

# Optica Quantum 2.0 Conference and Exhibition

**Disclaimer:** this guide is limited to technical program with abstracts and author blocks as of 02 June. For updated and complete information with special events, reference the online schedule or mobile app

## Monday, 15 June

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**09:00 -- 10:00**

**Room: Lomond Auditorium**

**QM1A • Keynote Session I**

*Presider: To Be Announced*

**QM1A.1 • 09:00 (Plenary)**

**Diamond-Based Quantum Networks: From Metropolitan-Scale Demonstrations to a Quantum Internet**, Ronald Hanson<sup>1</sup>; <sup>1</sup>*QuTech, Netherlands*. This talk will present our ongoing work and future prospects on diamond-based quantum networks. I will first discuss the state of the art, including metropolitan-scale entanglement distribution between qubit chips over deployed fiber and a rudimentary network operating system. I will then discuss the exciting new prospects for scaling these technologies using a novel qubit platform and integrated photonics and show the latest results in this direction.

**10:30 -- 12:30**

**Room: Alsh 1**

**QM2A • Quantum Transduction and Switching**

*Presider: Abram Falk; International Business Machines Corp, USA*

**QM2A.1 • 10:30**

**Electro-Optic Conversion of Itinerant Fock States**, Andrei Militaru<sup>2</sup>, Thormas Werner<sup>2</sup>, Erfan Riyazi<sup>2</sup>, Samarth Hawaldar<sup>2</sup>, Rishabh Sahu<sup>2</sup>, Georg Arnold<sup>2</sup>, Paul Falthansl-Scheinecker<sup>2</sup>, Jennifer Sanchez-Naranjo<sup>2</sup>, Dante Loi<sup>2</sup>, Lucky Kapoor<sup>2</sup>, Martin Zemlicka<sup>2</sup>, Liu Qiu<sup>1,2</sup>, Johannes Fink<sup>2</sup>; <sup>1</sup>*Zhejiang Univ., China*; <sup>2</sup>*Inst. of Science and Technology Austria, Austria*. Superconducting qubits face scaling challenges due to millikelvin temperature requirements. Here we demonstrate the generation and low-noise upconversion of single microwave photons to telecom frequencies, paving the way for quantum networks with superconducting qubits.

**QM2A.2 • 10:45**

**Broadband Spectral Manipulation of Single Photons Using Cross-Phase Modulation**, Kate L. Fenwick<sup>2</sup>, Frédéric Bouchard<sup>2</sup>, Guillaume Thekkadath<sup>2</sup>, Philip Bustard<sup>2</sup>, Duncan England<sup>2</sup>, Benjamin Sussman<sup>2,1</sup>; <sup>1</sup>*Univ. of Ottawa, Canada*; <sup>2</sup>*National Research Council Canada, Canada*. Using cross-phase modulation in single-mode fiber, we deterministically shift and reshape telecom single-photon spectra. We achieve terahertz frequency shifts and bandwidth control, enabling scalable spectral manipulation for ultrafast quantum networking and computing.

**QM2A.3 • 11:00**

**Frequency Conversion With Bandwidth Expansion for Quantum Networks**, Francesca Sansavini<sup>1</sup>, Clark Embleton<sup>1</sup>, Michael G. Raymer<sup>1</sup>, Brian J. Smith<sup>1</sup>; <sup>1</sup>*Department of Physics, Oregon Center for Optical, Molecular, and Quantum Science, Univ. of Oregon, USA*. We propose a quantum interface based on bandwidth expansion via difference-frequency generation between narrowband memory photons and broadband telecom photons, whose

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## QM2A.4 • 11:15

**Single-Photon Frequency Combs From Cascaded Frequency Conversion of Quantum dot Luminescence in Photonic Crystal Fibre**, Alex O. Davis<sup>1</sup>, Alfie Broughton<sup>2</sup>, Harry Dyte<sup>2</sup>, Petros Androvitsaneas<sup>1,2</sup>, Michael Woodley<sup>1</sup>, Leah Murphy<sup>1</sup>, Mateusz J. Olszewski<sup>1</sup>, Anthony Bennett<sup>2</sup>; <sup>1</sup>*Univ. of Bath, UK*; <sup>2</sup>*Cardiff Univ., UK*. We show coherent nanometer-scale frequency conversion of single photons from an InAs quantum dot by four-wave mixing in microstructured fibre with >89% efficiency. The process can be cascaded, generating a coherent single-photon frequency comb.

## QM2A.5 • 11:30

**Integrated Triply Resonant Transducer With Fabrication-Tolerant Frequency Matching**, Charles Möhl<sup>1</sup>, Giovanni Finco<sup>3</sup>, Constantin Wehrbach<sup>1</sup>, Daniele Caimi<sup>1</sup>, Thomas Karg<sup>1</sup>, David Indolese<sup>1</sup>, Rachel Grange<sup>2</sup>, Paul Seidler<sup>1</sup>; <sup>1</sup>*IBM Research Europe - Zurich, Switzerland*; <sup>2</sup>*Eidgenössische Technische Hochschule Zurich, Switzerland*; <sup>3</sup>*Department of Physics, Inst. for Quantum Electronics, Optical Nanomaterial Group, Eidgenössische Technische Hochschule Zurich, Switzerland*. We present an integrated electro-optic transducer that does not rely on coupled optical modes or orthogonal polarizations to achieve triple resonance, resulting in fabrication-tolerant frequency matching and a dense optical spectrum suited for quantum transduction.

## QM2A.6 • 11:45

**Efficient Few-Photon-Level Light Storage in an Optomechanical Quantum Memory**, Alexander R. Korsch<sup>1</sup>, Liu Chen<sup>1</sup>, Pedro V. Pinho Nascimento<sup>2,1</sup>, Boris Müllendorff<sup>1</sup>, Jan N. Kirchhof<sup>1</sup>, Yong Yu<sup>1</sup>, Thiago P. Mayer Alegre<sup>2</sup>, Simon Groblacher<sup>1</sup>; <sup>1</sup>*Kavli Inst. of Nanoscience, Technische Universiteit Delft, Netherlands*; <sup>2</sup>*IFGW, Universidade Estadual de Campinas, Brazil*. We demonstrate the storage of weak coherent input signals on the few-photon level in a low-noise two-dimensional optomechanical crystal at Millikelvin temperatures. We probe the stored mechanical state via Hanbury Brown-Twiss measurements and demonstrate a memory lifetime of  $T = 7.3$  ms with a storage efficiency of 76% and a bandwidth of 4.5 MHz.

## QM2A.7 • 12:00

**High-Dimensional Temporal Mode Processing With Raman Quantum Memory**, Shicheng Zhang<sup>1</sup>, Aonan Zhang<sup>1,2</sup>, Ilse Mailllette de Buy Wenniger<sup>1,2</sup>, Paul Burdekin<sup>1,2</sup>, Jerzy Szuniewicz<sup>3,1</sup>, Steven Sagona-Stopfel<sup>1,4</sup>, Sarah E. Thomas<sup>1,2</sup>, Ian A. Walmsley<sup>1,2</sup>; <sup>1</sup>*Imperial College London, UK*; <sup>2</sup>*Univ. of Oxford, UK*; <sup>3</sup>*Uniwersytet Warszawski, Poland*; <sup>4</sup>*Okinawa Kagaku Gijyutsu Daigakuin Daigaku, Japan*. We demonstrate a Raman quantum memory as a high-dimensional temporal mode processor, enabling programmable storage, filtering, and conversion. The platform bridges MHz–GHz bandwidths, providing a scalable interface for quantum network nodes.

## QM2A.8 • 12:15

**Towards Cavity-Integrated Switching of Single-Photon Level Light via Phase Modulation in Warm Rubidium Vapor**, Georgia Booton<sup>1</sup>, Tabijah Wasawo<sup>1</sup>, William Davis<sup>2</sup>, Cameron McGarry<sup>1,3</sup>, Alex O. Davis<sup>1</sup>, Kristina Rusimova<sup>1</sup>, Josh Nunn<sup>4</sup>, Peter Mosley<sup>1,4</sup>; <sup>1</sup>*Univ. of Bath, UK*; <sup>2</sup>*Macquarie Univ., Australia*; <sup>3</sup>*School of Physics, Univ. of Sydney, Australia*; <sup>4</sup>*ORCA computing, UK*. Scalable photonic quantum platforms require a fast, low-loss switch to re-route

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**Disclaimer:** this guide is limited to technical program with abstracts and author blocks as of 02 June. For updated and complete information with special events, reference the online schedule or mobile app photons whilst preserving their quantum state. We show light-matter interactions can deliver all-optical high-bandwidth switching with minimal loss in warm rubidium vapour.

**10:30 -- 12:30**

**Room: Alsh 2**

**QM2B • Matter-Based Quantum Sensing**

*Presider: Roland Nagy; FAU Erlangen-Nürnberg, Germany*

**QM2B.1 • 10:30 (Invited)**

**Hot Atom - Based Quantum Sensors for Charged Particle Diagnostics**, Irina

Novikova<sup>1</sup>; <sup>1</sup>*College of William & Mary, USA*. We use atomic sensors based on multi-photon optical resonances to reconstruct electromagnetic signatures of electron density and current distributions in particle beams and low-temperature plasmas. The use of long-lived atomic quantum superpositions and non-classical optical probe boosts sensitivity.

**QM2B.2 • 11:00**

**Extending the Lifetime of Collective Rydberg Excitations via Spatial ac-Stark**

**Modulation**, Bartosz Niewelt<sup>2,1</sup>, Stanislaw Kurzyna<sup>2,1</sup>, Mateusz Mazelanik<sup>2</sup>, Wojciech Wasilewski<sup>2,1</sup>, Michal Parniak<sup>2,1</sup>; <sup>1</sup>*Uniwersytet Warszawski Wydział Fizyki, Poland*; <sup>2</sup>*Uniwersytet Warszawski Centrum Nowych Technologii, Poland*. We demonstrate AC-Stark phase modulation of a Rydberg quantum memory, extending spin-wave lifetimes by over tenfold. Experiments and simulations show suppressed thermal dephasing, enabling long-lived collective Rydberg qubits for quantum simulation and electrometry.

**QM2B.3 • 11:15**

**Towards the Limits of a Large Area Cold Atoms Gyroscope in the Double Diffraction**

**Regime.**, Romain Duverger<sup>1</sup>, Nathan Marlière<sup>1</sup>, Arnaud Landragin<sup>1</sup>; <sup>1</sup>*LTE, Observatoire de Paris, Université PSL, Sorbonne Université, Université de Lille, LNE and CNRS, France*. We present here alternative methods of real time phase control in cold atoms interferometers, suitable for dual interleaved operation that may push the limits of cold atoms inertial sensors.

**QM2B.4 • 11:30**

**Rydberg Atom Calibrated Sensing of a Terahertz Frequency Comb With Single-Mode**

**Resolution**, Wiktor Krokosz<sup>1</sup>, Jan Nowosielski<sup>1</sup>, Bartosz Kasza<sup>1</sup>, Sebastian Borówka<sup>1</sup>, Mateusz Mazelanik<sup>1</sup>, Wojciech Wasilewski<sup>1</sup>, Michal Parniak<sup>1</sup>; <sup>1</sup>*Uniwersytet Warszawski, Poland*. Experimental demonstration of atom-calibrated, room-temperature sensing of a terahertz frequency comb, resolving individual modes with MHz selectivity across octave-scale bandwidth, enabled by Rydberg atom RF-to-optical upconversion.

