance, miniaturization 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.

QM3B.2 • 15:00
Optimal Multi-photon Phase Sensing with a Single Interference Fringe, *Guoyong Xiang[1,2], Holger Hofmann[3,4], Geoff J. Pryde[1]; [1]Centre for Quantum Dynamics and Centre for Quantum Computer Technology, Griffith Univ., Australia; [2]Key Lab of Quantum Information, Univ. of Science & Technology of China, China; [3]Graduate School of Advanced Sciences of Matter, Hiroshima Univ., Japan; [4]JST, 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.

QM3B.3 • 15:15
High Resolution Measurement of Polarization Mode Dispersion in Discrete Telecom Devices using Quantum Interferometry, *Alexander Sergienko[1], Andrew Fraine[1], Olga Minaeva[1], David Simon[1], Roman Egorov[1]; [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.

Hong Kong

High Intensity Lasers and High Field Phenomena

14:30–16:30
HM3C • HHG1
Jens Biegert; *ICFO, Spain, Presider*

HM3C.1 • 14:30
Megahertz High Harmonic Generation at the µW Level with Fiber CPA Systems, *Steffen Hädrich[1,2], Manuel Krebs[1], Stefan Demmler[1], Jan Rothhardt[1,2], Jens Limpert[1,2], Andreas Tünnermann[1,3]; [1]Inst. of Applied Physics, Germany; [2]Helmholtz-Institut Jena, Germany; [3]Fraunhofer Inst. for 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.

HM3C.2 • 14:45
Efficiency Scaling of High Harmonic Generation Driven by a Tunable Optical Parametric Amplifier in the Visible, *Giovanni Cirmi[1,2], Chien-Jen Lai[1], Eduardo Granados[1,3], Shu-Wei Huang[1], Phillip Keathley[1], Alexander Sell[1], Franz Kärtner[1,2]; [1]Department of Electrical Engineering and Computer Science and Research Laboratory of Electronics, MIT, USA; [2]Center for Free-Electron Laser Science, DESY and Univ. of Hamburg, Germany; [3]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.

HM3C.3 • 15:00
Polarization Gating in Plasmon-assisted Low-intensity High Harmonic Generation, *Anton Husakou[1], Freek Kelkensberg[2], Joachim Herrmann[1], Marc J. Vrakking[1,2]; [1]Max Born Inst., Germany; [2]FOM Inst. AMOLF, Netherlands.* We predict that generation of isolated attosecond pulses by sub-1-TW/cm 2 pump pulses is possible by the polarization gating technique and plasmonic field enhancement in the vicinity of a specifically designed metal nanostructure.

HM3C.4 • 15:15
Quasi-phase-matched hgh Harmonic Generation Using Trains of Uniformly-spaced Ultrafast Pulses, *Kevin O'Keeffe[1], Tom Robinson[1], Simon M. Hooker[1]; [1]Oxford Univ., UK.* We investigate quasi-phase-matching of high harmonic generation over a range of harmonic orders using trains of up to 8 uniformly-spaced counter-propagating pulses, produced using an array of birefringent crystals.

Istanbul

International Conference on Ultrafast Structural Dynamics

14:30–16:30
IM3D • Electronic Excitations
Andrei Tokmakoff; *MIT, USA, Presider*

IM3D.1 • 14:30 Invited
UV Two-Dimensional Transient Absorption Spectroscopy, *Gerald Auböck[1], Cristina Consani[1], Frank van Mourik[1], Majed Chergui[1]; [1]Laboratory 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 capabilities of the setup discussed.

IM3D.2 • 15:00
Two-Dimensional Electronic Spectroscopy for Vibrational Wavepacket Analysis and Electronic Structure Determination, *Niklas Christensson[1], Tomas Mancal[2], Franz Milota[1], Oliver Bixner[1], Harald F. Kauffmann[1], Juergen Hauer[1]; [1]Faculty of Physics, Univ. of Vienna, Austria; [2]Faculty 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.

IM3D.3 • 15:15
Two-Dimensional Optical Spectroscopy of Charge Transfer, *Tomas Mancal[1], Niklas Christensson[2], Oliver Bixner[2], Vladimír Lukeš[3], Franz Milota[2], Harald F. Kauffmann[2], Juergen Hauer[2]; [1]Faculty of Mathematics and Physics, Charles Univ. in Prague, Czech Republic; [2]Faculty of Physics, Univerity of Vienna, Austria; [3]Department of Chemical Physics, Slovak Technical Univ., Slovakia.* Interaction of exciton and charge transfer states in a molecular dimer is traced by the dynamics of the cross-peaks in two-dimensional electronic spectra. Simulations reveal the corresponding chain of electron transfer steps in the dimer.

Madrid / Sydney — Quantum Information and Measurement

QM3A • Novel Systems for Quantum Measurement—Continued

QM3A.4 • 15:30
Optimal Mass-sensing with a Nano-mechanical Resonator, *Daniel Braun[1]; [1]Univ. Toulouse Paul Sabatier, France.* I report 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 Vitali[1], Shabir Barzanjeh[1], Mehdi Abdi[1], Paolo Tombesi[1], Gerard J. Milburn[2]; [1]Physics Division, Univ. of Camerino, Italy; [2]Centre 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 Guerlin[1], Tristan Farah[1], Anne Louchet-Chauvet[1], Sébastien Merlet[1], Franck Pereira Dos Santos[1]; [1]LNE-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 Silberhorn[1]; [1]Univ. 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 Sciarrino[1], Linda Sansoni[1], Paolo Mataloni[1], Andrea Crespi[2,3], Roberta Ramponi[2,3], Roberto Osellame[2,3]; [1]Dipartimento di Fisica, Sapienza Università di Roma, Italy; [2]Istituto di Fotonica e Nanotecnologie, Consiglio Nazionale delle Ricerche, Italy; [3]Dipartimento di Fisica, Politecnico di Milano, Italy.* Integrated photonics have 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 Oppel[1,2], Thomas Büttner[1], Pieter Kok[3], Joachim von Zanthier[1,2]; [1]Institut für Optik, Information und Photonik, Friedrich-Alexander-Universität Erlangen-Nürnberg, Germany; [2]Erlangen Graduate School in Advanced Optical Technologies (SAOT), Friedrich-Alexander-Universität Erlangen-Nürnberg, Germany; [3]Department of Physics and Astronomy, Univ. of Sheffield, UK.* 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.

Hong Kong — High Intensity Lasers and High Field Phenomena

HM3C • HHG1—Continued

HM3C.5 • 15:30
High-field Nonlinear Fiber Optics, *KaFai Mak[1], John C. Travers[1], Philipp Hoelzer[1], Wonkeun Chang[1], Nicolas Y. Joly[2,1], Mohammed F. Saleh[1], Fabio Biancalana[1], Philip Russell[1,2]; [1]Max Planck Inst. for the Science of Light, Germany; [2]Univ. 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 influenced propagation.

HM3C.6 • 15:45
Low- and high-order Harmonic Generation Inside an Air Filament, *Tobias Vockerodt[1,2], Daniel Steingrube[1,2], Emilia Schulz[1,2], Martin Kretschmar[1], Uwe Morgner[1,2], Milutin Kovacev[1,2]; [1]Inst. of Quantum Optics, Leibniz Universitaet Hannover, Germany; [2]QUEST Centre of Quantum Engineering and Space-Time Research, Germany.* 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.

HM3C.7 • 16:00
Phase-matching Aspects in High-order Harmonic Generation from Liquid Water Droplets, *Milutin Kovacev[1,2], Uwe Morgner[1,2], Daniel Steingrube[1,2], Heiko G. Kurz[1,2], Detlev Ristau[3], Manfred Lein[1,2]; [1]Leibniz Univ. Hannover, Germany; [2]QUEST - Centre for Quantum Engineering and Space-Time Research, Germany; [3]Laser 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
High-Order Harmonic Generation in Stabilized Plasma Plumes Using the 800 and 1300 nm Femtosecond Pulses, *Rashid Ganeev[1], C. Hutchison[1], A. Zair[1], T. Witting[1], F. Frank[1], S. Weber[1], W. A. Okell[1], J. W. Tisch[1], J. P. Marangos[1]; [1]Imperial 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.

Istanbul — International Conference on Ultrafast Structural Dynamics

IM3D • Electronic Excitations—Continued

IM3D.4 • 15:30
Ultrafast Electronic Relaxations in Metal Mixed-Ligand Dithiolene Complexes, *Andrea Cannizzo[1], Franziska Frei[1], Thomas Feurer[1], Ahmad Odeh[2], Frank van Mourik[2], Majed Chergui[2], Davide Espa[3], Maria Laura Mercuri[3], Luca Pilia[3], Angela Serpe[3], Paola Deplano[3], Antonin Vlček[4]; [1]Inst. of Applied Physics, Univ. of Bern, Switzerland; [2]Laboratoire de Spectroscopie Ultrarapide, Ecole Polytechnique Fédérale de Lausanne, Switzerland; [3]Dipartimento di Chimica Inorganica ed, Università di Cagliari, Italy; [4]Queen 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.5 • 15:45
Photoisomerisation Quantum Yield, Double Quantum and Stimulated Emission Cross Section with Femtosecond Excitation of the Photoactive Yellow Protein for Pump-Probe Protein Diffraction, *Jasper J. van Thor[1], Craig N. Lincoln[1]; [1]Division of Molecular Biosciences, Imperial College London, UK.* We consider conditions for femtosecond pump-probe photocrystallography. The quantum yield of photoisomerisation of the Photoactive Yellow Protein strongly depends on peak power, dispersion and wavelength with femtosecond optical excitation.

IM3D.6 • 16:00
Fast Recombination after Electron Photo-Detachment of Hydroxide in H-bonded Liquids, *Hubert Rossmadl[1], Martin K. Fischer[1], Alfred Laubereau[1], Hristo Iglev[1]; [1]Physics, E11, TU Munich, Germany.* PREP spectroscopy on OH- in H-bonded liquids reveals an ultrafast geminate recombination channel. The process is assigned to formation of short-lieved OH:e- pairs facilitated by the inhomogeneous local H-bonding environment of OH-.

IM3D.7 • 16:15
Heterodyne Detected Transient Grating UV/VIS-pump IR-probe Measurements of Energy Transport through Proteins, *Halina Strzalka[1], Shabir Hassan[1], Paul M. Donaldson[1], Peter Hamm[1]; [1]PCI, 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.

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

Madrid	Sydney	Hong Kong	Istanbul
Quantum Information and Measurement		High Intensity Lasers and High Field Phenomena	International Conference on Ultrafast Structural Dynamics

07:00–18:30 Registration, *Grosser Stern*

Tuesday, 20 March

08:00–10:00 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 Rempe[1]; [1]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. Clark[1,2], Quentin Glorieux[2], Alberto Marino[2], Paul D. Lett[3]; [1]Univ. of Maryland, USA; [2]JQI, USA; [3]NIST, 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 Jing[1,2], Cunjin Liu[1,2], Zhifan Zhou[1,2], Florian Hudelsit[1,2], Z. Y. Ou[1,3], Weiping Zhang[1,2]; [1]State Key Lab of Precision Spectroscopy, Department of Physics,, East China Normal Univerisity, China; [2]Quantum Inst. for Light and Atoms, Department of Physics, East China Normal Univ., China; [3]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.

08:00–10:00 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 Fabre[1], Olivier Pinel[1], Pu Jian[1], Nicolas Treps[1], Julien Fade[2], Daniel Braun[3]; [1]Laboratoire Kastler Brossel, France; [2]Institut de Physique de Rennes, France; [3]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 Allevi[1,2], Stefano Olivares[3,4], Matteo G. A. Paris[5,4], Maria Bondani[6,2]; [1]Dipartimento di Scienza e Alta Tecnologia, Universita' degli Studi dell'Insubria, Italy; [2]C.N.I.S.M. U.d.R. Como, Italy; [3]Dipartimento di Fisica, Universita' degli Studi di Trieste, Italy; [4]CNISM U.d.R. Milano Statale, Italy; [5]Dipartimento di Fisica, Universita' degli Studi di Milano, Italy; [6]Istituto di Fotonica e Nanotecnologie, C.N.R., Italy.* Non-Gaussianity is a resource for Quantum Information. By performing conditional measurements on classically and quantum correlated optical states with different photo-resolving 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 Su[1], Yaping Zhao[1], Shuhong Hao[1], Changde Xie[1], Kunchi Peng[1]; [1]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 two-diamond shape cluster states with continuous variable entanglement.

08:00–10:00 HT1C • Lasers, OPA, OPCPA

Tobias Witting; *Imperial College London, UK, Presider*

HT1C.1 • 08:00 Invited

Science on the Texas Petawatt Laser and Technology Development Toward an Exawatt Laser, *Todd Ditmire[1]; [1]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 Tang[1], Chris J. Hooker[1], Bryn Parry[1], Oleg Chekhlov[1], Steve Hawkes[1], Klaus Ertel[1], Rajeev Pattathil[1], John L. Collier[1]; [1]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

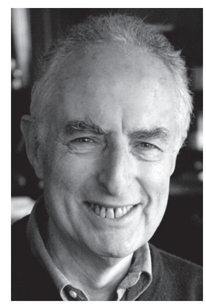
A Cryogenic Gas Cooled Multi-Slab Yb:YAG Amplifier Producing 6.4 J at 10 Hz, *Klaus Ertel[1], Saumyabrata Banerjee[1], Paul D. Mason[1], Paul J. Phillips[1], Cristina Hernandez-Gomez[1], John L. Collier[1]; [1]Central Laser Facility, STFC Rutherford Appleton Laboratory, UK.* We present preliminary results 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.

08:00–10:00 IT1D • X-ray Diffraction II

Andrea Cavalleri; *Max Planck Department for Structural Dynamics, Germany, Presider*

IT1D.1 • 08:00 Tutorial

Time-resolved Laue Diffraction at High Positional Accuracy and the Optimizing of Time-Resolution at Synchrotron Beamlines, *Philip Coppens[1]; [1]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.2 • 08:45

The Rotating Crystal Method in Femtosecond X-Ray Diffraction, *Benjamin Freyer[1], Johannes Stingl[1], Flavio Zamponi[1], Michael Woerner[1], Thomas Elsaesser[1]; [1]Max-Born-Inst. 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.

Quantum Information and Measurement

QT1A • Quantum Light and Matter Interaction—Continued

QT1A.4 • 09:00 Invited

Coherent Coupling of a Superconducting Flux Gubit to an Electron Spin Ensemble in Diamond, *Kouichi Semba[1]; [1]NTT Basic Research Laboratories, NTT Corporation, Japan.* We report evidence of coherent strong coupling, observation of vacuum Rabi oscillations, between a superconducting artificial atom (flux qubit) and a macroscopic number of electron spins in the form of nitrogen-vacancy color centres in diamond.

QT1A.5 • 09:30

Storing Quantum States in a Slow Light Cavity, *Stefan Kröll[1], Lars Rippe[1], Mahmood Sabooni[1], Axel Thuresson[1], Samuel T. Kometa[1]; [1]Dept of Physics, Lund Univ., Sweden.* High efficiency quantum state storage using cavities made out of rare earth crystals is investigated. In these cavities the speed of light is reduced by 3-4 orders of magnitude which open for exciting possibilities.

QT1A.6 • 09:45

Superluminal Twin Beams, Superluminal Images and the Arrival Time of Spatial Information in Optical Pulses with Negative Group Velocity, *Ulrich Vogl[1], Ryan T. Glasser[1], Paul D. Lett[1]; [1]Laser cooling and trapping group, NIST, USA.* We generate superluminal pulses via four-wave-mixing in 85Rb vapor, both for the injected and the generated beam, and imprint images on the pulses and time-resolve the arrival of information in the spatial domain.