**QM2B.5 • 11:45**

**High Sensitivity Fiber-Integrated Broadband Magnetometry and Thermometry Using NV Centers in a Femtosecond Laser-Written Diamond Waveguide**, Deminingus Pekei<sup>1,2</sup>,

Yanzhao Guo<sup>3</sup>, Giulio Coccia<sup>4,5</sup>, Argyro Giakoumaki<sup>4,5</sup>, Roberta Ramponi<sup>4,5</sup>, Anthony Bennett<sup>1,2</sup>, Shane Eaton<sup>4,5</sup>, JP Hadden<sup>1,2</sup>; <sup>1</sup>*School of Engineering, Cardiff Univ., UK*; <sup>2</sup>*Translational Research Hub, UK*; <sup>3</sup>*School of Engineering, Univ. of Bristol, UK*; <sup>4</sup>*Department of Physics, Politecnico di Milano, Italy*; <sup>5</sup>*Inst. for Photonics and Nanotechnologies (CNR-IFN), Italy*. We investigate realistic fiber-integrated broadband magnetometry and thermometry with projected shot-noise-limited DC-sensitivity of up to 63 pT/ $\sqrt{\text{Hz}}$ , based on dense NV center ensembles in a femtosecond laser-written diamond waveguide using balanced photodiodes.

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## QM2B.6 • 12:00

### **Microwave-Free NV-Center Magnetometry for High-Power Transformer**

**Diagnostics**, Fernando J. Hidalgo<sup>1,2</sup>, Oliver T. Whaites<sup>2,3</sup>, Jorge Casanova<sup>2,3</sup>, Pablo Acedo<sup>2,4</sup>; <sup>1</sup>*Departamento de Física, Universidad del País Vasco, Spain*; <sup>2</sup>*EHU Quantum Center, Universidad del País Vasco, Spain*; <sup>3</sup>*Departamento de Química-Física, Universidad del País Vasco, Spain*; <sup>4</sup>*IKERBASQUE, Ikerbasque, Spain*. Microwave-free NV-center magnetometry is investigated for high-power transformer diagnostics. Density-dependent photoluminescence versus magnetic-field features enable bias-free optical detection of weak AC magnetic instabilities, aiming to bring quantum sensing technologies closer to impactful industrial applications.

## QM2B.7 • 12:15

### **Integrated Laser and Amplifier Modules for Field-Deployable Atomic Quantum**

**Sensors**, Peter Schlosser<sup>1</sup>, Jan-Simon Hennig<sup>1</sup>, Michael Wright<sup>2</sup>, David Pabœuf<sup>2</sup>, Adam Selyem<sup>1</sup>, William Dorward<sup>2</sup>, Loyd J. McKnight<sup>1</sup>; <sup>1</sup>*Fraunhofer UK Research Ltd, UK*; <sup>2</sup>*Alter Technology Tuv Nord UK, UK*. We present a compact laser engine integrating a frequency-stabilised rubidium-referenced source and butterfly-packaged tapered amplification, delivering over one Watt fibre output and enabling manufacturable laser subsystems for deployable atom-based quantum sensing applications in harsh environments.

**10:30 -- 12:30**

**Room: Carron**

## **QM2C • Towards Transduction and Networking of Quantum Devices**

*Presider: Christopher Eichler, Germany*

### **QM2C.1 • 10:30 (Tutorial)**

#### **Prospects for Networking Superconducting Quantum Computers Over Optical**

**Channels**, Abram Falk<sup>1</sup>; <sup>1</sup>*International Business Machines Corp, USA*. A promising quantum computing architecture comprises modules of superconducting quantum processors linked via quantum transducers over optical channels. I will discuss how transducers entangle microwave and optical photons and their perspectives for quantum networking.

### **QM2C.2 • 11:30**

#### **Investigating the Propagation of Two-Photon Correlations by Second Harmonic**

**Generation**, Thomas C. Dickinson<sup>2</sup>, Alessandra Gatti<sup>1</sup>, Ottavia Jedrkiewicz<sup>1</sup>, Matteo Clerici<sup>2</sup>, Lucia Caspani<sup>2</sup>; <sup>1</sup>*Istituto di Fotonica e Nanotecnologie del CNR, Italy*; <sup>2</sup>*Como lake Inst. of Photonics, Università degli Studi dell'Insubria - Sede di Como, Italy*. We experimentally demonstrate that the interaction length for second-harmonic generation of entangled photons can be significantly shorter than that for a classical field at high photon fluxes.

### **QM2C.3 • 11:45**

#### **Machine Learning-Informed Deterministic Fabrication of Nanophotonic Spin-Photon**

**Interfaces**, Julian M. Bopp<sup>1,2</sup>, Maarten H. van der Hoeven<sup>1</sup>, Marco E. Stucki<sup>1,2</sup>, Tommaso Pregnolato<sup>1,2</sup>, Tim Schröder<sup>1,2</sup>; <sup>1</sup>*Department of Physics, Humboldt-Universität zu Berlin, Germany*; <sup>2</sup>*Ferdinand-Braun-Institut gGmbH, Germany*. Reliable large-scale fabrication of nanophotonic spin-photon interfaces for quantum networking is unavailable. We employ machine learning to raise the yield of fabricating such interfaces around pre-characterized solid-state color centers, predicting success probabilities from pre-characterization data.

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## QM2C.4 • 12:00

**On the Feasibility of Distributed Measurement-Based Quantum Computing in Quantum Data Centers**, Seyed Navid Elyasi<sup>1</sup>, Paolo Monti<sup>1</sup>, Rui Lin<sup>1</sup>; <sup>1</sup>*Chalmers Univ. of Technology, Sweden*. We evaluate entanglement requirements, preparation, and execution times for QFT and Grover algorithms in distributed measurement-based quantum computation and compare them with gate-based implementations on modular superconducting architectures, identifying regimes where measurement-based approaches outperform gate-based ones.

## QM2C.5 • 12:15

**Experimental Private Quantum Networked Sensing**, Nicolas S. Laurent-Puig<sup>1</sup>, Laura Dos Santos Martins<sup>1</sup>, Luis Bugalho<sup>2</sup>, Santiago Scheiner<sup>1</sup>, Majid Hassani<sup>3</sup>, Sean Moore<sup>1</sup>, Damian Markham<sup>1</sup>, Eleni Diamanti<sup>1</sup>; <sup>1</sup>*Sorbonne Université LIP6, France*; <sup>2</sup>*Universidade de Lisboa Instituto Superior Tecnico, Portugal*; <sup>3</sup>*Universiteit Leiden Instituut-Lorentz, Netherlands*. Quantum networks enable secure multi-party protocols, and distributed sensing allows the private estimation of global linear functions. We experimentally implement a secure distributed quantum sensing protocol using high-fidelity Greenberger-Horne-Zeilinger (GHZ) states.

10:30 -- 12:30

Room: Lomond Auditorium

## QM2D • Satellite and Free-space Quantum Communication

Presider: Eleni Diamanti; CNRS, France

### QM2D.1 • 10:30 (Invited)

**Quantum Networks for the Upcoming QEYSSat Satellite**, Thomas Jennewein<sup>1</sup>; <sup>1</sup>*Univ. of Waterloo, Canada*. Abstract not available.

### QM2D.2 • 11:00

**Telecommunications Fiber-Optic and Free-Space Quantum Local Area Networks at the Air Force Research Laboratory**, Erin C. Sheridan<sup>1</sup>, Nicholas J. Barton<sup>2</sup>, Richard Birrittella<sup>3</sup>, Vedansh Nehra<sup>4</sup>, Zachary Smith<sup>1</sup>, Christopher Tison<sup>1</sup>, Amos Matthew Smith<sup>1</sup>, Shashank Dharanibalan<sup>4</sup>, Vijit Bedi<sup>1</sup>, David Hucul<sup>1</sup>, Benjamin Kyle<sup>1</sup>, Christopher Nadeau<sup>3</sup>, Mary Draper<sup>3</sup>, John Heinig<sup>1</sup>, Scott Faulkner<sup>3</sup>, Randal Scales<sup>3</sup>, Andrew M. Brownell<sup>2</sup>, Stefan Preble<sup>5</sup>, James Schneeloch<sup>1</sup>, Samuel Schwab<sup>1</sup>, Daniel Campbell<sup>1</sup>, Derrick Sica<sup>2</sup>, Peter Ricci<sup>1</sup>, Vladimir Nikulin<sup>6</sup>, John Malowicki<sup>1</sup>, Jacob Hall<sup>1</sup>, Michael Fanto<sup>1</sup>, Matthew D. LaHaye<sup>1</sup>, Laura Wessing<sup>1</sup>, Paul Alsing<sup>1</sup>, Kathy-Anne Soderberg<sup>1</sup>, Donald Telesca<sup>1</sup>; <sup>1</sup>*US Air Force Research Laboratory, USA*; <sup>2</sup>*Murray Associates of Utica, USA*; <sup>3</sup>*Booz Allen Hamilton, USA*; <sup>4</sup>*Technergetics, USA*; <sup>5</sup>*Microsystems Engineering, Rochester Inst. of Technology, USA*; <sup>6</sup>*Binghamton Univ., USA*. To support the Air Force Research Laboratory's mission of building heterogeneous quantum networks, we report on the development of Quantum Local Area Networks operating at telecommunications-band frequencies. Our results underscore the practical viability of field-deployable, qubit-agnostic quantum network infrastructure.

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## QM2D.3 • 11:15

**Long-Distance Free-Space Twin-Field Quantum Key Distribution Towards Satellite-Based Quantum Network**, minyan wang<sup>1</sup>; <sup>1</sup>*Univ. of Science and Technology of China, China*. We report the first experimental demonstration of free-space twin-field quantum key distribution over 14.2 km urban atmospheric channels and achieve a secret key rate exceeding the repeaterless capacity bound. The compensation for Doppler frequency shifts is demonstrated, representing a pivotal advance toward satellite-based quantum networks.

## QM2D.4 • 11:30

**Daylight Field Demonstration of C-Band Time-Bin/Phase QKD/Classical Coexistence Over a Fi-Wi-Fi Link**, Argiris Ntnaos<sup>1</sup>, Aristeidis Stathis<sup>1</sup>, Panagiotis Kourelas<sup>1</sup>, Nikolaos Makris<sup>2</sup>, Persefoni Konteli<sup>2</sup>, Alkinoos Papageorgopoulos<sup>2</sup>, Evrydiki Kyriazi<sup>1</sup>, Panagiotis Toumasis<sup>1</sup>, Konstantinos Tsimvrakidis<sup>2</sup>, Ilias Papastamatiou<sup>3</sup>, George T. Kanellos<sup>2</sup>, Hercules Avramopoulos<sup>1</sup>, Giannis Giannoulis<sup>1</sup>; <sup>1</sup>*National Technical Univ. of Athens, Greece*; <sup>2</sup>*National Kapodistrian Univ. of Athens, Greece*; <sup>3</sup>*Ethniko Diktyo Ereunas kai Technologias, Greece*. We demonstrate daylight QKD using C-band time-bin/phase encoding over a 0.75 km urban FSO link coexisting with a C-band classical laser, achieving an average key rate of more than 850 bps, towards interoperable, multi-domain quantum networks.

## QM2D.5 • 11:45

**A Nomadic, Multi-Mission Ground Station for Satellite Quantum Key Distribution**, Hobbs Willett<sup>1</sup>, Jaya Sagar<sup>1</sup>, Callum Jones<sup>1</sup>, Daniel Oi<sup>2</sup>, John Rarity<sup>1</sup>, Siddarth Joshi<sup>1</sup>; <sup>1</sup>*Univ. of Bristol, UK*; <sup>2</sup>*Univ. of Strathclyde, UK*. We present HedgehQGS -- a van-portable optical ground station for quantum key distribution compatible with multiple: satellites, QKD protocols and choice of wavelengths for the quantum signal, up & down link beacons.

## QM2D.6 • 12:00

**Seamless Satellite–Fibre Quantum Networking With a Compact Space–Deployable QKD Payload**, Chithrabhanu Perumangatt<sup>1</sup>, Thomas Roger<sup>1</sup>, ravinder singh<sup>1</sup>, Robert Woodward<sup>1</sup>, oliver crampton<sup>1,2</sup>, Rodrigo Tessinari<sup>1</sup>, Martin Ward<sup>1</sup>, camaron simmons<sup>2</sup>, Andrew Green<sup>2</sup>, Ross Donaldson<sup>2</sup>, R. Mark Stevenson<sup>1</sup>, Andrew J. Shields<sup>1</sup>; <sup>1</sup>*Toshiba Europe Limited, UK*; <sup>2</sup>*School of Engineering and Physical Sciences, Heriot-Watt Univ., UK*. We demonstrate a hybrid quantum network connecting a satellite-deployable transmitter, telescope-mounted receiver, and commercial fibre QKD. Free-space and fibre keys were combined through a trusted-node relay, enabling secure image transmission from the payload to the remote fibre node.