QT1B • Quantum Gaussian Light—Continued

QT1B.4 • 09:00

Probing Multimode Squeezing with Correlation Functions, *Andreas Christ[1], Kaisa Laiho[2], Andreas Eckstein[2], Katiúscia N. Cassemiro[2,3], Christine Silberhorn[1,2]; [1]Applied Physics, Univ. of Paderborn, Germany; [2]IQO Group, MPL for the Science of Light, Germany; [3]Departamento de Física, Universidade Federal de Pernambuco, Germany.* We use broadband correlation functions to probe multimode squeezed states. Measuring the higher-order correlations enables loss independent access to the state characteristics which is less costly and time-consuming than standard tomographic methods.

QT1B.5 • 09:15

Multipartite Photonic Entanglement Generated from Polarization Squeezing at 795 nm, *Federica A. Beduini[1], Morgan W. Mitchell[1,2]; [1]ICFO - Institut de Ciències Fòtoniques, Spain; [2]ICREA, Institució Catalana de Recerca i Estudis Avancats, Spain.* We describe an experiment to generate photonic multipartite entangled states from polarization squeezing generated by a sub-threshold OPO. The technique is very efficient: about 5 10^5 atom-tuned entangled photons per second are generated.

QT1B.6 • 09:30

Fundamental Limit to Qubit Control with Coherent Field, *Kazuhiro Igeta[1,2], Nobuyuki Imoto[3], Masato Koashi[4]; [1]NTT Basic Research Laboratories, Japan; [2]Japan Science and Technology Agency, CREST, Japan; [3]Graduate School of Engineering Science, Osaka Univ., Japan; [4]Photon Science Center, The Univ. of Tokyo, Japan.* The accuracy in controlling qubit with coherent field is studied by full quantum treatment. We found π/2 pulse fidelity error found ~ 1/(photon number) as previously known but to depends strongly on initial state of qubit.

QT1B.7 • 09:45

Studying Photon Antibunching of Bunched Emitters, *Silke Peters[1], Daniel Scholz[1], Helmuth Hofer[1], Stefan Kück[1], Mark Rodenberger[1], Waldemar Schmunk[1], Michael Weyrauch[1]; [1]PTB Braunschweig, Germany.* We report on the single photon emission of bunched NV-centres by focusing on different spatial fractions of the emission spot, which shows that g(2)(0)<0.5 does not sufficiently prove the single photon characteristics of the centres.

High Intensity Lasers and High Field Phenomena

HT1C • Lasers, OPA, OPCPA—Continued

HT1C.4 • 09:00

High Energy Optical Parametric Chirped Pulse Amplification in Yttrium Calcium Oxyborate, *Xiaoyan Liang[1], Lianghong Yu[1], Jin-Feng Li[1], Xiaoming Lu[1], Cheng Wang[1], Yuxin Leng[1], Ruxin Li[1], Zhizhan Xu[1], Yanqing Zheng[2], Anhua Wu[2]; [1]Shanghai Inst. of Optics and Fine Mechanics, China; [2]Shanghai Inst. of Ceramics, China.* We report the high energy non-collinear optical parametric chirped-pulse amplification with yttrium calcium oxyborate. The amplified energy of 3.36J centered at 800nm was generated with pump of 35J. After compression, the pulse duration was 44.3fs.

HT1C.5 • 09:15 Invited

Two-color Pumped OPCPA System with µJ Pulse Energy and a Spectral Bandwidth of 1.5 Octaves from VIS to NIR, *Anne Harth[1,2], Marcel Schultze[1], Tino Lang[1,2], Stefan Rausch[1,2], Thomas Binhammer[3], Uwe Morgner[1,2]; [1]Institut für Quantenoptik, Universität Hannover, Germany; [2]Centre for Quantum Engineering and Space-Time Research (QUEST), Germany; [3]VENTEON Laser Technologies GmbH, Germany.* We present a double-stage OPCPA system which is pumped by two different wavelengths. It delivers a coherent 450 THz broad output spectrum around 650 nm with a Fourier limited pulse duration of sub-3 fs.

HT1C.6 • 09:45

High average-power, Self-CEP Stable Few-cycle Pulses at 2.1 µm Through Collinear OPA in BiB3O6, *Francisco Silva[1], Philip K. Bates[1], Adolfo Esteban-Martin[1], Majid Ebrahim-Zadeh[1,2], Jens Biegert[1,2]; [1]ICFO - Institut de Ciences Fotoniques, Spain; [2]ICREA - Institució Catalana de Recerca i Estudis Avançats, Spain.* Passively phase stabilized six cycle pulses at 2.1 µm and 3kHz are generated through collinear OPA in BiB3O6 with an energy of 372 µJ and 42 fs pulse duration. HHG up to 72 eV is demonstrated.

International Conference on Ultrafast Structural Dynamics

IT1D • X-ray Diffraction II—Continued

IT1D.3 • 09:00

Watching Femtosecond Symmetry Breaking in Bismuth with X-Ray Diffraction, *Steven L. Johnson[1], Paul Beaud[2], Ekaterina Möhr-Vorobeva[2], Andrin Caviezel[2], Gerhard Ingold[2], Christopher J. Milne[3]; [1]Inst. for Quantum Electronics, ETH Zurich, Switzerland; [2]Swiss Light Source, Paul Scherrer Institut, Switzerland; [3]Laboratoire de Spectroscopie Ultrarapide, EPFL, Switzerland.* We use femtosecond x-ray diffraction to make a quantitative study of the structural symmetry-breaking coherent Eg mode of bismuth created by intense laser excitation. Coherent amplitudes on the order of 0.1 pm are observed.

IT1D.4 • 09:15

Experimental investigation of the coupling of an optical phonon mode to individual Bloch states in photoexcited Bismuth, *Jerome Faure[1,2]; [1]LOA, France; [2]Laboratoire des Solides Irradiés, France.* The effect of lattice distortions on electronic states in Bismuth is investigated using time resolved photoemission spectroscopy. The data reveals a strong dependence of the electron phonon coupling with the Bloch state wave vectors.

IT1D.5 • 09:30 Invited

Ultrafast x-ray Studies of Ferroelectric Materials, *Aaron Lindenberg[1,2], Dan Daranciang[2,3], John Goodfellow[1]; [1]Materials Science and Engineering, Stanford Univ, USA; [2]PULSE Inst., Stanford Univ./SLAC, USA; [3]Chemistry, Stanford Univ., USA.* Femtosecond x-ray scattering studies reveal large amplitude increases in the polarization of thin-film ferroelectrics and elucidate the first steps in their bulk photovoltaic response. Complimentary terahertz emission and second harmonic generation studies are also presented.

10:00–10:30 Coffee Break, *Grosser Stern*

Joint Quantum Information and Measurement / High Intensity Lasers and High Field Phenomena / International Conference on Ultrafast Structural Dynamics Poster Session

10:30–12:30
JT2A • Joint Poster

JT2A.1
Perturbative Treatment of Up-conversion Detection of Pulsed-shaped Entangled Photons, *André Stefanov[1], Bänz Bessire[1], Christof Bernhard[1], Thomas Feurer[1]; [1]Inst. of Applied Physics, Univ. of Bern, Switzerland.* We perturbatively describe the sum frequency generation of broadband 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, *Niels Lörch[1]; [1]Inst. for Theoretical Physics Hannover and Max Planck Inst. for Gravitational Physics, Germany.* We derive a Non-Gaussian master equation for the strong coupling regime ($g>\kappa$) 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 Vallone[1], Paolo Villoresi[1], Ivan Capraro[1], Alberto Dall'Arche[1], Andrea Tomaello[1], Francesca Gerlin[1]; [1]Department of Information Engeneering, 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 Roa[1]; [1]Departamento de Física, Universidad de Concepción, Chile.* We study how the mathematical property of pure-state decomposition of a mixed state is related to the quantum state discrimination.

JT2A.5
Conclusive Entanglement Modification by a Local Non-unitary Operation, *Luis Roa[1]; [1]Departamento de Física, Universidad de Concepción, Chile.* Using the scheme proposed by L. Roa et al. [1] we propose a protocol to increase conclusively the entanglement of a bipartite system by means of local operations.

JT2A.6
Entanglement for 2xd-dimensional systems, *Luis Roa[1]; [1]Departamento de Física, Universidad de Concepción, Chile.* We calculate analytically the entanglement of formation for a family of bipartite 2xd-dimensional mixed states which are obtained from tripartite 2x2xd pure states.

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

JT2A.8
Electrooptical Method for Generating of Optical Vortices, *Ihor Skab[1], Yuriy Vasylkiv[1], Rostyslav Vlokh[1]; [1]Inst. 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 Bi12GeO20 crystals.

JT2A.9
Quantum Correlation Assists State Discrimination, *Luis Roa[1]; [1]Departamento de Física, Universidad de Concepción, 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 Alzar[1], Wenhua Yan[1], Arnaud Landragin[1]; [1]SYRTE, 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 Gubits, *Afef Ayachi[1]; [1]Physique, 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 Weller[1]; [1]Physics 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 Erenso[1], Daniel Bonior[1], Benjamin Bunnell[1], Jonathan Bentley[1], Hannah Norris[1]; [1]Physics & 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 Equilibration Produced by Chaotic Environments, *Gabriela B. Lemos[1], Fabricio Toscano[1]; [1]Federal Univ. of Rio de Janeiro, Brazil.* We investigate decoherence in quantum systems coupled via dephasing-type interactions to an arbitrary environment with chaotic underlying classical dynamics.

JT2A.15
Nonlinear Coherent Loss for Generating Nonclassical States, *Alexander B. Mikhalychev[1], Dmitri S. Mogilevtsev[1], Sergei Y. Kilin[1]; [1]B. I. Stepanov Inst. 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, *Juan C. López-Carreño[1], Juan P. Restrepo-Cuartas[2], Herbert Vinck-Posada[1]; [1]Universidad Nacional de Colombia, Colombia; [2]Universidad de Antioquia, Colombia.* In this work, the temporal evolution of the interaction between a two energy levels 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 Dalla Pozza[1], Nicola Laurenti[1], Francesco Ticozzi[1]; [1]Department 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, *Himadri S. Dhar[1]; [1]School of Physical Sciences, Jawaharlal Nehru Univ., India.* We observe that quantum entanglement properties in spin-1/2 Heisenberg ladder are influenced by its pseudo-2D geometry. Such non-intuitive qualitative manifestations can have important implications on the application of information processing tasks.

JT2A.19
Withdrawn

JT2A.20
Withdrawn

JT2A.21
Perfect Probabilistic Transformations between Symmetric Sets of Quantum States, *Erika Andersson[1], Vedran Dunjko[1]; [1]Physics, Heriot-Watt Univ., UK.* We study probabilistic transforms between sets of quantum states. An example is a multiprobabilistic transform from symmetric coherent states to qubit states. We suggest an asymptotically optimal linear optical realization based on quantum scissors.

JT2A.22
Information Transfer and Randomness in Quantum Measurements, *Sergey Mayburov[1]; [1]Lebedev 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 Pechen[1,2]; [1]Chemical Physics, Weizmann Inst. of Science, Israel; [2]Mathematical 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 Zhang[1]; [1]Shanxi 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 Photon Pairs Generation by 2x2 Fiber, *Hsin-Pin Lo[1,2], Atsushi Yabushita[2], Chih-Wei Luo[2], Pochung Chen[1], Takayoshi Kobayashi[2,3]; [1]Department of Physics, National Tsing Hua Univ., Taiwan; [2]Department of Electrophysics, National Chiao-Tung Univ., Taiwan; [3]Core 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 photon pairs be measured from the output.

JT2A.26
Withdrawn

JT2A.27
Quantum Holograms based on the Faraday Interaction. Spontaneous Emission in Such Systems. *Denis Vasilyev[1]; [1]Inst. for Theoretical Physics, Inst. for Gravitational Physics, Leibniz Univ. Hanover, 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. Khoury[1], Luis E. Oxman[1]; [1]Instituto de Fisica, Universidade Federal Fluminense, Brazil.* 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 Cavity, *Li-hui Sun[1,2], Gao-xiang Li[1], Wen-ju Gu[1], Zbigniew Ficek[3]; [1]Department of Physics, Huazhong Normal Univ., China; [2]College of Physical Science and Technology, Yangtze Univ., China; [3]National Centre for Mathematics and Physics, KACST, 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.

JT2A • Joint Poster—Continued

JT2A.30

Bright Beam High-noon States, *Aziz Kolkiran[1,2]; [1]Electrical and electronics eng, Gediz Univ., Turkey; [2]Electrical and electronics eng, Izmir Katip Celebi Univ., Turkey.* We show how to generate High-noon states at high flux of photons using coherent beam stimulated non-collinear parametric down conversion (PDC) process.

JT2A.31

Multi-Quabit Entanglement of Nanomechanical Resonators, *Mahmoud Abdel-Aty[2,1]; [1]Science, Univ. of Bahrain, Bahrain; [2]Mathematics, Sohag Univ., Egypt.* We discuss the entanglement dynamics of interaction between a multi-qubit system (Cooper-pair boxes) and a nanomechanical resonator. New type of oscillations employing different entanglement measures is introduced.

JT2A.32

Ultrafast All Optical Switching in Paramagnetic Magneto-optical Crystals, *Guohong Ma[1]; [1]Physics Department, Shanghai Univ., China.* Ultrafast optical switching of magnetization in paramagnetic magneto-optical crystals was demonstrated. The switching as fast as 200 fs is reached, the switching amplitude is revealed to be proportional to the MO coefficient of the crystal.

JT2A.33

Control of Quantum Fluctuation of Atomic Displacements by Femtosecond Laser Pulses, *Jianbo Hu[1,2], Oleg V. Misochko[3], Kazutaka G. Nakamura[1,2]; [1]Materials and Structures Laboratory, Tokyo Inst. of Technology, Japan; [2]JST-CREST, Japan; [3]Inst. of Solid State Physics, Russian Academy of Sciences, Russian Federation.* By employing a two pump- one probe technique, we have realized coherent control of quantum fluctuation of atomic displacements via exciting two-phonon bound states generated by off-resonant impulsive stimulated second-order Raman scattering.

JT2A.34

Coherent and Squeezed Phonon States Generated in a Quantum Well by Ultrafast Optical Excitation, *Thomas Papenkort[1], Vollrath Martin Axt[2], Tilmann Kuhn[1]; [1]Institut für Festkörpertheorie, Universität Münster, Germany; [2]Institut für Theoretische Physik III, Universität Bayreuth, Germany.* We present simulations of the lattice dynamics in a quantum well driven by ultrashort optical pulses. Our calculations provide insight into the generation mechanisms for coherent phonons and show how squeezed phonon states can be excited.

JT2A.35

TD-DFT Molecular Dynamics simulations of ultrafast processes, *Pablo Lopez-Tarifa[1], Basile Curchod[1], Ivano Tavernelli[1], Ursula Rothlisberger[1]; [1]LCBC, EPFL, Switzerland.* A combination of Time-Dependent Density Functional Molecular Dynamics and Born-Oppenheimer Molecular Dynamics is applied to study the first stages that follow the singly and doubly electron ionization of small biomolecules.

JT2A.36

Photoinduced Structural Dynamics of Epitaxial BiFeO3 Thin Films Probed by Ultrafast Hard X-ray Diffraction, *Haidan Wen[1], Pice Chen[2], Donald A. Walko[1], June H. Lee[1], Carolina Adamo[3], Jon Ihlefeld[4], Eric M. Dufresne[1], Darrell Schlom[3], John W. Freeland[1], Paul G. Evans[2], Yuelin Li[1]; [1]X-ray Science Division, Argonne National Laboratory, USA; [2]Department of Materials Science and Engineering and Materials Science Program, Univ. of Wisconsin-Madison, Madison, USA; [3]Department of Materials Science and Engineering, Cornell Univ., USA; [4]Sandia National Laboratories, USA.* The photoinduced dynamical reverse piezoelectric effect in epitaxial BiFeO3 thin films has been characterized by time-resolved hard X-ray diffraction measurements for ultrafast optical control of room temperature multiferroics.