## QM2D.7 • 12:15

**Adaptive Optics-Assisted Free-Space Quantum Channel With EIT Based Quantum Memory Integration Over a 130 m Indoor Testbed**, Rishikesh Gokhale<sup>1</sup>, Justine Haupt<sup>2</sup>, Samuel Woronick<sup>1</sup>, Dimitrios Katramatos<sup>2</sup>, Eden Figueroa<sup>1,2</sup>; <sup>1</sup>*SUNY Stony Brook, USA*; <sup>2</sup>*Brookhaven National Laboratory, USA*. We present a 130m indoor free-space testbed with adaptive optics (AO), and Fast Steering Mirror (FSM) tip-tilt correction assisted photon storage in a warm Rb-87 EIT memory as a prototype for a 20 km quantum repeater link.

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**14:00 -- 16:00**

**Room: Alsh 1**

## **QM3A • High-dimensional and Continuous Variable Quantum Optics**

*Presider: Francesca Sansavini; Univ. of Oregon, USA*

### **QM3A.1 • 14:00 (Invited)**

**Continuous Variable Optical Resources for Quantum Reservoir Computing**, Valentina Parigi<sup>1</sup>; <sup>1</sup>*Laboratoire Kastler Brossel, Sorbonne Universite, France*. Continuous-variable photonic platforms using frequency- and pulse-multiplexed squeezed states from nonlinear waveguides enable scalable, room-temperature NISQ protocols. Femtosecond-driven entangled multimode states, shaped into cluster states and controlled via pump shaping and homodyne detection, enhance quantum reservoir computing for time-series tasks.

### **QM3A.2 • 14:30**

**Deterministic Entanglement Transformation for Distributed Variational Quantum Computing**, ilhwan I. kim<sup>1</sup>, yong-Su Kim<sup>1,4</sup>, Kwang Jo Lee<sup>2</sup>, Hyukjoon Kwon<sup>3</sup>, yosep kim<sup>5</sup>, Hyang-Tag Lim<sup>1,4</sup>; <sup>1</sup>*Center for Quantum Technology, Korea Inst. of Science and Technology, Korea (the Republic of)*; <sup>2</sup>*Applied Physics, Kyung Hee Univ., Korea (the Republic of)*; <sup>3</sup>*School of computational sciences, Korea Inst. for Advanced Study, Korea (the Republic of)*; <sup>4</sup>*Quantum Information, KIST School, korea Univ. of science and technology, Korea (the Republic of)*; <sup>5</sup>*Physics, Korea Univ., Korea (the Republic of)*. We propose and demonstrate a distributed variational quantum computing protocol exploiting deterministic entanglement tuning. Our strategy reduces resource overhead against gate teleportation with deterministic control of pre-shared entanglement using only local operations and classical communication.

### **QM3A.3 • 14:45**

**Towards High-Dimensional Frequency-bin Quantum key Distribution in a Multi-User Quantum Network**, Meritxell Cabrejo<sup>1</sup>, Fabian Steinlechner<sup>1,2</sup>; <sup>1</sup>*Fraunhofer IOF, Germany*; <sup>2</sup>*Friedrich-Schiller-Universitat Jena, Germany*. We develop methods to harness the high-dimensional entanglement of biphoton quantum frequency combs for frequency-multiplexed, multi-user networks. Using matrix completion techniques and computing asymptotic keys, we investigate the impact of dimension-dependent noise and identify the optimal dimension for encoding quantum information.

### **QM3A.4 • 15:00**

**Programming 11-Dimensional Time-Bin Measurements Inside a Multi-Mode Fiber**, DYLAN DANESE<sup>1</sup>, Vatshal Srivastav<sup>1</sup>, Will McCutcheon<sup>1</sup>, Saroch Leedumrongwathanakun<sup>2</sup>, Mehul Malik<sup>1</sup>; <sup>1</sup>*Heriot-Watt Univ., UK*; <sup>2</sup>*Prince of Songkla Univ., Thailand*. We use wavefront shaping to engineer large multi-mode unbalanced interferometers inside a commercial multi-mode fibre, enabling generalized measurements of photonic time-bin superpositions in up to dimension  $d=11$ . We use quantum tomography to characterize measurement quality.

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## QM3A.5 • 15:15

**Measurement-Efficient Tomography of High-Dimensional Frequency-bin Quantum States**, Hanson Nguyen<sup>1,2</sup>, Chen-You Su<sup>2,5</sup>, Diego Maragnano<sup>3</sup>, Marco Liscidini<sup>3</sup>, Jason McKinney<sup>2</sup>, Hsuan-Hao Lu<sup>6,2</sup>, Joseph M. Lukens<sup>2,4</sup>; <sup>1</sup>*School of Electrical, Computer and Energy Engineering, Arizona State Univ., USA*; <sup>2</sup>*Elmore Family School of Electrical and Computer Engineering, Purdue Univ., USA*; <sup>3</sup>*Universita di Pavia Dipartimento di Fisica, Italy*; <sup>4</sup>*Quantum Information Science Section, Oak Ridge National Laboratory, USA*; <sup>5</sup>*Department of Physics and Astronomy, Purdue Univ., USA*; <sup>6</sup>*Qunnect Inc., USA*. We implement threshold quantum state tomography of entangled frequency-bin qudits, demonstrating ultraefficient  $O(d^2)$  projector scaling, a significant reduction in the number of measurement settings compared to randomized measurements, and full tomography of biphoton frequency combs up to record Hilbert space dimension  $d^2=81$ .

## QM3A.6 • 15:30

**Generation and Distribution of Squeezed States of Light in a Campus Quantum Network**, Nathan Hughes<sup>2</sup>, Alfie Myers Wilson<sup>2</sup>, Igor Konieczniak<sup>1</sup>, Rupesh Kumar<sup>2</sup>; <sup>1</sup>*Department of Physics, Universidade Federal do Parana Departamento de Fisica, Brazil*; <sup>2</sup>*Univ. of York School of Physics Engineering and Technology, UK*. We achieved -4.5 dB of squeezing below the standard quantum limit using an optical parametric oscillator. The squeezed state was successfully distributed and verified across a fiber campus network

## QM3A.7 • 15:45

**A Semiconductor Quantum dot Interface for Entangled Multiphoton Generation in the Telecom C-Band**, Petros Laccotripes<sup>3,1</sup>, Junyang Huang<sup>1</sup>, Ginny Shooter<sup>1</sup>, Matthew Winnel<sup>1</sup>, Andrea Barbiero<sup>1</sup>, David A. Ritchie<sup>3</sup>, Andrew J. Shields<sup>1</sup>, Tina Müller<sup>2</sup>, R. Mark Stevenson<sup>1</sup>; <sup>1</sup>*Quantum Information Group, Toshiba Europe Limited, UK*; <sup>2</sup>*Karlsruher Institut für Technologie, Germany*; <sup>3</sup>*Univ. of Cambridge Department of Physics, UK*. Multiphoton entangled states are essential for memoryless quantum repeaters and measurement-based quantum computation. We demonstrate scalable multiphoton entanglement generation directly in the telecom C-band from an InAs/InP quantum dot, achieving two- and three-qubit fidelities of 59.5% and 52.7%, respectively.

**14:00 -- 16:00**

**Room: Alsh 2**

## QM3B • Quantum Optics and Sensing with Continuous Variables

### QM3B.1 • 14:00

**Direct Observation of 5 dB Squeezing From a SiN Micro-Ring With an on-Chip Parametric Amplifier and Realization of an on-Chip SU(1,1) Interferometer**, Zhe-Yu J. Ou<sup>1</sup>, Yuhang Lei<sup>1</sup>, Chenfei Cui<sup>2</sup>, Yue Li<sup>1</sup>, Hon Ki Tsang<sup>2</sup>; <sup>1</sup>*City Univ. of Hong Kong, Hong Kong*; <sup>2</sup>*Chinese Univ. of Hong Kong, Hong Kong*. By using two sequentially coupled SiN micro-rings, we measure quantum noise from the first with the second one as a part of quantum measurement tool and observe 5 dB of squeezing from the first micro-ring. Such a scheme with a coherent injection also forms an SU(1,1) interferometer.

# Optica Quantum 2.0 Conference and Exhibition

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## QM3B.2 • 14:15

### **Broadly Tunable Quantum Enhanced Raman Microscopy for Advancing**

**Bioimaging**, Dmitrii Akatev<sup>2,3</sup>, Yijian Meng<sup>1</sup>, Jonathan Brewer<sup>4</sup>, Maria V. Chekhova<sup>2</sup>, ulrik lund L. andersen<sup>3</sup>, Mikael Lassen<sup>1</sup>; <sup>1</sup>*Danish Fundamental Metrology, Denmark*; <sup>2</sup>*Max-Planck-Institut für die Physik des Lichts, Germany*; <sup>3</sup>*Center for Macroscopic Quantum States (bigQ), Danmarks Tekniske Universitet Institut for Fysik, Denmark*; <sup>4</sup>*Department of Molecular Biology and Biochemistry, Syddansk Universitet, Denmark*. We present quantum-enhanced stimulated Raman scattering microscopy using amplitude-squeezed light. A 5.2 dB-squeezed Stokes beam, combined with a broadly tunable pump, enables broadband vibrational access and achieves 3.6 dB noise reduction, corresponding to a 51% improvement in signal-to-noise ratio in biological tissue imaging experiments.

## QM3B.3 • 14:30

### **Towards Quantum Noise Squeezing in Ultra-Coherent Mechanical Resonators**

Aida Mashaal<sup>1</sup>, Lucio Stefan<sup>2</sup>, Andrea Ranfagni<sup>1</sup>, Thibault Capelle<sup>3</sup>, Clinton Potts<sup>1</sup>, Eric Langman<sup>1</sup>, Albert Schliesser<sup>1</sup>; <sup>1</sup>*The Niels Bohr Inst., Denmark*; <sup>2</sup>*Sparrow Quantum, Denmark*; <sup>3</sup>*Institut NEEL, France*. Using feedback-stabilized parametric modulation (*Phys. Rev. Research* **7**, L012071 (2025)), we demonstrate a record-level 21 dB thermomechanical noise reduction in a nanomechanical resonator, significantly surpassing the traditional 3 dB instability threshold.

## QM3B.4 • 14:45

### **Biphoton Quantum Imaging Gives Widefield Confocal Sectioning Without Scanning**

Euan Millar<sup>2</sup>, Emma P. Pearce<sup>1</sup>, Daniele Faccio<sup>1</sup>, Miles J. Padgett<sup>1</sup>; <sup>2</sup>*School of Physics and Astronomy, Univ. of Glasgow, UK*. Widefield confocal imaging is achieved without scanning by exploiting spatial correlations of entangled photon pairs, where biphoton generation and coincidence detection replace the illumination and detection apertures of a classical confocal microscope.

## QM3B.5 • 15:00

### **Simultaneous Time and Frequency Resolution in Two-Photon Absorption With Classical**

**Light**, Colin Veevers<sup>1</sup>, Benjamin Sussman<sup>2</sup>, Jeff Lundeen<sup>1</sup>; <sup>1</sup>*Univ. of Ottawa, Canada*; <sup>2</sup>*Naitonal Research Council of Canada, Canada*. Non-classical correlations in light have attracted interest for enhancing nonlinear spectroscopy. In two-photon absorption, non-classical correlations have enabled simultaneous fine resolution in time and frequency. We show theoretically that classical correlations can achieve the same result.

## QM3B.6 • 15:15

### **Generation of a CW Anti-Bunched Photon Field From a Thin-Film PPLN Waveguide by two-Photon Interference With a Weak Coherent State**

Zhe-Yu J. Ou<sup>1</sup>, Yue Li<sup>1</sup>, Haochuan Li<sup>1</sup>, Yuhang Lei<sup>1</sup>, Xiaoting Li<sup>1</sup>, Jianmin Wang<sup>1</sup>, Xuan Tang<sup>1</sup>, Mu Ku Chen<sup>1</sup>, Yue Bun E. Pun<sup>1</sup>, Cheng Wang<sup>1</sup>; <sup>1</sup>*City Univ. of Hong Kong, Hong Kong*. An anti-bunched photon field is produced from a thin-film PPLN waveguide by mixing the on-chip two-photon state with a weak but matched coherent state. This is achieved by taking out the two-photon part of the coherent state via a destructive two-photon interference.

## QM3B.7 • 15:30

# Optica Quantum 2.0 Conference and Exhibition

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**Bunching of Broadband Multimode Thermal Light Measured by Temporal Imaging**, Filip Sosnicki<sup>1,4</sup>, Sanjay Kapoor<sup>1</sup>, Michal Mikolajczyk<sup>1</sup>, Jerzy Szuniewicz<sup>1</sup>, Dmitri B. Horoshko<sup>2,3</sup>, Mikhail I. Kolobov<sup>2</sup>, Michal Karpinski<sup>1</sup>; <sup>1</sup>*Wydział Fizyki, Uniwersytet Warszawski, Poland*; <sup>2</sup>*UMR 8523 – PhLAM – Physique des Lasers Atomes et Molecules, Universite Lille, CNRS, France*; <sup>3</sup>*Institut für Quantenoptik, Universität Ulm, Germany*; <sup>4</sup>*Integrated Quantum Optics, Inst. for Photonic Quantum Systems (PhoQS), Universität Paderborn, Germany*. We demonstrate electro-optic temporal magnification of the time-resolved second-order coherence function used to resolve maximal bunching in multimode thermal light. By rescaling temporal correlations by a factor of 660, we overcome the limitations of detector jitter to observe photon statistics with sub-3.4-ps resolution.

## QM3B.8 • 15:45

**2D XY Spin Model in a Large Network of Coupled Parametric Oscillators**, Michal Natan<sup>1</sup>, Igal Aharonovich<sup>1</sup>, Avi Pe'er<sup>1</sup>; <sup>1</sup>*Bar Ilan Univ., Israel*. We demonstrate an RF two-dimensional network of >5,000 coupled oscillation-modes across the frequency-combs of two coupled parametric-oscillators. Energy-preserving, temporally modulated coupling enforces in-quadrature phase-locking and produces topology dependent phase correlations consistent with a finite XY spin-model.

**14:00 -- 16:00**

**Room: Carron**

## QM3C • Quantum Sources and Memories

*Presider: Sonali Gera, SUNY Stony Brook, USA*

### QM3C.1 • 14:00

**Electron-Heralded Generation of Single Photons**, Jan-Wilke Henke<sup>1,2</sup>, Germaine Arend<sup>1,2</sup>, Guan hao Huang<sup>3,4</sup>, Armin Feist<sup>1,2</sup>, Yujia Yang<sup>3,4</sup>, Zheru Qiu<sup>3,4</sup>, Hao Jeng<sup>1,2</sup>, Arslan S. Raja<sup>3,4</sup>, Rudolf Haindl<sup>1,2</sup>, Rui Ning Wang<sup>3,4</sup>, Tobias Kippenberg<sup>3,4</sup>, Claus Ropers<sup>1,2</sup>; <sup>1</sup>*MPI Multidisziplinäre Naturwissenschaft, Germany*; <sup>2</sup>*4th Physical Inst., Univ. of Göttingen, Germany*; <sup>3</sup>*Inst. of Physics, Swiss Federal Inst. of Technology Lausanne (EPFL), Switzerland*; <sup>4</sup>*Center for Quantum Science & Engineering, Swiss Federal Inst. of Technology Lausanne (EPFL), Switzerland*. We employ inelastic electron-light scattering between free electrons and the optical mode to generate photons that are correlated in energy and timing with the driving electron. Single-photon generation is then verified in a heralded Hanbury Brown-Twiss setup.

### QM3C.2 • 14:15

**Scalable Quantum Interference From Indistinguishable Quantum Dots**, Sheena Shaji<sup>1</sup>, Suraj Goel<sup>1</sup>, Julian Wiercinski<sup>1</sup>, Frederik Brooke Barnes<sup>1</sup>, Moritz Cygorek<sup>2</sup>, Antoine Borel<sup>1</sup>, Natalia Herrera Valencia<sup>1</sup>, Erik Gauger<sup>1</sup>, Mehul Malik<sup>1</sup>, Brian D. Gerardot<sup>1</sup>; <sup>1</sup>*Heriot-Watt Univ., UK*; <sup>2</sup>*Condensed Matter Theor, Technical Univ. of Dortmund, Germany*. We demonstrate the control of multiple, distinct quantum dots on a single sample via spatial light modulation, allowing us to observe cooperative emission from up to five dots and Hong-Ou Mandel interference with two dots.

### QM3C.3 • 14:30

# Optica Quantum 2.0 Conference and Exhibition

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**A Tunable GaAs Nanowire Polarization-Entangled Photon-Pair Source**, Elise Bailly-Rioufrey<sup>1</sup>, Zoya Polshchikova<sup>1</sup>, Gregoire Saerens<sup>1</sup>, Wenhe Jia<sup>1,2</sup>, Thomas Dursap<sup>3</sup>, Andreas Maeder<sup>1</sup>, Philippe Regreny<sup>3</sup>, Robert J. Chapman<sup>1</sup>, Helena Weigand<sup>1</sup>, Alexandre Danescu<sup>3</sup>, Nicolas Chauvin<sup>3</sup>, Jose Penuelas<sup>3</sup>, Rachel Grange<sup>1</sup>; <sup>1</sup>*ETH Zurich, Switzerland*; <sup>2</sup>*State Key Laboratory for Precision Measurement Technology and Instruments, China*; <sup>3</sup>*CNRS, ECL, INSA Lyon, UCBL, CPE Lyon, INL, France*. We present a tunable nanoscale source of high-fidelity (> 90%) polarization-entangled photon pairs in the near-infrared using orthogonal GaAs nanowires. The quantum state and degree of entanglement are controlled by the pump polarization.

## QM3C.4 • 14:45

**Tunable High-Fidelity Entanglement Generation in Quasi-Phase-Matched Layered Semiconductors**, Benjamin Braun<sup>1,2</sup>, Josip Bajo<sup>1,2</sup>, Chiara Trovatiello<sup>3,4</sup>, Philip Walther<sup>1,5</sup>, Lee A. Rozema<sup>1</sup>; <sup>1</sup>*Vienna Center for Quantum Science and Technology, Universitat Wien, Austria*; <sup>2</sup>*Vienna Doctoral School in Physics, Universitat Wien, Austria*; <sup>3</sup>*Dipartimento di Fisica, Politecnico di Milano, Italy*; <sup>4</sup>*Department of Mechanical Engineering, Columbia Univ., USA*; <sup>5</sup>*Christian Doppler Laboratory for Photonic Quantum Computer & Research Network Quantum Aspects of Space Time (TURIS), Universitat Wien, Austria*. We demonstrate tunable two-photon entangled and separable state generation via spontaneous parametric down conversion in ultra-thin periodically poled semiconductors, eliminating the need for compensation optics or interferometers while achieving fidelities exceeding 99%.

## QM3C.5 • 15:00

**Converting Laser Light Into Single Photons With Ultralong Coherence Time**, Manman WANG<sup>1,3</sup>, Yanfeng Li<sup>1,3</sup>, Chuanyu Zeng<sup>1,3</sup>, Hanqing Liu<sup>2,4</sup>, Haiqiao Ni<sup>2,4</sup>, Zhichuan Niu<sup>2,4</sup>, Chengyong Hu<sup>1</sup>; <sup>1</sup>*Beijing Academy of Quantum Info Sciences, China*; <sup>2</sup>*Inst. of Semiconductors Chinese Academy of Sciences, China*; <sup>3</sup>*Chinese Academy of Sciences Inst. of Physics, China*; <sup>4</sup>*Univ. of Chinese Academy of Sciences, China*. We demonstrate coherent conversion of laser light into single photons with ultralong coherence time, perfect single-photon purity and robust photon indistinguishability, using a single quantum dot embedded in an optical microcavity in the Purcell regime.

## QM3C.6 • 15:15

**Efficient Collection of Highly Indistinguishable Single Photons From an Organic Molecule**, Siwei Luo<sup>2,1</sup>, Tim Hebenstreit<sup>2,1</sup>, Alexey Shkarin<sup>2</sup>, Tobias Utikal<sup>2</sup>, Jan Renger<sup>2</sup>, Vahid Sandoghdar<sup>2,1</sup>, Stephan Götzinger<sup>2,1</sup>; <sup>1</sup>*Friedrich-Alexander-Universität Erlangen-Nürnberg, Germany*; <sup>2</sup>*Max-Planck-Institut für die Physik des Lichts, Germany*. We showcase a near-unity photon collection strategy by embedding organic molecules inside a cryogenic-compatible metallo-dielectric antenna. The device features a near-unity single-photon purity and an indistinguishability exceeding 85% under both continuous-wave (CW) and pulsed excitation.

## QM3C.7 • 15:30 (Invited)

**Interfacing Single Molecule Photon Sources With Atomic Quantum Memories**, Alex S. Clark<sup>1</sup>; <sup>1</sup>*Univ. of Bristol, UK*. Quantum networks can be extended when they include quantum memories interfaced with single photons. This paper describes recent work developing photon sources based on single organic molecules coupled to nanophotonics and rubidium atom quantum memories.

**14:00 -- 16:00**

**Room: Lomond Auditorium**

# Optica Quantum 2.0 Conference and Exhibition

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## QM3D • Quantum Computing: Atom, Ions & Interfaces

### QM3D.1 • 14:00 (Invited)

**Title to be Announced**, Jacob Covey<sup>1</sup>; <sup>1</sup>*Univ. of Illinois Urbana-Champaign, USA*. Abstract not available.

### QM3D.2 • 14:30

**Heavily Biased Qubit Encoded in a Trapped Atomic Ion**, Jameson O'Reilly<sup>1</sup>, Vikas Buchemmavari<sup>2,3</sup>, Oliver Miller<sup>1</sup>, Connor Burns<sup>1</sup>, Ivan H. Deutsch<sup>2,3</sup>, David J. Wineland<sup>1</sup>, David T. Allcock<sup>1</sup>; <sup>1</sup>*Department of Physics, Univ. of Oregon, USA*; <sup>2</sup>*Center for Quantum Information and Control (CQUIC), Univ. of New Mexico, USA*; <sup>3</sup>*Department of Physics and Astronomy, Univ. of New Mexico, USA*. We demonstrated a new trapped-ion qubit encoding for which >96% of fundamental errors and multiple classes of control errors can be erasure-converted and bit flips are exponentially less likely per logic gate than phase flips.

### QM3D.3 • 14:45

**Device-Independent Quantum Memory Certification on a Trapped-Ion Quantum Computer**, Peter Tirlir<sup>1</sup>, Leonardo Silva Viera Santos<sup>2</sup>; <sup>1</sup>*Leopold Franzens Universität Innsbruck, Austria*; <sup>2</sup>*Universität Siegen, Germany*. Quantum memories are key components of emerging quantum technologies, and the ideally device independent, certification of these is necessary in a commercial quantum computing sector. We first present such an approach for certifying black-box quantum memories and then perform a proof-of-principle experiment, certifying 35 ms of qubit memory.

### QM3D.4 • 15:00

**Four- and Six-Photon Stimulated Raman Transitions for Coherent Qubit and Qudit Operations**, Gabriel J. Gregory<sup>1</sup>, Evan R. Ritchie<sup>1</sup>, Alex Quinn<sup>1</sup>, Sean Brudney<sup>1</sup>, David J. Wineland<sup>1</sup>, David T. Allcock<sup>1</sup>, Jameson O'Reilly<sup>1</sup>; <sup>1</sup>*Department of Physics, Univ. of Oregon, USA*. We drive transitions between electronic angular momentum states with  $\Delta m_J=3, 4$ , and 5 via resonant four- and six-photon stimulated Raman transitions in a single trapped atom.