JT2A.37

Three displacively excited coherent phonons in infinite BN-nanotubes, *Bernd Bauerhenne[1]; [1]Universität Kassel, Germany.* We simulate the dynamics of a (5,0) zigzag BN-nanotube upon intense femtosecond laser excitation. We demonstrate, that three phonon modes are simultaneous excited and analyse the possibility to steer these motions.

JT2A.38

Time-Resolved Photoelectron Diffraction on Laser-Aligned Molecules, *Denis Anielski[1,3], Rebecca Boll[1,3], Daniel Rolles[1,2]; [1]Max Planck Advanced Study Group at CFEL, Germany; [2]Max-Planck-Institut für medizinische Forschung, Germany; [3]Max-Planck-Institut für Kernphysik, Germany.* We present static and time-resolved photoelectron angular distributions of laser-aligned pFAB and OCS molecules photoionized by fs-FEL pulses. Dynamic structural changes of a molecule during Coulomb explosion were recorded.

JT2A.39

Laser-induced Nonthermal Melting in Si, *Tobias Zier[1], Eeuwe S. Zijlstra[1], Martin E. Garcia[1]; [1]Theoretical Physics, Univ. Kassel, Germany.* In Si an ultrashort laser pulse excitation induces a nonthermal state with ensuing bond softening which leads to nonthermal melting. Our simulations allow us to explain the concerted decay of several x-ray diffraction peaks.

JT2A.40

2D-IR Spectroscopy of Intermolecular Ion-Water Coupling, *Joanna Borek[1], Fivos Perakis[1], Peter Hamm[1]; [1]Physical Chemistry Inst., Univ. of Zurich, Switzerland.* We present 2-color 2D-IR spectra of saturated aqueous solutions of pseudohalide and azide ions to extract the intermolecular coupling between the ion and its surrounding water molecules and thus measure solvation shell dynamics.

JT2A.41

State-selective Alignment of Molecules by Intense Nonresonant Laser Pulses, *Nina Owschimikow[1], Burkhard Schmidt[2], Nikolaus Schwentner[3]; [1]IOAP, TU Berlin, Germany; [2]Institut für Mathematik, FU Berlin, Germany; [3]Institut für Experimentalphysik, FU Berlin, Germany.* We identify the basic processes in the response of a molecule to a linearly polarized laser field. We disentangle the contributions of J and M quantum numbers, and show how rotationally hot and cool wave packets can be created.

JT2A.42

Calibrated Real Time Detection of Nonlinearly Propagating Giant Strain Waves, *André Bojahr[1], Daniel Schick[1], Marc Herzog[1], Matias Bargheer[1,2]; [1]Universität Potsdam, Institut für Physik und Astronomie, Germany; [2]Helmholtz-Zentrum Berlin für Materialien und Energie GmbH, Germany.* We show ultrafast all-optical reflectivity measurements on nonlinear propagating strain pulses for different fluences calibrated by ultrafast X-ray diffraction (UXRD) to the corresponding induced strain amplitudes.

JT2A.43

Ultrafast Tr-ARPES with Artemis XUV Beamline, *Cephise Cacho[1], Edmond Turcu[1], Chris Froud[1], Will Bryan[2], Jesse Petersen[3], Nicky Dean[3], Stefan Kaiser[4], Andrea Cavalleri[4], Alberto Simoncig[4], Haiyun Liu[4], Adrian Cavalieri[4], Sarnjeet Dhesi[5], Luca Poletto[6], Paolo Villoresi[6], Fabio Frassetto[6], Emma Springate[1]; [1]Artemis, CLF, UK; [2]Department of Physics, Swansea Univ., UK; [3]Clarendon Laboratory, Oxford Univ., UK; [4]Max Planck Research Department for Structural Dynamics, Centr for Free Electron Laser, Germany; [5]Physical Science Division, Diamond Light Source, UK; [6]LUXOR, CNR-INFM, Italy.*A new HHG XUV beamline at Artemis, user open-access facility at CLF, offers unique capabilities optimised for Tr-ARPES. Current result on ultrafast melting of Mott and charge order in TaS2 will be presented.

JT2A.44

Model-free Investigation of Ultrafast Bimolecular Chemical Reactions: Bimolecular Photoinduced Electron Transfer, *Bernhard Lang[1], Arnulf Rosspeintner[1], Eric Vauthey[1]; [1]Physical Chemistry, Univ. of Geneva, Switzerland.*Using photoinduced bimolecular electron transfer reactions as example we demonstrate how diffusion controlled bimolecular chemical reactions can be studied in a model-free manner by quantitatively combining different ultrafast spectroscopical tools.

JT2A.45

Dynamics of the OH Stretching Vibration in Aqueous Hydrates, *Jasper C. Werhahn[1], Sotiris S. Xantheas[2], Hristo Iglev[1]; [1]Physics, E11, TU Munich, Germany; [2]Chemical & Material Sciences Division, Pacific Northwest National Laboratory, USA.* Nonlinear IR spectroscopy gives evidence for intermolecular energy transfer as primary channel for the relaxation of the OH stretching vibration of HDO. Properties of bifurcated hydrogen bonds are unambiguously compared to strong and weak ones.

JT2A.46

Saturation Behavior of Femtosecond Laser Ablation in Silicon-on-insulator, *Hao Zhang[1], Dries Oosten[1], Denise Krol[1], Jaap Dijkhuis[1]; [1]Utrecht Univ., Netherlands.* Submicron single-shot ablation features produced by femtosecond laser pulses was investigated in silicon-on insulator with atomic force microscopy. The results are fitted with a model that includes secondary absorption in the laser-induced plasma.

JT2A.47

REGAE: New Source for Atomically Resolved Dynamics, *Masaki Hada[1], Julian Hirscht[1], Dongfang Zhang[1], Stephanie Manz[1], Kostyantyn Pichugin[1], Dmitry Mazurenko[1], Shima Bayesteh[2], Hossein Delsim-Hashemi[2], Klaus Floettmann[2], Markus Huening[2], Sven Lederer[2], Gustavo Moriena[3], Christina Mueller[3], German Sciaini[1,3], Dwayne Miller[1,3]; [1]Center for Free Electron Laser Science, Max Planck Research Department for Structural Dynamics, Univ. of Hamburg, Germany; [2]Deutsches Elektronen-Synchrotron, Germany; [3]Department of Chemistry and Physics, Univ. of Toronto, Canada.* In this paper, we show the design and theoretical calculation of our new femtosecond electron source based on rf-accelerator generating 2-5 MeV electron bunches with high electron density and high coherence length.

JT2A.48

Radio-frequency Electron Bunches Compression for Ultrafast Diffraction Experiment, *Stefano Dal conte[1]; [1]Department of Applied Physics, Technical Univ. of Eindhoven, Netherlands.* We temporally compress highly charged electron bunches (100 fC). The linear chirp of a waterbag bunch is inverted by using a synchronized 3 GHz cavity leading to short (< 100 fs) and high-density electron pulses.

JT2A.49

Structure Changes of Ferromagnetic/Ferroelectric Oxide Nanolayers by Ultrafast X-ray Diffraction at Laser-based and Synchrotron-based Sources, *Lena Maerten[1], Daniel Schick[1], Marc Herzog[1], André Bojahr[1], Jevgenij Goldshteyn[2], Wolfram Leitenberger[1], Ionela Vrejoiu[3], Roman Shayduk[2], Peter Gaal[1], Matias Bargheer[1,2]; [1]Institut für Physik und Astronomie, Universität Potsdam, Germany; [2]Helmholtz-Zentrum Berlin für Materialien und Energie GmbH, Germany; [3]Max-Planck-Institut für Mikrostrukturphysik, Germany.* We present ultrafast x-ray diffraction experiments on oxide nanostructures consisting of ferromagnetic and ferroelectric layers. We discuss how the strain couples to heat in electrons, phonons and magnons.

JT2A.50

Versatile Non Collinear Four-Wave Mixing Set-Up Fully Based on Femtosecond Pulse Shaping for Coherent Electronic Spectroscopy, *Andrea Cannizzo[1], Franziska Frei[1], Thomas Feurer[1]; [1]Inst. of Applied Physics, Univ. of Bern, Switzerland.* herein we will present a set-up for four wave mixing experiments in the Vis and IR, fully based on femtosecond pulse shaping. Several examples from different molecular systems are shown.

JT2A.51

Design and Construction of a 700-W CW Diode-Pumped Nd:YAG rod laser with high beam quality and highly efficient concentrator of Pump-Light, *Iraj Mashaiekhyasl[1]; [1]Iranian National Center for Laser Science, Islamic Republic of Iran.* In this work design and construction of a diode pumped solid state laser of 700-W CW with high efficiency and reliability, very good beam quality, high uniform pumping intensity in the active area is presented.

JT2A • Joint Poster—Continued

JT2A.52
Probing Femtosecond Filamentation via High-order Harmonics, *Daniel Steingrube[1,2], Emilia Schulz[1,2], Martin Kretschmar[1], Thomas Binhammer[3], Mette Garde[4,5], Arnaud Couairon[6], Uwe Morgner[1,2], Milutin Kovacev[1,2]; [1]Leibniz Universitaet Hannover, Institut fuer Quantenoptik, Germany; [2]Quest, Centre for Quantum Engineering and Space-Time Research, Germany; [3]VENTEON Laser Technologies GmbH, Germany; [4]Department of Physics and Astronomy, Louisiana State Univ., USA; [5]PULSE Inst., SLAC National Accelerator Laboratory, USA; [6]Centre de Physique Theorique, 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 simple attosecond light source.

JT2A.53
Coupled-coherent State Approach for High-order Harmonic Generation, *Jie Wu[1], Bradley B. Augstein[1], Carla Faria[1], Adam Kirrander[2], Dmitry Shalashilin[3]; [1]Physics & Astronomy, Univ. College London, UK; [2]Laboratorie Aimé Cotton Bat, France; [3]Chemistry, Univ. of Leeds, UK.* We present the first ever computation of HHG spectra using the orbit-based Coupled-Coherent State (CCS) method, whose outcome exhibits a plateau and a cutoff. The CCS fully accounts for quantum interference and the binding potential.

JT2A.54
Above-threshold Ionization (ATI) from Nonhomogeneous Fields, *Marcelo Ciappina[1], Jens Biegert[1,2], Romain Quidant[1,2], Maciej Lewenstein[1,2]; [1]QOT, ICFO, Spain; [2]ICREA, Spain.* We present theoretical studies of above-threshold ionization (ATI) produced by nonhomogeneous fields. This kind of fields appears when a plasmonic nanostructure is illuminated by a short laser pulse.

JT2A.55
Various Techniques for Power Scaling Fiber Laser Output, *Maryam Ilchi-Ghazaani[1], Parviz Parvin[1], Vajiheh Daneshafrooz[1]; [1]Physics Department, Amirkabir Univ. of Technology, Islamic Republic of Iran.* Here, different amplifying methods for power scaling of fiber lasers are represented comprising beam combining of multifiber lasers, distributed array as well as MOPA arrays. Those models are done numerically for Yb:silica fiber lasers.

JT2A.56
Excitation of Residual Current by Femtosecond Laser Pulses in Gas of Asymmetric Molecules, *Leonid Alexandrov[1], Mikhail Emelin[1], Mikhail Ryabikin[1]; [1]Inst. 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.

JT2A.57
Spatio-Spectral Coupling in Multi-Petawatt Ti:Sapphire Lasers, *Gabriel Mennerat[3], Fabio Giambruno[1,2], Antoine Freneaux[1,2], Frederic Leconte[1,2], Gilles Cheriaux[2]; [1]ILE, France; [2]LOA, France; [3]CEA, France.* The influence of the radially varying Ti:Sapphire gain on the spectral amplitude and phase of a 15 femtoseconds pulse is studied

JT2A.58
Analysis of Gold Nanoantennas for Harmonic Generation Utilising Plasmonic Field Enhancement, *Nils Pfullmann[1,2], Christian Waltermann[1,2], Milutin Kovacev[1,2], Vanessa Knittel[3], Rudolf Bratschitsch[3], Alfred Leitenstorfer[3], Uwe Morgner[1,2]; [1]Leibniz Universität Hannover, Institut für Quantenoptik, Germany; [2]QUEST Centre for Quantum Engineering and Space-Time Research, Germany; [3]Department of Physics and Center for Applied Photonics, Univ. of Konstanz, Germany.* We present an analysis of the plasmonic field enhancement in gold nanoantennas based on FDTD calculations. In experiments up to the 7th harmonic-order is observed. Experimental issues are discussed and explained by a theoretical model.

JT2A.59
Pulse Shortening by spectral gain modulation in a regenerative Yb:CaF2 laser amplifier, *Fabian Roeser[1], Markus Loeser[1], Mathias Siebold[1], Ulrich Schramm[1]; [1]HZDR, Germany.* We successfully demonstrate bandwidth enhancement via gain modulation in a regenerative Yb:CaF2 amplifier implementing a birefringent quartz crystal. 260 fs pulses of a Yb:KGW oscillator can be shortened down to 220 fs after amplification.

JT2A.60
Cascaded Soliton Compression of Energetic Femtosecond Pulses at 1030 nm, *Morten Bache[1], Binbin Zhou[1]; [1]Department of Photonics Engineering, DTU Fotonik, Denmark.* We discuss soliton compression with cascaded second-harmonic generation of energetic femtosecond pulses at 1030 nm. We discuss problems encountered with soliton compression of long pulses and show that sub-10 fs compressed pulses can be achieved.

JT2A.61
Trajectory Selection in High Harmonic Generation Using Multicolor Fields, *David Hoffmann[1], Leonardo Brugnera[1], F. Frank[1], A. Zair[1], J. P. Marangos[1]; [1]Physics, Imperial College London, UK.* We examine trajectory selection and resulting yield modulation in high harmonic generation using a multicolor field composed of an 800nm fundamental and its perpendicularly polarized second harmonic.

JT2A.62
The Dependence of the Photon-number Distribution of Parametric Down-conversion on the Number of Collected Modes, *Liat Dovrat[1], Michael Bakstein[1], Daniel Istrati[1], Assaf Shaham[1], Hagai Eisenberg[1]; [1]Racah Inst. of Physics, Hebrew Univ., Israel.* The dependence of the photon-number distribution from parametric down-conversion on the number of collected modes is directly measured using Silicon Photo-Multiplier number-resolving detectors. Measurements are analyzed using a novel crosstalk model.

JT2A.63
Large Aperture Multi-Pass Amplifiers for High Peak Power Lasers, *V.V. Chvykov, K. Krushelnick; Univ. of Michigan, USA.* We demonstrate the optimal conditions whereby amplification using the Extraction During Pumping (EDP) technique can deliver up to four times more energy than a conventional amplifier. This allows kJ level energy extraction with existing technology.

JT2A.64
Self-Compression of a Few-Cycle Petawatt Laser Pulses in Transparent Plasma, *S. Skobelev[1], A. Balakin[1], A. Litvak[1], V. Mironov[1]; [1]The Institute of Applied Physics of the Russian Academy of Sciences, Russia.* We propose new method for self-compression of few-cycle relativistic laser pulses at petawatt power level with duration less than plasma period, using non-stationary self-focusing of spatially confined wave packet in transparent plasma.

JT2A.65
The FLOWER Project: Test of Possible Fluctuations of the Speed of Light in Vacuum, *X. Sarazin; Laboratoire de l'Accélérateur Linéaire, Université Paris, France.* The goal of the project FLOWER is to test possible fluctuations of the speed of light by studying the time broadening of a femtosecond laser pulse in a multi-pass Herriot cell in vacuum.