### QM3D.5 • 15:15

**A Waveguide QED Platform for Coupling Slow-Mode Nanophotonic and Cold Atoms.**, Idriss Douss<sup>1</sup>, Julien Laurat<sup>1</sup>, Alban Urvoy<sup>1</sup>, Adrien Bouscal<sup>1,2</sup>, Anais Chocho<sup>1</sup>, Sukanya Mahapatra<sup>1</sup>, Roy Eid<sup>1</sup>; <sup>1</sup>*Laboratoire Kastler Brossel, France*; <sup>2</sup>*Max-Planck-Institut für Quantenoptik, Germany*. Cold atoms interfaced with nanophotonic waveguides are a promising platform to enhance light-matter coupling. We present our approach with slow-mode waveguide and report advances in design, nanofabrication, and precise atom delivery near surfaces.

### QM3D.6 • 15:30

**Post-CMOS Photonics for Ion Trap Quantum Computers: Optimized Laser Distribution Build on CMOS ASIC Using Waveguide Platforms**, Marcus Westhues<sup>1</sup>, Jonas Klempel<sup>1</sup>, Thomas Gerschke<sup>1</sup>, Julia Hauser<sup>1</sup>, Aleksandar Nestic<sup>1</sup>, Roman Burkard<sup>2</sup>, Eike T. Icking<sup>1</sup>, Jennifer Ruskowski<sup>1</sup>, Anna L. Schall-Giesecke<sup>1,2</sup>; <sup>1</sup>*Fraunhofer-Institut für Mikroelektronische Schaltungen und Systeme IMS, Germany*; <sup>2</sup>*Department of Electronic Components and Circuits, Universität Duisburg-Essen, Germany*. An integrated, low-loss, post-CMOS photonic waveguide platform for ultraviolet to infrared wavelength ranges enables a fully integrated approach for scalable building blocks in quantum technologies, e.g., ion trap quantum computing.

### QM3D.7 • 15:45

# Optica Quantum 2.0 Conference and Exhibition

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**Hz-Linewidth Miniaturized ECDLs Using a Shared High-Q Reference Cavity**, Christian Assmann<sup>1</sup>, Sebastian Schmidtmann<sup>1</sup>, Denis Erfle<sup>1</sup>, Hervé Tatenguem<sup>1</sup>, Joachim Sacher<sup>1</sup>; <sup>1</sup>*Sacher Lasertechnik GmbH, Germany*. We demonstrate a compact and robust laser system in which multiple lasers are stabilized to a shared high-Q reference cavity via photonic-crystal fiber distribution, achieving hertz-level linewidths at 813, 689, and 461 nm for a strontium optical lattice experiment.

**16:30 -- 18:00**

**Room: Alsh 1**

**QM4A • Photonic Technologies for Quantum Computing I**

*Presider: Mehul Malik; Heriot-Watt Univ., UK*

**QM4A.1 • 16:30**

**Deterministic Photonic Schrödinger Cat States by Engineered Two-Photon Dissipation**, Odiel Hooybergs<sup>1,2</sup>, Tumas Napoleon Arge<sup>1</sup>, Nicholas Gialouris<sup>1</sup>, Werner Wegscheider<sup>2</sup>, Robert J. Chapman<sup>1</sup>, Rachel Grange<sup>1</sup>; <sup>1</sup>*Optical Nanomaterial Group, Inst. for Quantum Electronics, Eidgenössische Technische Hochschule Zurich, Switzerland*; <sup>2</sup>*Solid State Physics Laboratory, Eidgenössische Technische Hochschule Zurich, Switzerland*. We propose deterministic generation of photonic Schrödinger cat states using a  $\chi^{(2)}$  doubly resonant optical parametric oscillator operated where engineered two-photon processes dominate single-photon loss. Simulations indicate practicality once  $g/\kappa_a$  improves by 2 orders.

**QM4A.2 • 16:45**

**Generation of 12 dB Squeezing from a Waveguide Optical Parametric Amplifier by Machine-Learning-Controlled Spatial Light Modulator**, Gyeongmin Ha<sup>1</sup>, Kazuki Hirota<sup>1</sup>, Takahiro Kashiwazaki<sup>2</sup>, Takumi Suzuki<sup>1</sup>, Akito Kawasaki<sup>3,4</sup>, Warit Asavanant<sup>3,4</sup>, Mamoru Endo<sup>1,3</sup>, Akira Furusawa<sup>1,3</sup>; <sup>1</sup>*Univ. of Tokyo, Japan*; <sup>2</sup>*Device Technology Labs, NTT, Inc., Japan*; <sup>3</sup>*RIKEN Center for Quantum Computing, Japan*; <sup>4</sup>*OptQC Corp., Japan*. We report the generation of  $12.1 \pm 0.1$  dB squeezed light from a waveguide optical parametric amplifier. Machine learning was used to optimize a spatial light modulator, significantly enhancing homodyne detection efficiency.

**QM4A.3 • 17:00**

**Exchange Symmetry in Multiphoton Quantum Interference**, Shreya Kumar<sup>1,2</sup>, Alex E Jones<sup>3</sup>, Daniel Bhatti<sup>4</sup>, Stefanie Barz<sup>1,2</sup>; <sup>1</sup>*Universität Stuttgart, Germany*; <sup>2</sup>*Center for Integrated Quantum Science and Technology, Germany*; <sup>3</sup>*Quantum Engineering Technology Labs, H. H. Wills Physics Laboratory and Department of Electrical and Electronic Engineering, Univ. of Bristol, UK*; <sup>4</sup>*Networked Quantum Devices Unit, Okinawa Inst. of Science and Technology Graduate Univ., Japan*. Although photons are bosons, certain entangled states exhibit effectively non-bosonic behaviour. We study new forms of symmetries in multiphoton states, where each pair of photons possesses different exchange symmetry, leading to interesting interference effects.

**QM4A.4 • 17:15**

**Programmable Quantum Circuits With Ultrafast Time-bin Encoding**, Frederic Bouchard<sup>1</sup>; <sup>1</sup>*National Research Council Canada, Canada*. The temporal degree of freedom of single photons is a promising avenue for many quantum information tasks. We investigate the feasibility of time-bin states at the picosecond timescale for applications in quantum information processing.

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## QM4A.5 • 17:30

**Optimal and Reliable Certification of Linear Optical Quantum Processes**, Riko Shadow<sup>3</sup>, Naomi Spier<sup>2,1</sup>, Stefan van den Hoven<sup>2</sup>, Malaquias Correa Anguita<sup>2</sup>, Redlef B. Braamhaar<sup>2</sup>, Sara Marzban<sup>2</sup>, Jens Eisert<sup>3</sup>, Jelmer Renema<sup>1,2</sup>, Nathan Walk<sup>3</sup>; <sup>1</sup>*TU/e, Netherlands*; <sup>2</sup>*Universiteit Twente, Netherlands*; <sup>3</sup>*Freie Universitat Berlin, Germany*. We introduce a measure of fidelity suitable for linear optical quantum computing (LOQC) and experimentally realize several witnesses for it. The witness based on the discrete Fourier transform is shown to be optimal.

## QM4A.6 • 17:45

**Photonic Quantum-to-Quantum Bernoulli Factory**, Francesco Hoch<sup>1</sup>, Giovanni Rodari<sup>1</sup>, Taira Giordani<sup>1</sup>, Alessia Suprano<sup>1</sup>, Luca Castello<sup>1</sup>, Elena Negro<sup>1</sup>, Gonzalo Carvacho<sup>1</sup>, Nicolò Spagnolo<sup>1</sup>, Francesco Ceccarelli<sup>2</sup>, Ciro Pentangelo<sup>2</sup>, Simone Piacentini<sup>2</sup>, Andrea Crespi<sup>2</sup>, Roberto Osellame<sup>2</sup>, Ernesto Galvao<sup>3</sup>, Fabio Sciarrino<sup>1</sup>; <sup>1</sup>*Univ degli Studi di Roma La Sapienza, Italy*; <sup>2</sup>*Istituto di Fotonica e Nanotecnologie, Consiglio Nazionale delle Ricerche, Italy*; <sup>3</sup>*International Iberian Nanotechnology Laboratory, Portugal*. We present a linear optical scheme for the implementation of a quantum-to-quantum Bernoulli factory both in dual rail and in polarisation encoding. We experimentally validate the proposed interferometers, showing their potential for quantum algorithm applications.

**16:30 -- 18:00**

**Room: Alsh 2**

**QM4B • Quantum Devices**

*Presider: Andrei Militaru; ISTA, Austria*

## QM4B.1 • 16:30

**Validated Multi-Tier Cascaded Quantum Frequency Conversion Noise Model**, Atharva Jadhav<sup>1</sup>, Mehmetcan Akbulut<sup>1</sup>; <sup>1</sup>*The Univ. of Arizona James C Wyant College of Optical Sciences, USA*. Quantum Frequency Conversion (QFC) noise can become a major detriment for quantum network performance. In this work, we present a multi-tier QFC noise model aimed at better understanding and prediction, validated with published noise data.

## QM4B.2 • 16:45

**Sapphire as a Platform for Three-Dimensional Integrated Quantum Photonics**, Mohan Wang<sup>1</sup>, Tongyu Liu<sup>1</sup>, Frank Payne<sup>1</sup>, Martin Booth<sup>1</sup>, Patrick Salter<sup>1</sup>, Julian Fells<sup>1</sup>; <sup>1</sup>*Univ. of Oxford, UK*. We demonstrate femtosecond-laser-written single-mode waveguides in sapphire operating at 780 nm and 1550 nm, together with polarization-independent 50:50 directional couplers, establishing sapphire as a compact, robust platform for three-dimensional integrated quantum photonics.

## QM4B.3 • 17:00

**Analytical Framework for Optomechanical Transduction With Embedded Quantum Dots**, Karthik V. Myilswamy<sup>1</sup>, Kevin Silverman<sup>1</sup>; <sup>1</sup>*National Inst. of Standards and Technology, USA*. We present a theoretical analysis of quantum dots embedded in acoustic cavities for optomechanical transduction and identify the optimal pump power and detuning conditions that maximize photon-phonon conversion efficiency.

## QM4B.4 • 17:15

**Single Mode Lithium-Niobate on Insulator Structures for Efficient Non-Gaussian State Generation**, Tumas Napoleon Arge<sup>2,3</sup>, Michelle Schweizer<sup>2,3</sup>, Odiel Hooybergs<sup>2,4</sup>, Iven F.

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Welp<sup>2,1</sup>, Werner Wegscheider<sup>4</sup>, Robert J. Chapman<sup>2,1</sup>, Rachel Grange<sup>2,1</sup>; <sup>1</sup>*Inst. for Quantum Electronics, Eidgenossische Technische Hochschule Zurich, Switzerland*; <sup>2</sup>*Optical Nanomaterials Group, Eidgenossische Technische Hochschule Zurich, Switzerland*; <sup>3</sup>*Quantum Center, ETH-Bereich Hochschulen, Switzerland*; <sup>4</sup>*Solid State Physics Laboratory, ETH-Bereich Hochschulen, Switzerland*. Squeezed states of light are a key resource for continuous-variable (CV) quantum computing. Resonant structures provide efficient generation of light but produce states in all phase-matched resonances, complicating photon subtraction protocols. Here we demonstrate efficient coupled-cavity designs that suppress unwanted modes.

## QM4B.5 • 17:30

**An Integrated Microwave-Optic Entangled Photon Pair Source**, Matthew weaver<sup>1</sup>, Taryn Stefanski<sup>1</sup>, Roberto Zurita<sup>1</sup>, Beer de Zoeten<sup>1</sup>, Merve Tamer<sup>1</sup>, Hannah Weaver<sup>1</sup>, Linh Nguyen<sup>1</sup>, Salvatore Cianci<sup>1</sup>, Georg Arnold<sup>1</sup>, Mathilde Lemang<sup>1</sup>, Simon Groeblacher<sup>1</sup>, Robert Stockill<sup>1</sup>; <sup>1</sup>*QphoX, Netherlands*. Microwave frequency quantum processors need an optical interface for distributed computing beyond cryogenic limits. We use an on-chip microwave-mechanical-optical transducer to generate microwave-optic entangled emission, a crucial ingredient for remote quantum links between processors.

## QM4B.6 • 17:45

### **Toward Microwave-to-Optical Transduction With Bulk Acoustic Wave**

**Resonators**, Samuel Pautrel<sup>1</sup>, Tom Schatteburg<sup>1</sup>, Maxwell G. Drimmer<sup>1</sup>, Hans K. Beukers<sup>1</sup>, Frederike Brockmeyer<sup>1</sup>, Yiwen Chu<sup>1</sup>; <sup>1</sup>*Department of Physics, Eidgenossische Technische Hochschule Zurich, Switzerland*. We present our progress toward designing and building a microwave-to-optical transducer based on a bulk acoustic wave resonator piezoelectrically coupled to a superconducting qubit and optomechanically coupled to a cryogenic free-space Fabry-Perot optical cavity.

**16:30 -- 18:00**

**Room: Carron**

## QM4C • Quantum Light-Matter Interconnects

*Presider: Ben Dixon; MIT Lincoln Laboratory, USA*

### QM4C.1 • 16:30 (Invited)

**Title to be Announced**, Aziza Suleymanzade<sup>1</sup>; <sup>1</sup>*Univ. of California Berkeley, USA*. Abstract not available.

### QM4C.2 • 17:00

#### **Quantum Memory Enhanced Optical Interconnects for Modular Trapped-Ion Quantum**

**Computers**, Madison Sutula<sup>1</sup>, Pierre Barral<sup>1</sup>, Mihir Bhaskar<sup>1</sup>, M. C. Cambria<sup>1</sup>, Alexander Chuang<sup>1</sup>, Jacob Davidson<sup>1</sup>, Chawina De-Eknamkul<sup>1</sup>, Noah Glachman<sup>1</sup>, Jeonghoon Ha<sup>1</sup>, Lukas Hartung<sup>1</sup>, Michael Haas<sup>1</sup>, Bart Machielse<sup>1</sup>, Christopher Monroe<sup>1</sup>, David Levonian<sup>1</sup>, Matteo Pompili<sup>1</sup>, Sagnik Saha<sup>1</sup>, Denis Sukachev<sup>1</sup>, George Toh<sup>1</sup>, Carsten Robens<sup>1</sup>; <sup>1</sup>*IonQ Quantum, Inc., USA*. Trapped-ion quantum computers with electronic control provide a promising pathway towards high-fidelity quantum computers. Here we present a modular interconnect platform enabled by quantum memories based on silicon-vacancy (SiV) centers in diamond nanophotonic cavities.

### QM4C.3 • 17:15

# Optica Quantum 2.0 Conference and Exhibition

**Disclaimer:** this guide is limited to technical program with abstracts and author blocks as of 02 June. For updated and complete information with special events, reference the online schedule or mobile app

**Two-Dimensional Spectroscopy of Rubidium Atom Transitions**, Eesa Ali<sup>1</sup>, Rowan Hoggarth<sup>1</sup>, Carrie Weidner<sup>1</sup>, Alex S. Clark<sup>1</sup>; <sup>1</sup>*Univ. of Bristol, UK*. We perform two-dimensional spectroscopy of rubidium atoms between the 5S<sub>1/2</sub>, 5P<sub>3/2</sub> and 4D<sub>5/2</sub> states using two independently tunable lasers, laying the groundwork for single-photon frequency conversion between 780 nm and 1530 nm wavelengths.

## QM4C.4 • 17:30

**Towards Density-Engineered Bose–Einstein Condensates for Long-Lived Quantum Memories**, Elisa Da Ros<sup>1</sup>, Simon Kanthak<sup>1</sup>, Valerie Mauth<sup>1</sup>, Erhan Sağlamyürek<sup>2,3</sup>, Mustafa Gündoğan<sup>1</sup>, Markus Krutzik<sup>1,4</sup>; <sup>1</sup>*Humboldt-Universität zu Berlin, Germany*; <sup>2</sup>*Univ. of Calgary, Canada*; <sup>3</sup>*Univ. of Alberta, Canada*; <sup>4</sup>*Ferdinand-Braun-Institut gGmbH, Germany*. We propose a microgravity matter-wave protocol, with experimental implementation underway, that prolongs quantum-memory coherence in untrapped Bose–Einstein condensates through dynamic suppression of density-dependent decoherence.

## QM4C.5 • 17:45

**Rack-Mounted Ion Trap With Integrated Optical Cavity**, Lara Becker<sup>1</sup>, Stephan Kucera<sup>1,2</sup>, Max Bergerhoff<sup>1</sup>, Jolan Costard<sup>1</sup>, Franz Krieger<sup>1</sup>, Jan Müller<sup>3</sup>, Jürgen Eschner<sup>1</sup>; <sup>1</sup>*Experimentalphysik, Universität des Saarlandes, Germany*; <sup>2</sup>*Materials Research and Technology Department, Luxembourg Inst. of Science and Technology, Luxembourg*; <sup>3</sup>*Department of Physics, Johannes Gutenberg Universität Mainz, Germany*. We present a multi-segment Paul trap for <sup>40</sup>Ca<sup>+</sup> ions with an integrated fiber cavity to increase the photon collection and generation efficiency. In a first prototype trap with 190 μm electrode separation, we integrated a cavity with 220 μm length and 7300 finesse.

16:30 -- 18:00

Room: Lomond Auditorium

## QM4D • Quantum Computing: Superconducting Circuits & Hybrid Systems

Presider: Martin Weides; *Univ. of Glasgow, UK*

### QM4D.1 • 16:30 (Invited)

**Efficient Entanglement Generation in Superconducting Qubit Systems**, Stefan Filipp<sup>1,2</sup>; <sup>1</sup>*Technische Universität München, Germany*; <sup>2</sup>*Walther-Meißner-Institut für Tieftemperaturforschung, Germany*. The exceptional controllability of superconducting qubits allows us to generate entangled states within hundred nanoseconds or less. Specifically, tunable couplers enable both high-fidelity two-qubit gates and single-step multi-qubit entanglement generation.

### QM4D.2 • 17:00

**Implementation of a Dual-Rail Qubit Based on Fixed-Frequency Transmons and a Tunable Coupler**, Harshanth Ram Murugesan<sup>1</sup>, Tejeshwar H. Reddy<sup>1</sup>, Anton Lampenscherf<sup>1</sup>, Thomas Foesel<sup>1</sup>, Victor Kemme<sup>1</sup>, Murali Krishna Kurmapu<sup>1</sup>, Prakiran Baidya<sup>1</sup>, Mojahed Jaber<sup>1</sup>, Stephan Tasler<sup>1</sup>, Markus Sondermann<sup>1</sup>, Michael Hartmann<sup>1,2</sup>, Christopher Eichler<sup>1,2</sup>; <sup>1</sup>*Friedrich-Alexander-Universität Erlangen-Nürnberg, Germany*; <sup>2</sup>*Quint Computing, Germany*. Erasure qubits promise to lower the resource overhead of error correcting codes. Here, we realize and characterize an erasure qubit based on a dual-rail encoding in a system of two fixed-frequency transmon qubits coupled by a tunable coupler.

### QM4D.3 • 17:15

# Optica Quantum 2.0 Conference and Exhibition

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**Detecting Polar Molecules With Superconducting Microwave Resonators**, Nikolaus de Zordo<sup>2</sup>, Carla Borja-Espinosa<sup>1</sup>, Ragheed Alhyder<sup>1</sup>, Georgios Koutentakis<sup>1</sup>, Wenzel Kersten<sup>2</sup>, Andrew Kanagin<sup>2</sup>, Jinglun Li<sup>1</sup>, Florian Kluibenschedl<sup>1</sup>, Mikhail Lemeshko<sup>1</sup>, Johannes Fink<sup>1</sup>, Joerg Schmiedmayer<sup>2</sup>, Elena Redchenko<sup>2</sup>; <sup>1</sup>*Inst. of Science and Technology Austria, Austria*; <sup>2</sup>*Technische Universitat Wien, Austria*. We report progress toward strong electric-dipole coupling of polar molecules in cryogenic crystals to superconducting microwave resonators for hybrid quantum computing. We detect crystal-shifted inversion transitions of ammonia in neon using a multimode resonator.

## QM4D.4 • 17:30

### **Modeling of a Quantum-Limited Flux-Driven Amplifier With Impedance**

**Engineering**, Yongjie Yuan<sup>1</sup>, Johannes Stowasser<sup>1</sup>, Michael Haider<sup>1,2</sup>, Christian Jirauschek<sup>1</sup>; <sup>1</sup>*Technische Universitat Munchen, Germany*; <sup>2</sup>*Univ. of the Bundeswehr Munich, Germany*. We present a theoretical model for a quantum superconducting amplifier with ultra-low added noise. This theory provides a promising solution for modeling quantum fluctuations in impedance-matched broadband amplifiers driven by a flux wave.

## QM4D.5 • 17:45

Withdrawn

# Optica Quantum 2.0 Conference and Exhibition

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## Tuesday, 16 June

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**09:00 -- 10:00**

**Room: Lomond Auditorium**

**QTu1A • Glasgow Lord Provost Welcome and Joint Keynote Session**

*Presider: To Be Announced*

**QTu1A.1 • 09:00 (Plenary)**

**Building Quantum Safe Networks for a Post Quantum World**, Andrew J. Shields<sup>1</sup>; <sup>1</sup>*Toshiba Europe - Quantum Technology, UK*. Quantum computing is advancing at an unprecedented pace, challenging the foundations of security that underpin today's communication networks. In this talk, we explore how the industry is responding—integrating quantum-safe technologies such as quantum key distribution, alongside quantum-resistant algorithms, into commercial metro and national networks. We look beyond today's deployments to consider what it will take to realise a truly global infrastructure for secure communications and computing in the quantum era.

**10:30 -- 12:30**

**Room: Alsh 1**

**QTu2A • Solid-state Quantum Devices**

*Presider: Ben Dixon; MIT Lincoln Laboratory, USA and Ben Dixon; MIT Lincoln Laboratory, USA*

**QTu2A.1 • 10:30 (Invited)**

**A Many-Body Nuclear Spin Quantum Register**, Mete Atature<sup>1</sup>; <sup>1</sup>*Univ. of Cambridge, UK*. Abstract not available.

**QTu2A.2 • 11:00**

**Electrically Tunable and Purcell Enhanced Telecom Single-Photon Emission From Quantum Dots in Circular Photonic Crystal Resonators**, Ginny Shooter<sup>1</sup>, Andrea Barbiero<sup>1</sup>, Joanna Skiba-Szymanska<sup>1</sup>, Junyang Huang<sup>1</sup>, Loganathan Ravi<sup>2</sup>, J. Iwan Davies<sup>2</sup>, Benjamin Ramsay<sup>3</sup>, David J. Ellis<sup>3</sup>, Andrew J. Shields<sup>1</sup>, Tina Müller<sup>1</sup>, R. Mark Stevenson<sup>1</sup>; <sup>1</sup>*Toshiba Europe Ltd CRL, UK*; <sup>2</sup>*IQE Europe Limited, UK*; <sup>3</sup>*Cavendish Laboratory, Univ. of Cambridge, UK*. Bright telecom quantum light sources can be realized by integrating semiconductor quantum dots into circular Bragg gratings. To enable tunability of such structures, we fabricate and characterize hole grating devices compatible with electrical contacts.