12:30–14:00 Exhibit Hall / Lunch, *Hall 13*

Madrid / Sydney

Quantum Information and Measurement

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High Intensity Lasers and High Field Phenomena

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International Conference on Ultrafast Structural Dynamics

Tuesday, 20 March

14:00–16:00
QT3A • Photon Entanglement
John Howell; *Univ. of Rochester, USA, Presider*

QT3A.1 • 14:00
Experimental Observation of the Ultra-narrow Temporal Entanglement of Twin Beams by Means of Frequency Up-conversion
Ottavia Jedrkiewicz[1], Jean-Luc Blanchet[1], Alessandra Gatti[2], Enrico Brambilla[1], Luigi A. Lugiato[1], Paolo Di Trapani[1]; [1]Dipartimento di Scienza e Alta Tecnologia, Università dell'Insubria, Italy; [2]Istituto di Fotonica e Nanotecnologie, 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.

QT3A.2 • 14:15
Dissipation-boosted Entanglement of Coupled Harmonic Oscillators, *Erika Andersson[1], Chaitanya Joshi[1], Michael J W Hall[2,3], Mats Jonson[1,4], Patrik Ohberg[1]; [1]Physics, Heriot-Watt Univ., UK; [2]Theoretical Physics, RSPE, Australian National Univ., Australia; [3]Centre for Quantum Dynamics, Griffith Univ., Australia; [4]Department 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.

QT3A.3 • 14:30
Photon Pairs from Cavity-Enhanced Parametric Down-Conversion with Tunable Bandwidth for Quantum Interfaces, *Andreas Ahlrichs[1], Lars Koch[1], Martin Kerbach[1], Oliver J. Benson[1]; [1]Institut of Physics, Humboldt-Univ. of Berlin, Nano-Optics 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.

QT3A.4 • 14:45
Two-photon Interference and Polarization Entanglement of Photon Pair Beam by Path Overlap Scheme, *Atsushi Yabushita[1], Hsin-Pin Lo[2], Chih-Wei Luo[1], Pochung Chen[2], Takayoshi Kobayashi[1,3]; [1]Department of Electrophysics, National Chiao-Tung Univ., Taiwan; [2]Department of Physics, National Tsing Hua Univ., Taiwan; [3]CREST, JST, Japan.* Polarization entangled photon pairs are generally obtained at crossing points of light cones. This work generated photon pairs in beam shape and overlapped their light paths to demonstrate their two-photon interference and polarization entanglement.

14:00–16:00
QT3B • Quantum Information
Gerhard Rempe; *Max-Planck Inst. of Quantum Optics, Germany, Presider*

QT3B.1 • 14:00 Invited
Quantum Information Storage in Atomic Media, *Elisabeth Giacobino[1]; [1]Laboratoire Kastler Brossel, Université Pierre et Marie Curie, France.* Storage and read-out of quantum states of light based on EIT is studied in atomic ensembles. We compare storage schemes in Cs atomic vapors at room temperature and in cold atomic clouds.

QT3B.2 • 14:30
Spin Squeezing of Large-Spin Ensembles via Quantum Non-demolition Measurement, *Robert J. Sewell[1], Marco Koschorreck[2], Mario Napolitano[1], Brice Dubost[1,3], Naeimeh Behbood[1], Morgan W. Mitchell[1]; [1]ICFO - Institut de Ciències Fotòniques, Spain; [2]Departement of Physics, Univ. of Cambridge, UK; [3]Laboratoire Mate riaux et Phe nome'nes Quantiques, Universite Paris Diderot et CNRS, France.* We report the first demonstration of spin squeezing of a large-spin system via quantum non-demolition (QND) measurement. We observe 2 dB of metrological squeezing in an ensemble of ~ 106 laser cooled 87Rb atoms in the F = 1 hyperfine ground state.

QT3B.3 • 14:45
Optical Quantum Information Processing using Forced Fermion-like Behavior of Photonic Qubits, *Todd Pittman[1], James Franson[1]; [1]Physics, UMBC, USA.* We review a new paradigm for optical quantum logic gates that relies on forced "fermion-like" behavior of photonic qubits, and describe experimental work on demonstrating these gates with entangled photons from a parametric down-conversion source

14:00–16:00
HT3C • OPCPA and Waveform Synthesis
Takao Fuji; *Inst. for Molecular Science, Japan, Presider*

HT3C.1 • 14:00 Invited
High Repetition Rate Few-cycle OPCPA for Generation of Isolated Attosecond Pulses, *Manuel Krebs[1], Steffen Hädrich[1,2], Stefan Demmler[1], Jan Rothhardt[1,2], Jens Limpert[1,2], Andreas Tünnermann[1,2]; [1]Institut für Angewandte Physik, Friedrich-Schiller-Universität Jena, Germany; [2]Helmholtz Inst. Jena, Germany.* A 20W average power optical parametric amplifier system delivering CEP stable 20µJ, sub 5fs pulses at megahertz repetition rate is presented. First high harmonic generation experiments suggest its feasibility for isolated attosecond pulse generation.

HT3C.2 • 14:30 Invited
A Mid-IR, High Repetition Rate, Few-Cycle Laser Source for High-Field Physics Experiments, *Michael Hemmer[1], Alexandre Thai[1], Matthias Baudisch[1], Jens Biegert[1,2]; [1]ICFO - The Inst. of Photonics Sciences, Spain; [2]ICREA - Institucio Catalana de Recerca i Estudis Avançats, Spain.* We report on a high average power, few-cycle laser system operating in the mid-IR. The system delivers 20 microJoule energy pulses with ~67 fs duration at 160 kHz repetition rate with sub-250 mrad carrier-envelope-phase stability.

14:00–16:00
IT3D • Electron Diffraction
Thomas Elsaesser; *Max Born Inst., Germany, Presider*

IT3D.1 • 14:00 Invited
MeV Ultrafast Electron Diffraction, *Xijie Wang[1]; [1]Photon 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 100-nm Al film with 10^5 electrons, and super-lattice of TaSe2 was observed with SRN of 400.

IT3D.2 • 14:30 Invited
Femtosecond Electron Diffraction for the Study of Charge Density Waves, *Germán Sciaini[1,2], Maximilian Eichberger[3], Hanjo Schäfer[3], Marina Krumova[4], Markus Beyer[3], Helmuth Berger[6], Gustavo Moriena[1,2], Jure Demsar[3,5], Dwayne Miller[1,2]; [1]Max Planck Research Department for Structural Dyanmics, Univ. of Hamburg, Germany; [2]Chemistry and Physics, Univ. of Toronto, Canada; [3]Physics Department and Center of Applied Photonics and Zukunftskolleg, Univ. of Konstanz, Germany; [4]Chemistry, Univ. of Konstanz, Germany; [5]Complex Matter Department, Jozef Stefan Inst., Slovenia; [6]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 photoexcitation

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QT3A • Photon Entanglement—Continued

QT3A.5 • 15:00
Heralded Quantum Entanglement between two Rare-Earth-Ion Doped Crystals, *Christoph Clausen[1], Imam Usmani[1], Felix Bussieres[1], Nicolas Sangouard[1], Mikael Afzelius[1], Nicolas Gisin[1]; [1]GAP-Optique, Univ. of Geneva, Switzerland.* Two 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.

QT3A.6 • 15:15
Evolution of Two Photon Path Entangled States in Multimode Waveguides, *Eilon Poem[1], Yehonatan Gilead[1], Yaron Silberberg[1]; [1]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.

QT3A.7 • 15:30 Invited
Nano Optical Fibers for Photonic Quantum Information, *Shigeki Takeuchi[1,2]; [1]Research Inst. for Electronic Science, Hokkaido Univ., Japan; [2]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.

QT3B • Quantum Information—Continued

QT3B.4 • 15:00
Single and Coupled Photonic Crystal Cavities for Solid-State Cavity-QED, *Cristian Bonato[1], Jenna Hagemeier[2], Dario Gerace[3], Susanna M. Thon[2,4], Hyochul Kim[2,5], Gareth Beirne[1], Morten Bakker[1], Lucio C. Andreani[3], Pierre M. Petroff[2], Martin P. van Exter[1], Dirk Bouwmeester[1,2]; [1]Huygens Laboratory, Leiden Univ., Netherlands; [2]Univ. of California Santa Barbara, USA; [3]Univ. of Pavia, Italy; [4]Univ. of Toronto, Canada; [5]Univ. of Maryland, USA.* We discuss the implementation of quantum information schemes with quantum dots in photonic crystal cavities, focusing on the optimization of far-field emission profiles and independent electrical tuning on quantum dots in waveguide-coupled cavities

QT3B.5 • 15:15 Invited
Quantum Ergodic Channels and Generation of Quantum States, *Kazuya Yuasa[1]; [1]Waseda Inst. for Advanced Study, Waseda Univ., Japan.* We introduce “quantum ergodic/mixing channel” that drives a quantum system from any initial states to a certain target state. By making use of mathematical theorems on ergodicity and mixing, we construct schemes for generating entanglement.

QT3B.6 • 15:45
Directionnal Entanglement in Coupled Quantum-dot Photonic-bandgap Microcavity Systems, *Marc-André Dupertuis[1,2], Raphael Faerber[1]; [1]Laboratory of Quantum Optoelectronics, EPFL, Switzerland; [2]Laboratory of Physics of Nanostructures, EPFL, Switzerland.* We investigate pair of isolated quantum dot excitons strongly coupled to microcavity, and quantum dot biexciton, as sources of directionnal entanglement in photonic bandgap microcavity circuits, and compare the results with polarisation entanglement.

HT3C • OPCPA and Waveform Synthesis—Continued

HT3C.3 • 15:00
Phase-stabilized sub 3-cycle 100 kHz Optical Parametric Amplifier at 2.1 µm, *Julien Nillon[1], Sébastien Montant[1], Guillaume Machinet[1], Eric Cormier[1,2]; [1]CELIA, France; [2]Lawrence Livermore National Laboratory, USA.* We report on a new scheme for ultra-broadband optical parametric amplification at 2.1 µm delivering CEP-stabilized pulses of duration down to 16 fs (2.2 cycles) and energy up to 10 µJ at 100 kHz.

HT3C.4 • 15:15 Invited
Optical Field Waveform Generation and Characterization, *Andy Kung[1,2]; [1]Inst. of Photonics Technologies, National Tsing Hua Univ., Taiwan; [2]Inst. of Atomic and Molecular Sciences, Academia Sinica, Taiwan.* We report the realization of fully-controlled synthesis of femtosecond and subfemtosecond optical field waveforms using a comb of frequencies generated by the adiabatic Raman technique.

HT3C.5 • 15:45
Coherent Synthesis of Ultra-broadband Optical Parametric Amplifiers, *Cristian Manzoni[1], Shu-Wei Huang[2], Giovanni Cirmi[2], Jeffrey Moses[2], Franz Kärtner[2,3], Giulio Cerullo[1]; [1]IFN-CNR Politecnico di Milano, Italy; [2]Department of Electrical Engineering and Computer Science and Research Laboratory of Electronics, MIT, USA; [3]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.

IT3D • Electron Diffraction—Continued

IT3D.3 • 15:00
Femtosecond Transmission Electron Diffraction on Single Crystalline Graphite, *Christian Gerbig[1], Silvio Morgenstern[1], Cristian Sarpe[1], Matthias Wollenhaupt[1], Thomas Baumert[1]; [1]Institut für Physik und Center for Interdisciplinary Nanostructure Science and Technology (CINSaT), Universität Kassel, Germany.* We use a self-referencing highly compact femtosecond transmission electron diffractometer to study the evolution of strongly coupled optical phonons and lattice phonon thermalization in single crystalline graphite after ultrashort laser excitation.

IT3D.4 • 15:15
Time-Resolved Phototelectron Diffraction for Measuring Structural Dynamics at Surfaces, *Michael E. Greif[1]; [1]Uni Zürich, Switzerland.* Photoelectron Diffration is an established method for structural analysis of surfaces. New light sources open the possibility for Time-Resolved Structural Dynamics via pump-probe spectroscopy. A structural study on SnPc/Ag(111) is presented.

IT3D.5 • 15:30 Invited
Four-Dimensional Electron Nanocrystallography, *Chong-Yu Ruan[1]; [1]Physics and Astronomy, Michigan State Univ., USA.* A framework to determine interfacial structure, temperature, and photovoltage dynamics based on surface sensitive ultrafast electron crystallography and voltammetry is demonstrated based on recent studies of surface supported nanomaterials.

16:00–16:30 Coffee Break, *Grosser Stern*

Tuesday, 20 March

Madrid	Sydney	Hong Kong	Istanbul
Quantum Information and Measurement		High Intensity Lasers and High Field Phenomena	International Conference on Ultrafast Structural Dynamics

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 Lütkenhaus[1]; [1]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 Gauthier[1], Hannah Guilbert[1], Yunhui Zhu[1], Meizhen Shi[1], Kevin McCusker[2], Bradley Christensen[2], Paul Kwiat[2], Thomas Brougham[3], Stephen M. Barnett[3], Venkat Chandar[4]; [1]Dept. of Physics, Duke Univeristy, USA; [2]Department of Physics, Univ. of Illinois Urbana-Champaign, USA; [3]Department of Physics, Univ. of Strathclyde, UK; [4]Lincoln Laboratory MIT, USA.* We describe our progress on achieving quantum key distribution with high photon efficiency and high rate using hyperentanglement. Our goal is encode 10 bits per photon and distribute a secure key at 1 Gbit/s.

QT4A.3 • 17:30 Invited
Experimental Studies Toward the Quantum Communications with Orbiting Terminals, *Paolo Villoresi[1], Andrea Tomaello[1], Alberto Dall'Arche[1], Francesca Gerlin[1], Ivan Capraro[1], Giuseppe Vallone[1]; [1]Information 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.

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. Lett[1,2], Neil Corzo[1,2], Alberto Marino[1,2], Kevin Jones[3,1]; [1]NIST, USA; [2]Joint Quantum Inst., USA; [3]Physics Department, Williams College, USA.* We have used four-wave mixing in hot atomic vapors to generate multi-spatial-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.

QT4B.2 • 17:00
Ghost Imaging by Intense Multimode Twin Beam, *Alessia Allevi[1,2], Maria Bondani[3,2]; [1]Dipartimento di Scienza e Alta Tecnologia, Universita' degli Studi dell'Insubria, Italy; [2]C.N.I.S.M. U.d.R. Como, Italy; [3]Istituto 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 Israel[1], Shamir Rosen[1], Itai Afek[1], Oron Ambar[1], Yaron Silberberg[1]; [1]Physics 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.

QT4B.4 • 17:30
Spatially Entangled 4-photons States from a Periodically Poled KTP Crystal, *Michiel J. de Dood[1], Cigdem Yorulmaz[1], Alexander van der Torren[1], Jelmer Renema[1], Martin P. van Exter[1]; [1]Leiden 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 visiblity of stimulated pairs.

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 Harmonics Generation Case, *Marcelo Ciappina[1], Jens Biegert[1,2], Romain Quidant[1,2], Maciej Lewenstein[1,2]; [1]QOT, ICFO, Spain; [2]ICREA, 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
Measurement of Nonlinear Refractive Index and MPI Coefficients in Gases Using a Wavefront Sensor, *Jens Schwarz[1], Patrick Rambo[1], Mark Kimmel[1], Briggs Atherton[1]; [1]Sandia National Laboratories, USA.* A wavefront sensor has been used to measure the Kerr nonlinear focal shift of a high intensity ultrashort pulse beam in a focusing beam geometry while accounting for the effects of plasma-defocusing.

HT4C.3 • 17:00
Efficient High-Harmonic Generation in a Mixture of a Noble Gas and Metal Nanoparticles and on Rough Metal Surfaces, *Anton Husakou[1], Joachim Herrmann[1], Kwang-Hyon Kim[1]; [1]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 near random rough surfaces. HHG efficiencies up to 10-6 are predicted.

HT4C.4 • 17:15
Attosecond Pulse Narrowing by Off-axis Detection, *Carlos Hernandez-Garcia[1], Luis Plaja[1]; [1]Física Aplicada, Universidad de Salamanca, Spain.* Our simulations of high harmonic generation and propagation predict a shortening of the width of the synthetized attosecond pulses, when selecting the radiation at angles off-axis.

HT4C.5 • 17:30
Temporal Gatings for Broadband Attosecond Pulse Generation, *Peixiang Lu[1], Weiyi Hong[1]; [1]School 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 gatings for HHG to produce the broadband supercontinua. The macroscopic effects including the spectral, temporal and spacial properties are discussed.

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. Nelson[1]; [1]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 Bowlan[1], Klaus Reimann[1], Michael Woerner[1], Thomas Elsaesser[1]; [1]Max-Born-Institut, 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 photon echo signals are absent.

Madrid	Sydney	Hong Kong	Istanbul
Quantum Information and Measurement		High Intensity Lasers and High Field Phenomena	International Conference on Ultrafast Structural Dynamics

QT4A • Quantum Communication I—Continued

QT4A.4 • 18:00
Arbitrarily Loss-tolerant Einstein-Podolsky-Rosen Steering Allowing a Demonstration Over 1~km of Optical Fiber with no Detection Loophole, *Adam Bennet[1,2], David A. Evans[1,2], Dylan J. Saunders[1,2], Cyril Branciard[3], Eric Cavalcanti[1], Howard M. Wiseman[1,2], Geoff J. Pryde[1,2]; [1]Centre for Quantum Dynamics, Griffith Univ., Australia; [2]Centre for Quantum Computation and Communication Technology (Australian Research Council), Griffith Univ., Australia; [3]School of Mathematics and Physics, Univ. of Queensland, Australia.* EPR-steering is a nonclassical effect which allows one party to verify that he shares entanglement with another party. Using new, arbitrarily loss-tolerant tests, we demonstrate detection-loophole-free EPR-steering with entangled photon pairs.

QT4A.4 • 18:15
New Near-Deterministic All-Optical Teleportation, Superdense Coding, and Cryptography Scheme, Mladen Pavicic, *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.

QT4B • Quantum Imaging—Continued

QT4B.5 • 17:45 Invited
Entropy, Information and Compressive Sensing in the Quantum Domain, *John Howell[1], Gregory Howland[1], Robert Boyd[1,2], Petros Zerom[1], James Schneeloch[1]; [1]Univ. of Rochester, USA; [2]Univ. of Ottawa, Canada.* An introduction to compressive sensing and quantum imaging will be given. I will then show that compressive sensing can solve important problems in some applications of quantum imaging.

QT4B.6 • 18:15
Generation of Nonclassical Light in Waveguide Arrays, *Amit Rai[1], Dimitris Angelakis[1,2]; [1]Centre for Quantum Technologies, National Univ. of Singapore, Singapore; [2]Science Department, Technical Univ. of Crete, Greece.* We explore the possibility of generating broadband continuous variable entanglement in an integrated manner inside a system consisting of an array of waveguides with second order nonlinearity.

HT4C • HHG2—Continued

HT4C.6 • 17:45
Strong Field Ionization Imaging of Electron Dynamics, *Agnieszka A. Jaron-Becker[1]; [1]JILA Univ. of Colorado, USA.* Theory for ionization imaging for two dissociating nitrogen and bromine molecules is presented. It is shown how strong field ionization can be used to image dynamical electron rearrangement during dissociation.

HT4C.7 • 18:00
Multi-Electron Corrections in Molecular High-Order Harmonic Generation for Different Formulations of the Strong-Field Approximation, *Bradley B. Augstein[1], Carla Faria[1]; [1]Physics and Astronomy, UCL, UK.* Multi-electron corrections to the strong field approximation are calculated using the length and velocity forms of the dipole operator for diatomic molecules and found to have a limited influence on the overall harmonic yield.

HT4C.8 • 18:15
Valley Structure in the Harmonic Efficiency at Ultra-high Laser Intensities, *José Antonio Pérez-Hernández[1], Roland Guichard[2], Amelle Zaïr[3], Luis Roso[1], Luis Plaja[4]; [1]Centro de Láseres Pulsados, CLPU, Centro de Láseres Pulsados, CLPU, Spain; [2]Laboratorie de Chimie Physique-Matière et Rayonnement (LCPMR), UPMC Université Paris 6, France; [3]Department of Physics, Imperial College London, UK; [4]Grupo de Investigación en Óptica Extrema (GIOE), Universidad de Salamanca, Spain.* We demonstrate that Non Adiabatic Turn-on laser field allows one to avoid efficiency losses when the saturation level of atoms is rebased, providing new route for attosecond pulses production via high-order harmonic generation.

IT4D • THz Spectroscopy—Continued

IT4D.3 • 17:45
Time-resolved THz Spectroscopy of the Ultrafast Photoinduced Insulator-metal Phase Transition of VO_2, *Tyler L. Cocker[1], Lyubov V. Titova[1], Sylvain Fourmaux[2], Greg Holloway[1], Heidi-Christina Bandulet[2], Daniel Brassard[2], Jean-Claude Kieffer[2], My-Ali El Khakani[2], Frank A. Hegmann[1]; [1]Department of Physics, Univ. of Alberta, Canada; [2]INRS-EMT, Canada.* THz spectroscopy is used to create a phase diagram of the ultrafast, photoinduced insulator-metal phase transition in VO2. The phase diagram is described by a nonthermal model based on critical electron and structural transition phonon densities.

IT4D.4 • 18:00 Invited
Coherent THz Spectroscopy and Imaging, *Thomas Feurer[1]; [1]Univ. of Bern, Switzerland.* Nanostructures in thin metal sheets are shown to be a promising tool for THz switching or THz nonlinear spectroscopy applications. If designed appropriately, such structures show extremely strong field enhancement in the gap region.

19:00–21:00 Joint QIM & HILAS Postdedline Paper Session, *Madrid*

Madrid	Sydney	Hong Kong	Istanbul
Quantum Information and Measurement		High Intensity Lasers and High Field Phenomena	International Conference on Ultrafast Structural Dynamics

07:00–18:30 Registration, *Grosser Stern*

08:00–10:00
QW1A • Quantum Communication II
Harald Weinfurter; *Univ. of Munich, Germany, Presider*

QW1A.1 • 08:00 Invited
Advanced Quantum Communication via Hyperentanglement, *Paul Kwiat[1]; [1]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 Weinhold[1], Devin Smith[1], Geoff Gillett[1], Marcelo de Almeida[1], Alessandro Fedrizzi[1], Cyril Branciard[2], Brice Calkins[3], Adriana Lita[3], Thomas Gerrits[3], Sae Woo Nam[3], Andrew White[1]; [1]Centre for Engineered Quantum Systems and Centre for Quantum Computation and Communication Technology (Australian Research Council), School of Mathematics and Physics, Univ. of Queensland, Australia; [2]School of Mathematics and Physics, Univ. of Queensland, Australia; [3]National 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. Richardson[1], Carl Sabottke[1], Jonathan Dowling[1], Petr Anisimov[2], Ulvi Yurtsever[3], Antia Lamas[4]; [1]Hearne Inst. for Theoretical Physics, Louisiana State Univ., USA; [2]Metcalf Research Group, Stony Brook Univ., USA; [3]MathSense Analytics, MathSense Analytics, USA; [4]Department 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.

08:00–10:00
QW1B • Novel Quantum Information and Measurement Techniques I
Wolfgang Schleich; *Universitat Ulm, Germany, Presider*

QW1B.1 • 08:00 Invited
Adaptive Quantum Measurement via Swarm-intelligence Machine Learning, *Barry C. Sanders[1], Alexander Hentschel[1]; [1]Inst 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 Napolitano[1], Marco Koschorreck[2], Brice Dubost[1,3], Naeimeh Behbood[1], Robert Sewell[1], Morgan W. Mitchell[1,4]; [1]ICFO, Spain; [2]Department of Physics, Univ. of Cambridge, UK; [3]laboratoire Matriaux et Penomenes Quantiques, Universite Paris Diderot, France; [4]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 Wolters[1], Andreas W. Schell[1], Nikola Sadzak[1], Tim Schröder[1], Max Schoengen[2], Jürgen Probst[2], Bernd Löchel[2], Oliver J. Benson[1]; [1]Humboldt Univerity Berlin, Germany; [2]Helmholtz-Zentrum Berlin (HZB), 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 diffusion.

08:00–10:00
HW1C • Electronic Dynamics
Robert Moshammer; *MPI fuer Kernphysik, Germany, Presider*

HW1C.1 • 08:00 Invited
Attosecond Electron Emission and Acceleration from Nanoparticles in Strong Fields, *Matthias Kling[1,2]; [1]Max Planck Inst. of Quantum Optics, Germany; [2]Physics 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. Nanofocusing in large nanoparticles allows for an efficient acceleration of electrons towards the laser propagation direction.

HW1C.2 • 08:30 Invited
Attosecond Physics with Sub-optical-cycle Waveforms of Light, *Eleftherios Gouliemakis[1]; [1]Max-Planck-Institut for Quantum Optics, Germany.* We present synthesis of intense light transients of sub-cycle temporal confinement and their first applications for attosecond control of matter.

08:00–10:00
IW1D • Structure Probes and Methods
Christian Bressler; *European XFEL Facility, Germany, Presider*

IW1D.1 • 08:00 Invited
Status and future of SACLA: the Japan's X-ray Free-Electron Laser, *Makina Yabashi[1]; [1]RIKEN Harima Inst., Japan.* Current status and future perspective of SACLA (SPring-8 Angstrom Compact free electron LAser) is presented. SACLA produces brilliant, coherent, ultrafast pulses in the hard x-ray region. User operation will start in March, 2012.

IW1D.2 • 08:30
Resonant X-Ray Emission Spectroscopy with Free Electron Lasers: Nonequilibrium Electron Dynamics in Highly Excited Polar Semiconductors, *Faton Krasniqi[1,2], Yin-Peng Zhong[1,2], David A. Reis[3], Mirko Scholz[4], Robert Hartmann[5], Andreas Hartmann[5], Daniel Rolles[1,2], Artem Rudenko[1,7], Sascha W. Epp[1,7], Lutz Foucar[1,2], Mariano Trigo[3], Matthias Fuchs[3], David M. Fritz[8], Marco Cammarata[8], Diling Zhu[8], Henrik Lemke[8], Markus Braune[9], Markus Ilchen[9], Jorgen Larsson[10], Simone Techert[4], Lothar Strüder[6], Ilme Schlichting[2], Joachim Ullrich[7]; [1]ASG, Max-Planck-ASG at CFEL/DESY, Germany; [2]Max Planck Inst. for Medical Research, Germany; [3]PULSE Inst., SLAC National Accelerator Laboratory, USA; [4]Max Planck Inst. for Biophysical Chemistry, Germany; [5]pnSensor, Germany; [6]Max Planck Inst.-Semiconductor Laboratory, Germany; [7]Max Planck Inst. for Nuclear Physics, Germany; [8]Linac Coherent Light Source, SLAC National Accelerator Laboratory, USA; [9]DESY, Germany; [10]Lund 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 non-equilibrium electron distribution function.

IW1D.3 • 08:45
Ultrafast Conformational Changes in Biomolecules Studied by Time-resolved Circular Dichroism, *Francois Hache[1], Lucille Mendonça[1], Mai-Thu Khuc[1]; [1]LOB, CNRS-INSERM, France.* Structural changes in biological processes are investigated thanks to a full set of time-resolved circular dichroism experiments. Ultrarapid conformational changes in proteins and microsecond protein denaturation in polypeptides have been studied.

Madrid / Sydney — Quantum Information and Measurement

QW1A • Quantum Communication II—Continued

QW1A.4 • 09:00
The Secure Information Capacity of Photons Entangled in High Dimensions, *Eliot Bolduc[1], Jonathan Leach[1], Robert Boyd[1,2]; [1]Physics, Univ. of Ottawa, Canada; [2]Univ. of Rochester, USA.* High-dimensional entanglement is a key resource for quantum cryptography. We experimentally realise 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. Collins[1], Patrick J. Clarke[1], Vedran Dunjko[1,2], John Jeffers[3], Erika Andersson[1], Gerald S. Buller[1]; [1]School of Engineering and Physical Sciences, Heriot-Watt Univ., UK; [2]School of Informatics, Edinburgh Univ., UK; [3]Department 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 Thew[1], Clara I. Osorio[1], Natalia Bruno[1], Enrico Pomarico[1], Thiago Barbosa[1], Bruno Sanguinetti[1], Nicolas Sangouard[1], Hugo Zbinden[1], Nicolas Gisin[1]; [1]Group of Applied Physics, Univ. of Geneva, Switzerland.* We discuss several key challenges for quantum communication ranging from engineering photon sources through faithful entanglement swapping to heralded photon, or qubit, amplification and their implications for experimental device independent QKD.

QW1B • Novel Quantum Information and Measurement Techniques I—Continued

QW1B.4 • 09:00 Invited
Exploiting the Quantum Advantage, *Andrew White[1]; [1]Physics, 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 Lupo[1], Stefano Pirandola[2], Vittorio Giovannetti[3], Stefano Mancini[1,4], Samuel L. Braunstein[2]; [1]Physics Division, School of Science and Technology, Univ. of Camerino, Italy; [2]Computer Science, Univ. of York, UK; [3]Nest, Scuola Normale Superiore and Istituto Nanoscienze-CNR, Italy; [4]INFN, sezione di Perugia, 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 entaglement) for extracting information from optical memories, e.g. CDs, DVDs.

QW1B.6 • 09:45
Programmable Virtual Quantum Networks, *Seiji Armstrong[1,2], Jiri Janousek[1], Boris Hage[1], Jean-Francois Morizur[1,3], Hans Bachor[1], Ping Koy Lam[1]; [1]Quantum Science, Australian National Univ., Australia; [2]Applied Physics, The Univ. of Tokyo, Japan; [3]Laboratoire Kastler Brossel, 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.

Hong Kong — High Intensity Lasers and High Field Phenomena

HW1C • Electronic Dynamics—Continued

HW1C.3 • 09:00
Mid-infrared Photoelectron Emission and Acceleration at Metallic Nanotips, *Georg Herink[1], Daniel R. Solli[1], Max Gulde[1], Claus Ropers[1]; [1]Courant 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.

HW1C.4 • 09:15
Double Ionization Dynamics of Ethylene in a Strong Laser Field, *Xinhua Xie[1], Stefan Roither[1], Markus Schöffler[1], Daniil Kartashov[1], Li Zhang[1], Erik Lötstedt[2], Atsushi Iwasaki[2], Kaoru Yamanouchi[2], Andrius Baltuska[1], Markus Kitzler[1]; [1]Photonics Inst., Vienna Univ. of Technology, Austria; [2]Department of Chemistry, 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.

HW1C.5 • 09:30
Quantum Interference, Excitation and Multiple Orbitals in Atomic and Molecular High-harmonic Generation and Nonsequential Double Ionization, *Carla Faria[1]; [1]Physics and Astronomy, Univ. College London, UK.* We address excitation, electron-electron correlation and quantum interference beyond the single-active electron and single-active orbital approximationon in high-harmonic generation and nonsequential double ionization.

HW1C.6 • 09:45
Phase Dependence of Electron Localization in the Laser-Driven Dissociation of HeH^{2+}, *Kunlong Liu[1], Peixiang Lu[1]; [1]Wuhan National Laboratory for Optoelectronics, China.* We theoretically study the electron localization in the laser-driven dissociation of HeH^{2+}. The upward shift and suppression of the localization probability are observed. The phenomena are found to be associated with the molecular structure.