**QTu2A.3 • 11:15 (Invited)**

**Optically Addressable Molecular Spins for Quantum Information Applications**, David Hunger<sup>1</sup>; <sup>1</sup>*Faculty of Physics, Karlsruhe Institut fur Technologie, Germany*. Optically addressable spins are promising candidates for quantum network nodes. Molecular lanthanide complexes represent an emerging material platform that offers the possibility of chemical tailoring to optimize optical and spin properties. We report ultra-narrow optical linewidths, long spin lifetime, and optically detected nuclear spin control yielding coherence times ~1 ms in an Europium-based molecular crystal. We discuss steps towards single ion control to realize

# Optica Quantum 2.0 Conference and Exhibition

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## QTu2A.4 • 11:45

**Strain-Tuned Tin-Vacancy Centers for Indistinguishable Photons in an Integrated Photonics Platform**, David A. Golter<sup>1</sup>, Genevieve Clark<sup>1,2</sup>, Kevin Palm<sup>1,2</sup>, Matthew Zimmermann<sup>1</sup>, William Yzaguirre<sup>1</sup>, Andrew Leenheer<sup>3</sup>, Matt Eichenfield<sup>4,3</sup>, Gerald Gilbert<sup>5</sup>, Dirk Englund<sup>2</sup>; <sup>1</sup>*The MITRE Corporation Bedford, USA*; <sup>2</sup>*Massachusetts Inst. of Technology Research Laboratory of Electronics, USA*; <sup>3</sup>*Sandia National Laboratories, USA*; <sup>4</sup>*Univ. of Colorado Boulder Department of Electrical Computer and Energy Engineering, USA*; <sup>5</sup>*The MITRE Corporation Princeton, USA*. We tune tin-vacancy centers into optical resonance using piezo-actuated nanocantilevers. Coherent optical control and polarization filtering enable the generation of indistinguishable photons from multiple spin qubits in a device featuring integrated optical and microwave controls.

## QTu2A.5 • 12:00

**Towards High-Fidelity Gates for a Multi-Qubit Diamond Quantum Register**, Margriet van Riggelen<sup>1,2</sup>, Jiwon Yun<sup>1,2</sup>, Hendrik Benjamin van Ommen<sup>1,2</sup>, Tim Hugo Taminiau<sup>1,2</sup>; <sup>1</sup>*QuTech, Delft Univ. of Technology, Netherlands*; <sup>2</sup>*Kavli Inst. of Nanoscience Delft, Netherlands*. We investigate two-qubit quantum gates for a 7-qubit diamond quantum register with an average fidelity of ~99%. We quantify and demonstrate the gate performance using gate set tomography and the variational quantum eigensolver algorithm.

## QTu2A.6 • 12:15

**Coherent Coupling of a Tin Vacancy Center to a Diamond Photonic Crystal Cavity**, Tim Turan<sup>1,2</sup>, Nina Codreanu<sup>1,2</sup>, Daniel Bedialauneta Rodriguez<sup>1,2</sup>, Matteo Pasini<sup>1,2</sup>, Lorenzo de Santis<sup>1,2</sup>, Maximilian Ruf<sup>1,2</sup>, Christian Primavera<sup>1,2</sup>, Leonardo G. Wienhoven<sup>1,2</sup>, Caroline E. Smulders<sup>1,2</sup>, Simon Groblacher<sup>2</sup>, Ronald Hanson<sup>1,2</sup>; <sup>1</sup>*QuTech, Netherlands*; <sup>2</sup>*Kavli Inst. of Nanoscience Delft, Netherlands*. Tin vacancy centers in diamond photonic crystal cavities are a promising platform for realizing quantum networks. Here, we measure high quality factors up to  $Q = 25.4(4) \times 10^3$  and Purcell-reduced lifetimes yielding cooperativities up to  $C = 20.4(12)$ . We further observe the emitter to modulate the cavity transmission, confirming coherent coupling.

10:30 -- 12:30

Room: Alsh 2

## QTu2B • Novel Approaches to Quantum Sensing

Presider: Douglas Paul; Univ. of Glasgow, UK

### QTu2B.1 • 10:30 (Invited)

**Waveguide Optoacoustics for Quantum Information Processing**, Birgit Stiller<sup>1,2</sup>; <sup>1</sup>*Inst. for Photonics, Leibniz Universitat Hannover, Germany*; <sup>2</sup>*Max-Planck-Institut fur die Physik des Lichts, Germany*. We use the interaction of light with acoustic vibrations, in particular stimulated Brillouin-Mandelstam scattering (SBS), to store and process optical information. We experimentally demonstrate cavity-less strong coupling, active cooling of acoustic phonons and few-photon optoacoustic storage. We also show that waveguide optoacoustics provides rich physics and an efficient mechanism to generate photon-phonon entanglement and quantum memory.

# Optica Quantum 2.0 Conference and Exhibition

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## QTu2B.2 • 11:00

### **Preliminary Metrological Assessment and Thermal Robustness of a Field Differential Quantum Gravimeter**

Niranjan Myneni<sup>1</sup>, Romain Caldani<sup>1</sup>, Nawel Addi<sup>1</sup>, Franck pereira<sup>1</sup>, Sébastien Merlet<sup>1,2</sup>, Leonid Sidorenkov<sup>1</sup>, Camille Janvier<sup>3</sup>; <sup>1</sup>*Observatoire de Paris, France*; <sup>2</sup>*LNE, France*; <sup>3</sup>*Exail, Quantum Systems, Gradignan, France, France*. We report on indoor tests of an industrial quantum gravity sensor designed for field applications that employs two cold-atom probes. Measurements alongside precision gravimeters at well-characterized sites show stable, repeatable performance, while thermal tests validate high-sensitivity gradient operation under realistic outdoor conditions.

## QTu2B.3 • 11:15

### **Continuous-Variable Quantum Network for Multiparameter Sensing**

zhihui yan<sup>1</sup>, Xiaojun Jia<sup>1</sup>; <sup>1</sup>*Shanxi Univ., China*. To solve the challenge for scalable and versatile network for multiparameter sensing, we demonstrate a reconfigurable entangled network of Mach–Zehnder interferometers via single shared squeezed-vacuum resource, and a crossover from standard quantum limit to Heisenberg limit.

## QTu2B.4 • 11:30

### **Infrared Absorption Magnetometry in a Diamond Microcavity**

Nicholas Sorensen<sup>2</sup>, Sean McNaney<sup>2</sup>, Christopher Coutts<sup>2</sup>, Elham Zohari<sup>1,2</sup>, Sigurd Flågan<sup>2</sup>, Vlnaya K. Rathnakara<sup>2</sup>, Paul Barclay<sup>2</sup>; <sup>1</sup>*Department of Physics, Univ. of Alberta, Canada*; <sup>2</sup>*Physics and Astronomy, Univ. of Calgary, Canada*. We demonstrate an infrared absorption-based diamond magnetometer implemented in a high-Q diamond microcavity. Spectroscopy of whispering-gallery modes reveals spin-dependent absorption by the nitrogen-vacancy singlet transition. We evaluate the resulting magnetic sensitivity to be  $250 \text{ nT}/\sqrt{\text{Hz}}$ .

## QTu2B.5 • 11:45

### **Generation and Verification of Free-Electron-Photon Entanglement**

Jan-Wilke Henke<sup>1,2</sup>, Hao Jeng<sup>1,2</sup>, Murat Sivis<sup>1,2</sup>, Claus Ropers<sup>1,2</sup>; <sup>1</sup>*MPI Multidisziplinäre Naturwissenschaft, Germany*; <sup>2</sup>*4th Physical Inst., Univ. of Göttingen, Germany*. We demonstrate entanglement between a free electron's path and the polarisation of a generated photon, as evidenced by a violation of the Peres-Horodecki criterion exceeding 7 standard deviations. To this end, we reconstruct the joint electron-photon from coincidence measurements in different bases.

## QTu2B.6 • 12:00

### **Multi-Outcome High-Dimensional Bell Inequality Violations Using Joint Spectral Intensity Measurements**

Kiki F. Dekkers<sup>1</sup>, Laura Serino<sup>2</sup>, Nicola D'Alessandro<sup>3</sup>, Abhinandan Bhattacharjee<sup>2</sup>, Benjamin Brecht<sup>2</sup>, Armin Tavakoli<sup>3</sup>, Christine Silberhorn<sup>3</sup>, Jonathan Leach<sup>1</sup>; <sup>1</sup>*Heriot-Watt Univ. School of Engineering and Physical Sciences, UK*; <sup>2</sup>*Inst. for Photonic Quantum Systems, Universitat Paderborn, Germany*; <sup>3</sup>*Physics Department and NanoLund, Lunds Universitet, Sweden*. We observe an 8-dimensional Bell violation using frequency-only measurements. This result is contrary to the belief that the joint spectral intensity does not have sufficient information to certify entanglement or Bell-nonlocality.

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## QTu2B.7 • 12:15

**Individual Emitter Inference From Ensemble Photon Statistics**, Nicolas Dalbec-Constant<sup>1,2</sup>, Guillaume Thekkadath<sup>2</sup>, Duncan England<sup>2</sup>, Philip Bustard<sup>2</sup>, Frédéric Bouchard<sup>2</sup>, Benjamin Sussman<sup>1,2</sup>; <sup>1</sup>*Univ. of Ottawa, Canada*; <sup>2</sup>*National Research Council Canada, Canada*. Applicable to temporal, spatial, and spectral degrees of freedom, we present progress toward exploiting photon-counting statistics to reconstruct individual modes within unresolved ensembles, demonstrating parameter estimation beyond the resolution imposed by the measurement response function.

10:30 -- 12:30

Room: Carron

## QTu2C • Engineering and Applications of Quantum Light

### QTu2C.1 • 10:30 (Tutorial)

**Spectral Engineering of Pulsed Quantum Light and Its Applications**, Benjamin Brecht<sup>1</sup>; <sup>1</sup>*Universität Paderborn, Germany*. Temporal modes of optical quantum pulses are a promising resource for photonic quantum technologies. I will introduce the underlying mechanisms, discuss means for tailoring the temporal-mode structure of states and processes, and highlight recent applications. He is one of the co-inventors of the ORCA memory. He returned to Paderborn Univ. in 2018 to as group leader of the Quantum Networks Group in the Integrated Quantum Optics group led by Prof Christine Silberhorn. His current research covers the generation, manipulation, and application of pulsed broadband quantum light in quantum metrology and spectroscopy, communications and computing.

### QTu2C.2 • 12:00

Withdrawn

### QTu2C.3 • 12:15

**Two-Mode Squeezing in Fiber in the Quasi-CW Regime**, Elad Zehavi<sup>2</sup>, Alon Bernstein<sup>1,2</sup>, Michal Nathan<sup>3</sup>, Yosef London<sup>2,3</sup>, Avi Zadok<sup>1,2</sup>, Avi Pe'er<sup>3</sup>; <sup>1</sup>*Technion Israel Inst. of Technology, Israel*; <sup>2</sup>*Bar-Ilan Univ. Faculty of Engineering, Israel*; <sup>3</sup>*Bar-Ilan Univ. Faculty of Exact Sciences, Israel*. Two-mode squeezing is demonstrated in an optical fiber parametric amplifier, with 7.5dB gain and a strong coherent seed. The squeezed light is generated in quasi-CW, allowing simple integration with current telecom technology

10:30 -- 12:30

Room: Lomond Auditorium

## QTu2D • Nanophotonics for Quantum Networks

*Presider: Sonali Gera, SUNY Stony Brook, USA*

### QTu2D.1 • 10:30

**Highly Indistinguishable Single Photons From Tin-Vacancy Centers in Diamond**, Dennis Herrmann<sup>1</sup>, Robert Morsch<sup>1</sup>, Tobias Bauer<sup>1</sup>, Marlon Schäfer<sup>1</sup>, David Lindler<sup>1</sup>, Peter van Loock<sup>2</sup>, Christoph Becher<sup>1</sup>; <sup>1</sup>*Universität des Saarlandes, Germany*; <sup>2</sup>*Johannes Gutenberg Universität Mainz, Germany*. We generate highly indistinguishable single photons from a tin-vacancy center in diamond under pulsed resonant excitation. We observe raw Hong-Ou-Mandel visibilities above 95% for consecutively emitted visible photons using cross-polarization suppression

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## QTu2D.2 • 10:45

**Highly-Efficient Quantum Frequency Conversion of Single Photons From Tin-Vacancy Centers in Diamond**, Marlon Schäfer<sup>1</sup>, David Lindler<sup>1</sup>, Dennis Herrmann<sup>1</sup>, Robert Morsch<sup>1</sup>, Tobias Bauer<sup>1</sup>, Christoph Becher<sup>1</sup>; <sup>1</sup>*Universität des Saarlandes, Germany*. We demonstrate two-stage quantum frequency conversion of single photons from tin-vacancy centers in diamond to the telecom C-band, achieving 45% external efficiency and 100 Hz noise, and characterizing single-photon statistics and indistinguishability after conversion.