Istanbul — International Conference on Ultrafast Structural Dynamics

IW1D • Structure Probes and Methods—Continued

IW1D.4 • 09:00
Non-Adiabatic Ionization in Circularly Polarized Laser Fields, *Ingo Barth[1], Olga Smirnova[1]; [1]Max-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.

IW1D.5 • 09:15
Time-Resolved X-ray Absorption, Emission, and Scattering Probes of Molecular Dynamics, *Stephen H. Southworth[1], Anne Marie March[1], Gilles Doumy[1], Elliot P. Kanter[1], Linda Young[1], Bertold Kraessig[1], Phay J. Ho[1], Dipanwita Ray[1], Robert W. Dunford[1], Christian Buth[1]; [1]Argonne 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.

IW1D.6 • 09:30
Direct Observation of Arrival Time Jitter for RF Compressed Femtosecond Electron Bunches by Ponderomotive Scattering, *Meng Gao[1,2], Hubert Jean-Ruel[1,2], Ryan R. Cooney[1,2], Jonathan Stampe[3], Mark De Jong[3], German Sciaini[1,2], Gustavo Moriena[1,2], Dwayne Miller[1,2]; [1]Chemistry and Physics, Univ. of Toronto, Canada; [2]Max Planck Department for Structure Dynamics, DESY, Germany; [3]Canadian Light Source, Canada.* Arrival time jitter and pulse duration is measured using ponderomotive scattering for dense femtosecond electron bunches compressed by a 3GHz RF cavity. We report 65 fs RMS jitter over 2 hours.

IW1D.7 • 09:45
An Ultracold Electron Source for Ultrafast Electron Diffraction Experiments, *Wouter Engelen[1], Nicola Debernardi[1], Edgar Vredenbregt[1], Jom Luiten[1]; [1]Eindhoven Univ. of Technology, Netherlands.* We create ultrashort, 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.

10:00–10:30 Coffee Break, *Grosser Stern*

Madrid	Sydney	Hong Kong	Istanbul
Quantum Information and Measurement		High Intensity Lasers and High Field Phenomena	International Conference on Ultrafast Structural Dynamics

10:30–12:30
QW2A • Quantum Communication III
Sergei Kilin; *B. I. Stepanov Inst. of Physics of NASB, Belarus, Presider*

QW2A.1 • 10:30
Quantum Key Distribution Enhanced by Quantum Relays with Quantum Memories: Performances and Requirements, *Silvestre Abruzzo[1], Sylvia Bratzik[1], Hermann Kampermann[1], Dagmar Bruss[1]; [1]Inst. for Theoretical Physics III, Heinrich-Heine-Universitaet, Germany.* Quantum relays with quantum memories are proposed as a possible solution for increasing the distance of quantum key distribution. We consider a particular set-up which uses only linear optics and heralding devices.

QW2A.2 • 10:45
The Implementation of a Quantum Key Distribution Scheme based on the Frequency-Time Uncertainty, *Matthias Leifgen[1], Robert Elschner[2], Oliver J. Benson[1], Colja Schubert[2]; [1]Physics, AG Nano-Optics, Humboldt Universität Berlin, Germany; [2]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 uncertainety is presented, which uses mainly standard telecom components and offers strong robustness against decoherence in the transmission line.

QW2A.3 • 11:00
Influence of Atmospheric Turbulence on the Performance of a High Dimensional Quantum Key Distribution System using Spatial Mode Encoding, *Brandon Rodenburg[1], Mehul Malik[1], Malcolm O'Sullivan[1], Mohammad Mirhosseini[1], Robert Boyd[1,2]; [1]Inst. of Optics, Univ. of Rochester, USA; [2]Physics, Univ. of Ottawa, Canada.* The effects of atmospheric turbulence on a the channel capacity of a free-space quantum key distribution system with information encoded on the transverse modes of the photon are studied theoretically and experimentally.

QW2A.4 • 11:15
Polarization-Stable Long-Distance Interference of Independent Photons for Quantum Communications, *Thiago Ferreira da Silva[1,2], Douglas Vitoreti[1], Guilherme B. Xavier[3,4], Guilherme P. Temporão[1], Jean Pierre von der Weid[1]; [1]Center for Telecommunication Studies, Pontifical Catholic Univ. of Rio de Janeiro, Brazil; [2]Optical Metrology Division, National Inst. of Metrology, Quality and Technology, Brazil; [3]Departamento de Ingeniería Eléctrica, Universidad de Concepción, Chile; [4]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.

10:30–12:30
QW2B • Quantum Entanglement
Paul Kwiat; *Univ. of Illinois at Urbana-Champaign, USA, Presider*

QW2B.1 • 10:30
Bringing Entanglement to the High Temperature Limit, *Fernando Galve[1]; [1]IFISC (CSIC-UIB), 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 • 10:45
Quantum State Characterization of High-dimensionally Entangled Photons, *Jonathan Leach[1], Megan Agnew[1], Melanie McLaren[3], Stef Roux[3], Robert Boyd[1,2]; [1]Univ. of Ottawa, Canada; [2]Inst. of Optics, USA; [3]CSIR 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 • 11:00 Invited
Entangling Two Remote Rb-87 Atoms, *Harald Weinfurter[1,2], Wenjamin Rosenfeld[1,2], Julian Hofmann[1], Norbert Ortegel[1], Michael Krug[1], Lea Gerard[1], Florian Henkel[1], Markus Weber[1]; [1]Faculty of Physics, Ludwig-Maximillians Universitat, Germany; [2]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.

10:30–12:30
HW2C • Electronic Dynamics and Attosecond Physics
Amelle Zair; *Imperial College London, UK, Presider*

HW2C.1 • 10:30 Invited
When Does an Electron Exit a Tunneling Barrier?, *Nirit Dudovich[1]; [1]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 • 11:00
On the Wavelength Dependence of the Suppressed Ionization of Molecules in Strong Laser Fields, *Judith Dura[1], Alexander Grün[1], Phipil Bates[1], Stephan M. Teichmann[1], Thorsten Ergler[1], Arne Senftleben[2], Thomas Pflüger[2], Claus Dieter Schröter[2], Robert Moshammer[2], Joachim Ullrich[2], Agnieszka Jarón-Becker[3], Andreas Becker[3], Jens Biegert[1,4]; [1]Attoscience and Ultrafast Optics, ICFO - The Inst. of Photonics Sciences, Spain; [2]Max Planck Institut für Kernphysik, Germany; [3]JILA and Department of Physics, Univ. of Colorado, USA; [4]ICREA-Institucio Catalana de Recerca i Estudis Avançats, Spain.* We study ionization of molecules and atoms with same IP by intense laser field from 0.6-10 μm. A trend from ionization-suppression to non-suppression is found for many molecules as a function of wavelength.

HW2C.3 • 11:15
Multiorbital Contributions in N2 Harmonic Phase Measurements, *Roland Guichard[1]; [1]LCPMR, 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.

10:30–12:30
IW2D • X-ray Absorption
Steven Johnson; *ETH Zurich, Switzerland, Presider*

IW2D.1 • 10:30 Invited
Time-Resolved X-Ray Spectroscopies and Scattering, *Christian Bressler[1]; [1]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 • 11:00
Organometallic Chemistry in Solutions Investigated with Time-resolved X-ray Spectroscopy, *Nils Huse[1], Hana Cho[2,3], Matthew L. Strader[3], Tae Kyu Kim[2], Robert W. Schoenlein[3,4]; [1]Max Planck Research Department for Structural Dynamics, Univ. of Hamburg & Center for Free Electron Laser Science, Germany; [2]Department of Chemistry, Pusan National Univ., Republic of Korea; [3]Chemical Sciences Division, Lawrence Berkeley National Laboratory, USA; [4]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 organometallic chemistry in solution which is of importance in organic synthesis, catalysis and materials science.

IW2D.3 • 11:15
Simulations of Ground and Excited State X-ray Absorption Spectra for Molecules in Solution: The Role of the Solvent, *Thomas Penfold[1,3], Ivano Tavernelli[2], Rafael Abela[3], Ursula Rothlisberger[2], Majed Chergui[1]; [1]Laboratoire de spectroscopie ultrarapide, EPFL, Switzerland; [2]Laboratoire de chimie et biochimie computationnelles, EPFL, Switzerland; [3]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(dmp)2[4,5].

Madrid / Sydney — Quantum Information and Measurement

QW2A • Quantum Communication III—Continued

QW2A.5 • 11:30
Quantum Correction of Photon-scattering Errors, *Nitzan Akerman[1], Shlomi Kotler[1], Yinnon Glickman[1], Roee Ozeri[1]; [1]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.6 • 11:45
Revival of Silenced Echo for Optical Quantum Memories: Efficiency and Noise Level, *Matthieu Bonarota[1], Vianney Damon[1], Thierry Chanelière[1], Jean-Louis Le Gouët[1], María F. Pascual Winter[1]; [1]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.7 • 12:00
Probing a Many-particle System Using a Single Qubit, *Thomas Busch[1,2], Thomas Fogarty[1], Nicola Lo Gullo[1], John Goold[3,1], Mauro Paternostro[4]; [1]Physics Department, Univ. College Cork, Ireland; [2]Quantum Systems Unit, Okinawa Inst. of Science and Technology, Japan; [3]Clarendon Laboratory, Univ. of Oxford, UK; [4]Centre for Theoretical Atomic, Molecular and Optical Physics, Queen'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.8 • 12:15
Quantum Measurements As a Control Resource, *Alexander Pechen[1,2]; [1]Chemical Physics, Weizmann Inst. of Science, Israel; [2]Mathematical Physics, Steklov 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
Insensitivity of Entangled Photon Holes to Loss and Amplification, *James Franson[1]; [1]Physics, Univ. of Maryland, Baltimore County, USA.* Entangled photon holes are a new form of entanglement in which there is a correlation between the absence of two photons. Entangled photon holes are shown to be relatively insensitive to photon loss and amplification.

QW2B.5 • 11:45
Encoding of Higher Dimensional States in the Time-energy Degree of Freedom, *Daniel Richart[1,2]; [1]Laser Spectroscopy, Max Planck Institut Quantum Optics, Germany; [2]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 Invited
Complementarity Revisited, *Wolfgang P. Schleich[1]; [1]Institut für Quantenphysik and Center for Integrated Quantum Science and Technology (IQst), Universitat 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.

Hong Kong — High Intensity Lasers and High Field Phenomena

HW2C • Electronic Dynamics and Attosecond Physics—Continued

HW2C.4 • 11:30 Invited
Attosecond Strong-field Electron Wavepacket Interferometry, *Markus Kitzler[1], Xinhua Xie[1], Stefan Roither[1], Daniil Kartashov[1], Emil Persson[2], Diego G. Arbó[2,3], Li Zhang[1], Stefanie Gräfe[2], Markus Schöffler[1], Joachim Burgdörfer[2], Andrius Baltuska[1]; [1]Photonics Inst., Vienna Univ. of Technology, Austria; [2]Inst. for Theoretical Physics, Vienna Univ. of Technology, Austria; [3]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.

HW2C.5 • 12:00
Vectorial Phase Retrieval for Linear Characterization of Attosecond Pulses, *Oren Raz[1], Nirit Dudovich[1], Ian Walmsley[2]; [1]Complex Systems, Weizmann Inst. Of Science, Israel; [2]Physics, Oxford Univ., 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 CO_2 molecules.

HW2C.6 • 12:15
Atomic Photoionization and Stabilization with Relativistically Intense Circularly Polarized Light: Magnetic Field Effects Revisited, *Mikhail Emelin[1], Lev Smirnov[1], Mikhail Ryabikin[1]; [1]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.

Istanbul — International Conference on Ultrafast Structural Dynamics

IW2D • X-ray Absorption—Continued

IW2D.4 • 11:30
Molecular Structural Dynamics in Solution Revealed by Picosecond Time-Resolved XAFS, *Shin-ichi Adachi[1,2], Tokushi Sato[1], Shunsuke Nozawa[1]; [1]Photon Factory, High Energy Accelerator Research Organziation (KEK), Japan; [2]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

IW2D.5 • 11:45
Probing the Transition from Hydrophilic to Hydrophobic Solvation with Atomic Scale Resolution, *Christopher J. Milne[1,2], Van Thai Pham[1,6], Thomas Penfold[1,4], Renske M. van der Veen[1,7], Frederico A. Lima[1,2], Amal El Nahhas[1], Steven L. Johnson[2,8], Paul Beaud[2], Rafael Abela[2,3], Christian Bressler[1,5], Ivano Tavernelli[4], Majed Chergui[1]; [1]Laboratoire de Spectroscopie Ultrarapide, EPFL, Switzerland; [2]Swiss Light Source, PSI, Switzerland; [3]SwissFEL, PSI, Switzerland; [4]Laboratoire de Chimie Et Biochimie Computationnelles, EPFL, Switzerland; [5]FXE, European X-FEL, Germany; [6]Pacific Northwest National Laboratory, USA; [7]California Inst. of Technology, USA; [8]Inst. for Quantum Electronics, ETH Zürich, Switzerland.* We use ultrafast x-ray absorption spectroscopy to determine the solvent structure change upon laser abstraction of the electron from I-. The transition from hydrophilic to hydrophobic occurs over 4 ps during which a transient I-OH2 species is formed.

IW2D.6 • 12:00
X-ray Absorption Studies of the Photo-induced Structural Changes of Myoglobin in Physiological, *Frederico A. Lima[1], Christopher J. Milne[1], Mercedes Hannelore Rittmann-Frank[1], Renske M. van der Veen[1], Marco Reinhard[1], Thomas Penfold[1,2], Maurizio Benfatto[3], Majed Chergui[1]; [1]Laboratory of Ultrafast Spectroscopy, Ecole Polytechnique Fédérale de Lausanne, Switzerland; [2]Laboratoire de Chimie et Biochimie Computationnelles, Ecole Polytechnique Fédérale de Lausanne, Switzerland; [3]Laboratori Nazionali di Frascati, Istituto Nazionale di Fisica Nucleare, Italy.* We report the photo-induced structural changes of MbNO using ultrafast x-ray absorption spectroscopy. The NO recombination occurs in 216 ± 24 ps. The structural analysis indicates an intermediate structure where the NO is not completely de-ligated.

IW2D.7 • 12:15
Structural Dynamics Studies on Photoinduced Interfacial Electron Transfer using Ultrafast X-ray Spectroscopy, *Xiaoyi Zhang[1], Grigory Smolentse[2], Sophie Canton[2], Jianchang Guo[3], Villy Sundstrom[2], Lin Chen[3,4], Klaus Attenkofer[1], Guy Jennings[1], Charles Kurtz[1]; [1]X-ray Science Division, Argonne National Laboratory, USA; [2]Department of Chemical Physics, Lund Univ., Sweden; [3]Chemical Sciences and Engineering Division, Argonne National Laboratory, USA; [4]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.

12:30–14:00 Exhibit Hall / Lunch, *Hall 13*

Madrid

Quantum Information and Measurement

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

QW3A.1 • 14:00 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.

Ian Walmsley is the Hooke Professor of Experimental Physics at the University of Oxford, where is also the Pro-Vice-Chancellor for Research. His group's research covers a broad range of optical science and engineering, especially in the areas of ultrafast, nonlinear and quantum optics, both from a fundamental perspective, and with a view to applications in quantum technologies. He is a Fellow of the Optical Society of America (OSA), the American Physical Society (APS) and the Institute of Physics (IoP), and a recipient of the APS Keithley Award and the IoP Young Medal. He is a former Director of the OSA and currently on the Board of Reviewing Editors of Science Magazine.

QW3A.2 • 14:45

Maximizing the Dimensionality of Orbital Angular Momentum Entanglement in Parametric Down-conversion, *Jacqui Romero[1,2], Daniele Giovannini[1], Filippo M. Miatto[2], Stephen M. Barnett[2], Miles J. Padgett[1]; [1]School of Physics and Astronomy, Univ. of Glasgow, UK; [2]Department of Physics, Univ. of Strathclyde, UK.* Parametric down-conversion is a source of high-dimensional states entangled in orbital angular momentum (OAM). We analyze and maximize the number of OAM modes produced by down-conversion and detected by our measurement apparatus.

Sydney

14:45–16:00
QW3B • Quantum State Engineering I
Paolo Villoresi; *Univ. of Padova, Italy, Presider*

QW3B.1 • 14:45 Invited

Single-Qubit Laser: Generation of Nonlinear Coherent States, *Sergei Y. Kilin[1], Alexander B. Mikhalychev[1]; [1]B. I. Stepanov Inst. of Physics of NASB, Belarus.* 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.

Hong Kong

High Intensity Lasers and High Field Phenomena

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

HW3C.1 • 14:00 Invited

Collimated-Beam Third- and Fifth-Harmonic Generation by Mid-Infrared Ultrashort Pulses, *Aleksei Zheltikov[1,2], Alexander A. Voronin[1], Daniil Kartashov[3], Skirmantas Alisauškas[3], Audrius Pugzlys[3], Andrius Baltuška[3]; [1]Moscow State Univ., Russian Federation; [2]Texas A&M Univ., USA; [3]Vienna Univ. of Technology, Austria.* Third- and fifth-harmonic generation by 80-fs pulses of 3.9-um radiation enables efficient multiplex frequency conversion of ultrashort mid-IR pulses and metrology of high-order nonlinear susceptibilities.

HW3C.2 • 14:30

Free-Space Nitrogen Laser from a Mid-Infrared Filament, *Daniil Kartashov[1], Skirmantas Ališauskas[1], Audrius Pugzlys[1], Andrius Baltuška[1], Mikhail Shneider[2], Aleksei Zheltikov[3,4]; [1]Vienna Univ. of Technology, Photonic Inst.s, Austria; [2]Department of Mechanical and Aerospace Engineering, Princeton Univ., USA; [3]Physics Department M.V. Lomonosov Moscow State Univ., International Laser Center, Russian Federation; [4]Department of Physics and Astronomy, Texas 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 microjouls are generated.

HW3C.3 • 14:45

Phase-stable Sub-single-cycle Mid-infrared Pulses Generated Through Filamentation, *Takao Fuji[1], Yutaka Nomura[1], Hideto Shirai[2], Noriaki Tsurumachi[2], Alexander A. Voronin[3], Aleksei Zheltikov[3,4]; [1]Inst. for Molecular Science, Japan; [2]Kagawa Univ., Japan; [3]Moscow State Univ., Russian Federation; [4]Texas A&M Univ., USA.* 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 with frequency-resolved cross-correlation optical gating.

Istanbul

International Conference on Ultrafast Structural Dynamics

14:00–16:00
IW3D • 2D-IR
Peter Hamm; *Univ. of Zurich, Switzerland, Presider*

IW3D.1 • 14:00 Tutorial

Watching Time-evolving Molecular Structures with 2D IR Spectroscopy, *Andrei Tokmakoff[1]; [1]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 biophysical dynamics, including experimental methods and modeling of the data.

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 ultrafast two-dimensional infrared spectroscopy, including descriptions of water hydrogen-bonding dynamics and 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.

IW3D.2 • 14:45

Excitonic Effects in the 2DIR Spectra of Liquid Formamide, *Alexander Paarmann[1,2], Manuela Lima[3], Riccardo Chelli[3,4], Roberto Rhigini[3,4], Dwayne Miller[1,5]; [1]Physics and Chemistry, Univ. of Toronto, Canada; [2]Physical Chemistry, Fritz-Haber-Inst., Germany; [3]European Laboratory for Non-Linear Spectroscopy, Italy; [4]Chemistry, Universita di Firenze, Italy; [5]Max Planck Group for Atomically Resolved Dynamics, Centre for Free Electron Laser Science, Univ. of Hamburg, Germany.* The linear and 2DIR responses of the amide I vibration in liquid formamide are investigated experimentally and theoretically, focusing the interplay of the structural dynamics and the excitonic nature of the amide I modes.

Quantum Information and Measurement

QW3A • Quantum Information and Measurement with Photons II—Continued

QW3A.3 • 15:00
Dispersion-based Control of Spatial Modes for Parametric Down-conversion in a Multimode Waveguide, *Michal Karpinski[1], Czeslaw Radzewicz[1], Konrad Banaszek[1]; [1]Faculty 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 of beam quality factors.

QW3A.4 • 15:15
Waveguide Single Photon Detectors for Integrated Quantum Photonic Applications, *Dondu Sahin[1], A. Gaggero[2], J. p. Sprengers[1], S. Jahanmirinejad[1], G. Frucci[1], F. Mattioli[2], R. Leoni[2], J. Beetz[3], M. Lermer[3], M. Kamp[3], S. Höfling[3], R. Sanjines[4], A. Fiore[1]; [1]COBRA Research Inst., Eindhoven Univ. of Technology, Netherlands; [2]Istituto di Fotonica e Nanotecnologie, CNR, Italy; [3]Technische Physik and Wilhelm Conrad Röntgen Research Center for Complex Material Systems, Universität Würzburg, Germany; [4]Ecole Polytechnique Fédérale de Lausanne, Switzerland.* We demonstrate waveguide single-photon detectors based on NbN nanowires on top of GaAs/AlGaAs ridge waveguides. High quantum efficiencies of ~20% at 1300 nm with a response time of 3.6ns and timing jitter of ~60ps are reported.

QW3A.5 • 15:30
Playing the Aharon-Vaidman Quantum Game with a Young Type Photonic Gutrit, *Piotr Kolenderski[1,2], Urbasi Sinha[1], Li Youning[3], Tong Zhao[1], Matthew Volpini[1], Adan Cabello[4,5], Raymond Laflamme[1], Thomas Jennewein[1]; [1]Inst. for Quantum Computing, Univ. of Waterloo, Canada; [2]Inst. of Physics, Nicolaus Copernicus Univ., Poland; [3]Department of Physics, Tsinghua Univ., China; [4]Departamento de Fisica Aplicada II, Universidad de Sevilla, Spain; [5]Department of Physics, Stockholm Univ., Sweden.* The Aharon-Vaidman game exemplifies the advantage of using quantum systems to outperform classical strategies. We present an experimental test of this advantage by using a qutrit encoded in a single photon passing through three slits.

QW3A.6 • 15:45
Hybrid Radial-Angular Quantum Correlations of Spatially Entangled Photons, *Wolfgang Löffler[1], Vsevolod D. Salakhutdinov[1], Eric R. Eliel[1]; [1]Leiden Inst. of Physics, Leiden Univ., Netherlands.* We report the successful experimental exploration of the full transverse-mode space of spatially entangled photons, azimuthal and radial; and investigate theoretically and experimentally the relation to the Schmidt eigenmodes of the twin photons.

QW3B • Quantum State Engineering I—Continued

QW3B.2 • 15:15
Experimental Study of the Decoherence of Biphoton Qutrits, *Assaf Shaham[1], Hagai Eisenberg[1]; [1]Racah 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. Stace[1]; [1]Physics, 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 Born's Rule, *Alcenisio Jesus-Silva[1], Eduardo Fonseca[1], Jandir Hickmann[1]; [1]Optics and Materials Group, Brazil.* We use photon's 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 Born's rule.

High Intensity Lasers and High Field Phenomena

HW3C • NL and Extreme NL Optics—Continued

HW3C.4 • 15:00
Filamentation of Few-Cycle Mid-Infrared Pulses in Gases, *Daniil Kartashov[1], Skirmantas Ališauskas[1], Andrius Baltuška[1], Alexander A. Voronin[2], Aleksei Zheltikov[2,3], Massimo Petrarca[4], Pierre Bejot[4], Jerome Kasparian[4], Audrius Pugzlys[1]; [1]Vienna Univ. of Technology, Photonic Inst., Austria; [2]Physics Department M.V. Lomonosov Moscow State Univ., International Laser Center, Russian Federation; [3]Department of Physics and Astronomy, Texas A&M Univ., USA; [4]Université 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 a 350nm-5.5mcm spectral continuum in argon are demonstrated.

HW3C.5 • 15:15 Invited
Carrier-envelope Phase Double Stabilization Setup with sub-10 Attosecond Timing Jitter, *Bastian Borchers[1], Sebastian Koke[1], Gunter Steinmeyer[1]; [1]Max 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.

HW3C.6 • 15:45
Theoretical Explanation of the Soliton Self-frequency Blueshift in Gas-filled Hollow Core Photonic Crystal Fibres, *Fabio Biancalana[1], Mohammed F. Saleh[1], Philipp Hoelzer[1], Wonkeun Chang[1], John C. Travers[1], Nicolas Y. Joly[1], Philip Russell[1]; [1]NPN, Max Planck Inst. for the Science of Light, Germany.* By using a new theoretical framework based on equations for the electric field envelope, we provide a complete theoretical explanation of the plasma-induced soliton blueshift, recently observed experimentally in a gas-filled hollow-core PCF.

International Conference on Ultrafast Structural Dynamics

IW3D • 2D-IR—Continued

IW3D.3 • 15:00
Two-dimensional Femtosecond Infrared Spectroscopy of Hydrogen-bonded Wires, *Stephan Knop[1], Martin Olschewski[1], Peter Vöhringer[1]; [1]Inst. for Physical and Theoretical Chemistry, Univ. of Bonn, Germany.* 2DIR reveals frequency-dependent OH-stretching lifetimes and line broadening parameters of synthetic hydrogen-bond wires thereby reflecing uniquely conformational disorder of the supporting scaffold and the resulting wire flexibility.

IW3D.4 • 15:15
Dynamics of N-H Stretching Excitations of Guanosine-Cytidine Base Pairs in Solution, *Henk Fidder[1], Ming Yang[1], Lukasz Szyc[1], Katharina Röttger[2], Erik Nibbering[1], Thomas Elsaesser[1], Friedrich Temps[2]; [1]Max Born Institut, Germany; [2]Institut 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

IW3D.5 • 15:30
2D IR Spectroscopy of Ice Ih, *Fivos Perakis[1], Peter Hamm[1]; [1]Inst. of Physical Chemistry, Univ. of Zurich, Switzerland.* We present experimental 2D IR spectra of the OH stretch of ice Ih, for both the isotope dilute (5% HOD in D2O) and neat (100% H2O) cases, complemented by simulations using the Lippincott-Schroeder model.

IW3D.6 • 15:45
Surface Enhanced 2D-IR Spectroscopy of Gold Nanoparticle Capping Layers, *Paul M. Donaldson[1], Peter Hamm[1]; [1]Physikalisch-Chemisches Institut, Univ. of Zurich, Switzerland.* 2D-IR spectroscopy is used to quantify gold nanoparticle IR surface enhancement. Changes in 2D lineshapes and the appearance of surface group cross peaks demonstrate that 2D-IR offers a unique sensitivity to nanoparticle cappant structure/dynamics.

16:00–16:30 Coffee Break, *Grosser Stern*

Madrid / Sydney — Quantum Information and Measurement

16:30–18:00
QW4A • Novel Quantum Information and Measurement Techniques II
Paul Lett; *NIST, USA, Presider*

QW4A.1 • 16:30
Open Quantum Walks as a Tool for Dissipative Quantum Computing, *Francesco Petruccione[1], Ilya Sinayskiy[1]; [1]UKZN, 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.

QW4A.2 • 16:45
The Quantum Zeno Paradox: A Matter of Information, *Peter E. Toschek[1]; [1]Inst. 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.

QW4A.3 • 17:00
Heisenberg-limited Metrology without Entanglement, *Daniel Braun[1], John Martin[2]; [1]Univ. Toulouse Paul Sabatier, France; [2]Institut de Physique Nucléaire, Atomique et de Spectroscopie, Université de Liège, Belgium.* We show that making N systems interact with a $N+1$st enables Heisenberg limited sensitivity without entanglement, and robust under decoherence. An application is the measurement of the length of an optical cavity.

QW4A.4 • 17:15
N-photon Autocorrelator with Picosecond Temporal Resolution, *Zili Zhou[1], G. Frucci[1], Saeedeh Jahanmirinejad[1], F. Mattioli[2], A. Gaggero[2], R. Leoni[2], A. Fiore[1]; [1]COBRA Research Inst., Eindhoven Univ. of Technology, Netherlands; [2]Istituto di Fotonica e Nanotecnologie (IFN), CNR, via Cineto Romano 42, 00156 Rome, Italy.* We demonstrate an ultrafast autocorrelator with single-photon sensitivity based on superconducting nanodetectors. Its temporal resolution is only limited by the hotspot relaxation time which has been directly measured to be ~ 20 ps.

16:30–18:00
QW4B • Quantum State Engineering II
Alexander Sergienko; *Boston Univ., USA, Presider*

QW4B.1 • 16:30
Direct Measurements of the Non-classicality Degree in Photon-number Correlations, *Liat Dovrat[1], Michael Bakstein[1], Assaf Shaham[1], Eli Megidish[1], Assaf Halevy[1], Lior Cohen[1], Daniel Istrati[1], Hagai Eisenberg[1]; [1]Racah Inst. of Physics, Hebrew Univ., Israel.* We measure the two-mode photon-number distribution of parametric down-conversion for different degrees of correlation. The singular value decomposition of the joint probability matrix is shown to indicate the degree of non-classicality.

QW4B.2 • 16:45
Generation and Characterization of Multimode Quantum Frequency Combs, *Renné Medeiros de Araújo[1], Olivier Pinel[1], Pu Jian[1], Jinxia Feng[2], Benoît Chalopin[1,3], Claude Fabre[1], Nicolas Treps[1]; [1]Laboratoire Kastler Brossel, France; [2]State Key Laboratory of Quantum Optics and Quantum Optics devices, China; [3]Max Planck Inst. for the Science of Light, Germany.* We present the first experimental generation of a femtosecond quantum frequency comb using a synchronously pumped OPO, showing that it behaves as an assembly of independent squeezers in agreement with theoretical predictions.

QW4B.3 • 17:00
Demonstrating the Quantum Nature of Light with a Single Detector, *Gesine Steudle[1], Stefan Schietinger[1], David Höckel[1], Sander N. Dorenbos[2], Valery Zwiller[2], Oliver J. Benson[1]; [1]AG Nanooptik, HU Berlin, Germany; [2]Kavli Inst. of Nanoscience, Delft Univ. of Technology, Netherlands.* Utilizing a superconducting detector with a very short dead time, we performed the most fundamental experiment to demonstrate the quantum nature of light consisting only of a quantum emitter and a single detector.

QW4B.4 • 17:15
Fabrication of Optical Nanofiber Cavity Using Focused Ion Beam Milling, *Kali P. Nayak[1], Yuto Kawai[1], Fam L. Kien[1], Kiyomi Nakajima[2], Hideki T. Miyazaki[2], Yoshimasa Sugimoto[2], Kohzo Hakuta[1]; [1]Center for Photonic Innovations, Univ. of Electro-Communications, Japan; [2]Nanotechnology Innovation Center, National Inst. for Material Science, Japan.* We discuss the characteristics of optical nanofiber cavity fabricated using focused ion beam milling technique. Due to strong confinement of the field in such a nanofiber cavity, it can become a promising workbench for cavity-QED.

Hong Kong — High Intensity Lasers and High Field Phenomena

16:30–18:45
HW4C • Atomic and Molecular Physics
Joachim Ullrich; *Max-Planck-Institut fur Kernphysik, Germany, Presider*

HW4C.1 • 16:30 Invited
FEL Induced Molecular Dynamics: Time-Resolved and in 3D, *Robert Moshammer[1], Yuhai Jiang[1], Artem Rudenko[2], Arne Senftleben[1], Kirsten Schnorr[1], Lutz Foucar[2], Moritz Kurka[1], Kai-Uwe Kühnel[1], Matthias Kling[3], Stefan Düsterer[4], Rolf Treusch[4], Claus Dieter Schröter[1], Joachim Ullrich[1,2]; [1]Max-Planck Institut für Kernphysik, Germany; [2]Max-Planck Advanced Study Group at CFEL, Germany; [3]Max-Planck Institut für Quantenoptik, Germany; [4]DESY, Germany.* A setup for XUV-XUV pump-probe experiments with atoms and molecules using femtosecond FEL radiation will be presented along with first time-resolved results on the XUV induced fragmentation dynamics of small molecules.

HW4C.2 • 17:00 Invited
Towards Complete Space-time Reconstruction of Attosecond Pulses, Eugene Frumker, *JASLab - Joint Laboratory of Attosecond Science of Ottawa and NRC, Canada*. We introduce new approach for complete space-time reconstruction of the attosecond pulses. Measured spectrally resolved wavefront across one plane and knowledge of temporal profile at one point in space enables complete space-time characterization of the pulse.

Istanbul — International Conference on Ultrafast Structural Dynamics

16:30–18:00
IW4D • Phonon & Vibrational Probes
Martin Garcia; *Univ. Kassel, Germany, Presider*

IW4D.1 • 16:30
Ultrafast changes in lattice symmetry probed by coherent phonons at the onset of the photo-induced phase transition in VO2, *Simon Wall[1], Daniel Wegkamp[1], Laura Foglia[1], Kannatassen Appavoo[2], Joyeeta Nag[2], Richard Haglund[2], Julia Stähler[1], Martin Wolf[1]; [1]Physical Chemistry, Fritz Haber Inst., Germany; [2]Physics and Astronomy, Vanderbilt Univ., USA.* We show that the coherent phonon spectrum, probed by whitelight spectroscopy[1], can be a marker for photoinduced structural transitions. In VO2, the lattice potential symmetry is completely changed on ultrafast timescales before ionic motion occurs.

IW4D.2 • 16:45
Ultrafast structural change in single-walled carbon nanotubes using a few-cycle pulse laser, *Takayoshi Kobayashi[1], Zhaogang Nie[1], Juan Du[1], Hiromichi Kataura[2], Youichi Sakakibara Sakakibara[2], Yasumitsu Miyata[3]; [1]Univ. of Electro-Communications, Japan; [2]National Inst. of Advanced Industrial Science and Technology, Japan; [3]Nagoya Univ., Japan.* Coherent phonon dynamics in single-walled carbon nanotubes is studied by ultrafast spectroscopy using 7.1-fs laser pulses. Vibrational wave-packets motion due to the radial breathing, and the related coherent phonon generation is in-depth studied.

IW4D.3 • 17:00
Scattering of electrons with acoustic phonons in single-walled carbon nanotubes, *Olga A. Dyatlova[1], Christopher Koehler[2], Ermin Malic[2], Jordi Gomis-Bresco[1], Janina Maultzsch[3], Andrey Tsagan-Mandzhiev[1], Tobias Watermann[2], Andreas Knorr[2], Ulrike Woggon[1]; [1]Inst. for Optics and Atomic Physics, Technical Univ. of Berlin, Germany; [2]Inst. for Theoretical Physics, Technical Univ. of Berlin, Germany; [3]Inst. for Solid State Physics, Technical Univ. of Berlin, Germany.* We perform two color pump-probe experiments on nanotubes (8,7);(10,2);(11,3);(12,1). The dynamics were analyzed for three decay constants. A density-matrix formalism reveals that the fastest component is caused by intraband carrier-phonon scattering.

IW4D.4 • 17:15
Laser-induced Thermal Phonon Squeezing
Eeuwe S. Zijlstra[1]; [1]Fachbereich 10, Theoretical Physics, Germany. On the basis ab initio molecular dynamics simulations we infer that thermal phonon squeezing - an ultrafast phenomenon that has not been reported before - precurses ultrafast melting of solids as a function of fluence.

Quantum Information and Measurement

QW4A • Novel Quantum Information and Measurement Techniques II—Continued

QW4A.5 • 17:30
Ancilla-based Quantum Simulation, *Katherine L. Brown[1], Suvabrata De[1], Viv Kendon[1], William J. Munro[2,3]; [1]School of Physics and Astronomy, Univ. of Leeds, UK; [2]National Inst. of Informatics, Japan; [3]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.

QW4A.6 • 17:45
Optimal Measurement for the Discrimination of Quantum States with a Fixed Rate of Inconclusive Outcomes, *Janos A. Bergou[1], Ramon Munoz-Tapia[2], Emilio Bagan[1,2], Georgina A. Olivares Renteria[1]; [1]Physics and Astronomy, CUNY Hunter College, USA; [2]Fisica Teorica: Informacio i Fenomens Quantics, Universitat Autonoma de Barcelona, Spain.* We present the optimal measurement for discriminating among quantum states when a certain fixed rate of inconclusive measurement results is allowed and give analytical results for the maximal success probability for special cases.

QW4B • Quantum State Engineering II—Continued

QW4B.5 • 17:30
Superradiance from Entangled Atoms, *Ralph Wiegner[1], Joachim von Zanthier[1,2], Girish Agarwal[3]; [1]Inst. for Optics, Information and Photonics, Univ. Erlangen-Nuremberg, Germany; [2]Erlangen Graduate School in Advanced Optical Technologies (SAOT), Univ. Erlangen-Nuremberg, Germany; [3]Department 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 superradiance and subradiance of entangled sources in terms of interference among different photon quantum path ways.

QW4B.6 • 17:45
Optimal Minimum-cost Quantum Measurements for Imperfect Detection, *Erika Andersson[1]; [1]Physics, Heriot-Watt Univ., UK.* Quantum measurements, useful in quantum information and metrology, are mostly optimized for ideal realisation. Real devices are however imperfect. We give optimal minimum-cost and minimum-error measurements for a general model of imperfect detection.

High Intensity Lasers and High Field Phenomena

HW4C • Atomic and Molecular Physics—Continued

HW4C.3 • 17:30
Nanostructure-enhanced Atomic Line Emission from Noble Gases driven by Low-Energy, Few-Cycle Laser Pulses, *Murat Sivis[1], Matthias Duwe[1], Yaxing Liu[2], Katrin Siefermann[2,3], Bernd Abel[2,4], Claus Ropers[1]; [1]Courant Research Center, Univ. of Goettingen, Germany; [2]Department of Physical Chemistry I, Univ. of Goettingen, Germany; [3]College of Chemistry, Univ. of California, Berkeley, USA; [4]Faculty for Chemistry and Mineralogy, Univ. of Leipzig, Germany.* We present extreme ultraviolet emission from noble gases driven by low-energy, few-cycle light pulses enhanced in plasmonic nanostructures. The origin of the emission is atomic fluorescence, and we find no sign of high harmonic radiation.

HW4C.4 • 17:45
Complete Fragmentation of Hydrocarbon Molecules Probed by Few-cycle Laser Pulses, *Stefan Roither[1], Xinhua Xie[1], Daniil Kartashov[1], Li Zhang[1], Markus Schöffler[1,2], Huailiang Xu[3,4], Atsushi Iwasaki[4], Tomoya Okino[4], Kaoru Yamanouchi[4], Andrius Baltuska[1], Markus Kitzler[1]; [1]Photonics Inst., Vienna Univ. of Technology, Austria; [2]Institut für Kernphysik, Goethe- Univ., Germany; [3]Center for Ultrafast Optoelectronic Technologies, Jilin Univ., China; [4]Department of Chemistry, School of Science, The Univ. of Tokyo, Japan.* Multiparticle coincidence imaging reveals laser-driven ejection of energetic protons via concerted Coulomb explosions from unexpectedly high molecular charge states. The underlying mechanism is studied with laser pulses from 4.5 to 27 fs in duration.

HW4C.5 • 18:00
Measurement of Electronic Structure in Molecular High Harmonic Generation, *Michael C. Wong[1], Jean-Paul Brichta[1], Abdullah H. Alharbi[1], Andrey E. Boguslavskiy[1], Ravi Bhardwaj[1]; [1]Department of Physics, Univ. of Ottawa, Canada.* We report detailed measurements of high-order harmonic generation in a series of complex, unaligned, polyatomic molecules and show that fingerprints of electronic structure are embedded in harmonic spectra.

HW4C.6 • 18:15
Quantum Control of Photodissociation Using Shaped Ultrafast Pulses, *Uri Lev[1], Leigh Graham[2,1], Barry D. Bruner[3], Adi Natan[3], Vaibhav S. Prabhudesai[4], Oded Heber[1], Dirk Schwalm[5,1], Yaron Silberberg[3], Daniel Zajfman[1]; [1]Department of Particle Physics and Astrophysics, Weizmann Inst. of Science, Israel; [2]Centre for Plasma Physics, School of Mathematics and Physics, Queens Univ. Belfast, UK; [3]Department of Physics of Complex Systems, Weizmann Inst. of Science, Israel; [4]Tata Inst. of Fundamental Research, India; [5]Max-Planck-Institut fuer Kernphysik, Germany.* We demonstrate the ability to control dissociation rates of H2+ molecules from targeted vibrational levels using strong (4 × 1013 W/cm2) laser fields and simple analytically designed ultrafast pulse shapes.

HW4C.7 ▶

International Conference on Ultrafast Structural Dynamics

IW4D • Phonon & Vibrational Probes—Continued

IW4D.5 • 17:30
Conditions for Generating Squeezed Phonon States in an Optically Excited Quantum Dot, *Daniel Wigger[1], Doris E. Reiter[1], Vollrath Martin Axt[2], Tilmann Kuhn[1]; [1]Institut für Festkörpertheorie, Universität Münster, Germany; [2]Institut 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.

IW4D.6 • 17:45
Structure, Ultrafast Dynamics and Functionality of Nitrosylated Corynebacterium Glutamicum Catalase, *Neil T. Hunt[1], Katrin Adamczyk[1], Candelaresi Marco[1], Michael Towrie[3], Gregory M. Greetham[3], Anthony W. Parker[3], Martin A. Walsh[2], Paul A. Hoskisson[4], Nicholas P. Tucker[4]; [1]Physics, Univ. of Strathclyde, UK; [2]Diamond Light Source, UK; [3]STFC Rutherford Appleton Laboratory, UK; [4]SIPBS, Univ. of Strathclyde, UK.* The structure and ultrafast dynamics of a catalase 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.

HW4C.7 • 18:30
Attosecond Control of Laser Driven Plasmas, *Rodrigo Lopez-Martens[1], Antonin Borot[1], Arnaud Malvache[1], Xiaowei Chen[1], Aurélie Jullien[1], Aurélien Ricci[1], Patrick Audebert[2], Jean-Paul Geindre[2], Gérard Mourou[3], Fabien Quere[4]; [1]Laboratoire d'Optique Appliquée, ENSTA - Ecole Polytechnique - CNRS, France; [2]Laboratoire pour l'Utilisation des Lasers Intenses, CNRS - Ecole Polytechnique, France; [3]Institut de La Lumière Extrême, ENSTA - Ecole Polytechnique - CNRS, France; [4]Service des Photons, Atomes et Molécules, CEA - DSM/DRECAM, France.* We demonstrate for the first time attosecond time scale control of collective electron motion in overdense plasmas driven by intense waveform-controlled few-cycle laser pulses.

Key to Authors and Presiders

(**Bold** denotes Presider or Presenting Author)

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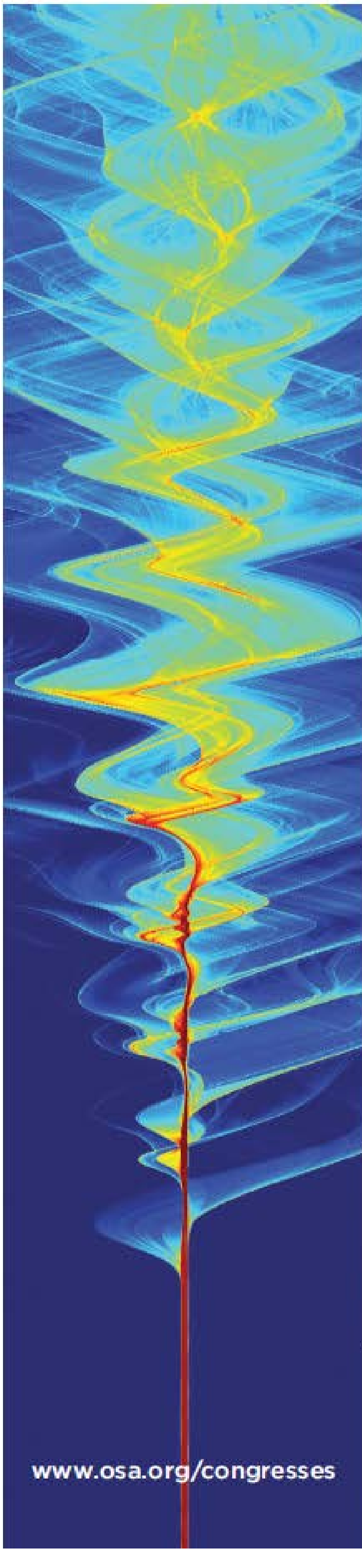

POSTDEADLINE PAPERS

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

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OSA

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. Raz[1], O. Pedatzur[1], N. Dudovich[1], B.D. Bruner[1]; [1]Weizmann 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. Oppermann[1], S. Weber[1], L. Frasinski[1], J.P. Marangos[1]; [1]Imperial 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. Barth[1], O. Smirnova[1]; [1]Max-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. Ruf[1], C. Handschin[1], S. Petit[1], D. Descamps[1], E. Mével[1], E. Constant[1], B. Fabre[1], Y. Mairesse[1], R. Cireasa[2], N. Thiré[2], V. Blanchet[2]; [1]CELIA : Université Bordeaux , France; [2]LCAR: 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 Chalus[1,2]; [1]Max-Born-Institut, Germany; [2]National 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. Halevy[1], E. Megidish[1], L. Dovrat[1], H. Eisenberg[1], P. Becker[2], L. Bohaty[2]; [1]Racah Inst. of Physics, The Hebrew Univ. of Jerusalem, Israel; [2]Instit. 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. Kang[1], B. Kim[1], Y. Park[1]*; [1]*GIST, 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. Zavatta[1], C. Polycarpou[1], M. Bellini[1], A. Zavatta[2], C. Polycarpou[2], G. Venturi[2], M. Bellini[2], K.N. Cassemiro[3], K.N. Cassemiro[4]; [1]Istituto Nazionale di Ottica (INO-CNR), Italy; [2]Università di Firenze, Italy; [3]Universidade Federal de Pernambuco, Brazil; [4]Max Planck Instit. 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. Zielinska[1], F.A. Beduini[1], M. Mitchell[1], N. Godbout[2], M. Mitchell[3]; [1]ICFO - Institut de Ciencies Fotoniques, Spain; [2]École Polytechnique de Montréal, Canada; [3]ICREA, 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. Kaiser[1], L. Ngah[1], A. Issautier[1], O. Alibart[1], A. Martin[1], T. Sébastien[1], [1]Univ. 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[1], Y. Shaked[1], A. Pe'er[1], [1]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[1], [1]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[1], P.M. Ledingham[1], A. Almasi[1], M. Cristiani[1], H. de Riedmatten[1], H. de Riedmatten[2]; [1]ICFO-Institut de Ciencies Fotoniques, Spain; [2]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[1], A. Halevy[1], T. Shacham[1], T. Dvir[1], L. Dovrat[1], H. Eisenberg[1]; [1]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.

Research in Optical Sciences: OSA Optics and Photonics Congress Update Sheet 2012

Postdeadline Sessions

HILAS Postdeadline Session
Tuesday, 20 March 2012
19:00-20:30
Hong Kong

QIM Postdeadline Session
Tuesday, 20 March 2012
18:45-21:00
Madrid

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 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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