## QTu2D.3 • 11:00

**Toward on-Chip Interference of Tin-Vacancy Centres in Integrated Diamond Nanophotonics**, Colin Sauerzapf<sup>1</sup>, Tom Jäger<sup>1</sup>, Jonathan Enßlin<sup>1</sup>, Vladislav Bushmakin<sup>1,2</sup>, Oliver von Berg<sup>1</sup>, Victoria Voinkova<sup>1</sup>, Vadim Vorobyov<sup>1</sup>, Jörg Wrachtrup<sup>1,2</sup>; <sup>1</sup>*3rd Inst. of Physics, Universität Stuttgart, Germany*; <sup>2</sup>*Max-Planck-Institut für Festkörperforschung, Germany*. Integrated diamond photonics enhance the optical properties of colour centres and enable flying-qubit processing. We report our progress toward coupling a tin-vacancy centre to a diamond waveguide and implementing on-chip interference using a diamond directional coupler.

## QTu2D.4 • 11:15

**Broadband Noise Spectroscopy of Rare-Earth Quantum Network Nodes**, Will A. Pajak<sup>1,2</sup>, Emanuel Green<sup>1,2</sup>, Mariya Ezzy<sup>1,2</sup>, Erin Liu<sup>1,2</sup>, Austin Minnich<sup>1,2</sup>, Joonhee Choi<sup>3</sup>, Andrei Faraon<sup>1,2</sup>; <sup>1</sup>*Thomas J. Watson, Sr, Laboratory of Applied Physics, California Inst. of Technology, USA*; <sup>2</sup>*Inst. for Quantum Information and Matter, California Inst. of Technology, USA*; <sup>3</sup>*Department of Electrical Engineering, Stanford Univ., USA*. We perform broadband noise spectroscopy of single Ytterbium ion quantum network nodes by combining three interrogating methods which reveal kHz level noise and interaction with nuclear spins as the dominant source for Ytterbium spin decoherence.

## QTu2D.5 • 11:30

**High-Q Diamond Bulk Acoustic Resonators for Spin-Phonon Quantum Memory Interfaces**, Arianne Brooks<sup>2</sup>, Stefan A. Pflüger<sup>2</sup>, Chris Adambukulam<sup>2</sup>, Oleksandr Pshyk<sup>1</sup>, Sebastian Siol<sup>1</sup>, Yiwen Chu<sup>2</sup>; <sup>1</sup>*EMPA, Swiss Federal Laboratories for Materials Science and Technology, Switzerland*; <sup>2</sup>*Department of Physics, Eidgenössische Technische Hochschule Zurich, Switzerland*. We present our progress toward designing and building a platform for spin-phonon coupling. We use SiVs implanted in high-overtone bulk acoustic resonators in diamond, ultimately paving the way for quantum spin memories for microwave circuits.

## QTu2D.6 • 11:45

**Spectral and Polarization Control of High Purity Lithium Niobate Nanophotonic Photon-Pair Sources**, Tristan Kuttner<sup>1</sup>, Matthieu Borello<sup>1</sup>, Rachel Grange<sup>1</sup>, Robert J. Chapman<sup>1</sup>; <sup>1</sup>*ETH Zurich, Switzerland*. We demonstrate an integrated lithium niobate SPDC source generating spectrally separable, deterministically split photon-pairs, with strongly tunable spectra towards degenerate or non-degenerate operation, which we use to demonstrate single source HOM interference with 92% visibility.

## QTu2D.7 • 12:00

**Transfer Printing of Diamond Microchips on Foundry Photonic Circuits for Scalable Color Center Quantum Technologies**, Jan Riegelmeyer<sup>1,2</sup>, Leonardo G. Wienhoven<sup>1</sup>, Fabrice-Roland Lamberti<sup>3</sup>, Nina Codreanu<sup>1,4</sup>, Onur Özdemir<sup>3</sup>, Sandeep S. Saseendran<sup>3</sup>, Tobias

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Martens<sup>1</sup>, Sjoerd J. Loenen<sup>4</sup>, Caroline E. Smulders<sup>1,4</sup>, Elena Volkova<sup>1,2</sup>, Kees Koot<sup>1</sup>, Xavier Rottenberg<sup>3</sup>, Ronald Hanson<sup>1,4</sup>, Carlos Errando-Herranz<sup>1,2</sup>; <sup>1</sup>*QuTech and Kavli Inst. of Nanoscience, Delft Univ. of Technology, Netherlands*; <sup>2</sup>*Department of Quantum and Computer Engineering, Delft Univ. of Technology, Netherlands*; <sup>3</sup>*IMEC, Belgium*; <sup>4</sup>*Delft Networks B.V., Netherlands*. We demonstrate hybrid integration of diamond microchips on SiN foundry photonic circuits via an adapted transfer printing process. Chiplet design and transfer are optimized and successful integration is confirmed by optical transmission measurements.

## QTu2D.8 • 12:15

**Scalable Registration of Solid-State Defect Qubits in Solid Immersion Lenses Through Femtosecond Laser Writing**, Alexander Jones<sup>1</sup>, Xingrui Cheng<sup>2,4</sup>, Shravan K. Parthasarathy<sup>3</sup>, Muhammad J. Arshad<sup>1</sup>, Pasquale Cilibrizzi<sup>1</sup>, Roland Nagy<sup>3</sup>, Patrick Salter<sup>2</sup>, Jason Smith<sup>4</sup>, Cristian Bonato<sup>1</sup>, Christiaan Bekker<sup>1</sup>; <sup>1</sup>*Inst. of Photonics and Quantum Sciences, Heriot-Watt Univ., UK*; <sup>2</sup>*Department of Engineering Science, Univ. of Oxford, UK*; <sup>3</sup>*Inst. of Applied Quantum Technologies, Friedrich-Alexander-Universitat Erlangen-Nurnberg, Germany*; <sup>4</sup>*Department of Materials, Univ. of Oxford, UK*. We demonstrate scalable generation of micrometer-deep arrays of solid-state qubits in the single-emitter regime through femtosecond laser writing. These arrays are registered to the center of solid immersion lens structures to maximize photon collection efficiency.

**14:00 -- 16:00**

**Room: Hall 2**

**QTu3A • Poster Session I**

## QTu3A.1

**Protecting Coherence in the Glued-Trees Quantum Walk**, Matan Haller<sup>1</sup>, Aliaksei Horlach<sup>1</sup>, Daniel Maison<sup>1</sup>, Nir Gutman<sup>1</sup>, Ido E. Kaminer<sup>1</sup>; <sup>1</sup>*Technion Israel Inst. of Technology, Israel*. The glued-trees quantum walk demonstrates exponential speedup over classical walk, but disorder suppresses it. We show that adding sparse intra-layer connections protects phase coherence and restores the advantage, enabling disorder-robust quantum-walk algorithms.

## QTu3A.2

**Phase Randomization of DFB Laser Pulses Beyond the Diffusion Limit**, Adam Brzosko<sup>2,1</sup>, Yuen S. Lo<sup>1</sup>, Peter R. Smith<sup>1</sup>, Robert Woodward<sup>1</sup>, Davide Marangon<sup>1</sup>, James Dynes<sup>1</sup>, Sergio Juarez<sup>1</sup>, Taofiq Paraiso<sup>1</sup>, R. Mark Stevenson<sup>1</sup>, Andrew J. Shields<sup>1</sup>; <sup>1</sup>*Toshiba Europe Limited Cambridge Research Laboratory, UK*; <sup>2</sup>*Univ. of Cambridge, UK*. We report increasing the rate of phase randomization of an optical field in a DFB laser cavity using externally injected ASE light. This enables a demonstration of 10 GHz gain-switched phase-randomized pulses for quantum technology applications.

## QTu3A.3

**Towards Optically Interfaced Quantum Memory Nodes With tin-Vacancy (SnV) Centers in Diamond**, Alexander Moritz Stramma<sup>1</sup>, Christopher Waas<sup>1</sup>, Timo Dolné<sup>1</sup>, Hans K. C. Beukers<sup>1</sup>, Nina Codreanu<sup>1</sup>, Ronald Hanson<sup>1</sup>; <sup>1</sup>*QuTech, Netherlands*. Quantum networks are based on remote entanglement between spatially separated quantum objects. We report on progress towards remote entanglement generation between two SnVs and show spin-photon correlations.

## QTu3A.4

# Optica Quantum 2.0 Conference and Exhibition

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**Thin-Film Lithium Niobate Receiver for Time-Bin Quantum Communication**, Andrea Bernardi<sup>2</sup>, Marco Clementi<sup>2</sup>, Marcello Bacchi<sup>2</sup>, Matias Rubén Bolanos<sup>1</sup>, Sara Congia<sup>2</sup>, Francesco Garrisi<sup>3</sup>, Andrea Martellosio<sup>3</sup>, Marco Passoni<sup>3</sup>, Alexander Wrobel<sup>3</sup>, Costantino Agnesi<sup>1</sup>, Giuseppe Vallone<sup>1</sup>, Paolo Villorosi<sup>1</sup>, Federico Andrea Sabbatoli<sup>3</sup>, Matteo Galli<sup>2</sup>, Daniele Bajoni<sup>2</sup>; <sup>1</sup>*Universita degli Studi di Padova, Italy*; <sup>2</sup>*Universita di Pavia, Italy*; <sup>3</sup>*Advanced Fiber Resources s.r.l, Italy*. We present a thin-film lithium niobate quantum receiver enabling gigahertz-rate manipulation of time-bin qubits without temporal post-selection. By actively switching time bins, we certify entanglement with >95% visibility and demonstrate stable, high-rate entanglement-based quantum key distribution.

## QTu3A.5

**Asynchronous Multiphoton Interference for Quantum Networks**, Baghdasar Baghdasaryan<sup>1</sup>, Karen Lozano Méndez<sup>2</sup>, Markus Leipe<sup>1,2</sup>, Meritxell Cabrejo-Ponce<sup>1,2</sup>, Kaushik Joarder<sup>1</sup>, Sabine Häussler<sup>1,2</sup>, Tim Gühring<sup>2</sup>, Stephan Fritzsche<sup>3,4</sup>, Thorsten A. Goebel<sup>1,2</sup>, Ria G. Krämer<sup>1</sup>, Stefan Nolte<sup>1,2</sup>, Carlos Andres Melo Luna<sup>2</sup>, Yoshiaki Tsujimoto<sup>5</sup>, Fabian Steinlechner<sup>1,2</sup>; <sup>1</sup>*Inst. of Applied Physics, Friedrich-Schiller-Universität Jena, Germany*; <sup>2</sup>*Fraunhofer-Institut für Angewandte Optik und Feinmechanik IOF, Germany*; <sup>3</sup>*Inst. for Theoretical Physics, Friedrich-Schiller-Universität Jena, Germany*; <sup>4</sup>*Helmholtz-Institut Jena, Germany*; <sup>5</sup>*National Inst. of Information and Communications Technology (NICT), 184-8795 Tokyo, Japan, Japan*. We develop and experimentally validate a model quantifying photon indistinguishability in continuous-wave multiphoton interference. For a target visibility and fixed detector timing jitter, we identify an optimal coincidence window that maximizes the CW photon rate.

## QTu3A.6

**Enabling Continuous Variable Quantum Key Distribution From Space**, Emma T. Medlock<sup>1</sup>, Harriet Soulsby<sup>1</sup>, Vinod N. Rao<sup>1,2</sup>, Timothy Spiller<sup>1,2</sup>, Rupesh Kumar<sup>1,2</sup>; <sup>1</sup>*Univ. of York, UK*; <sup>2</sup>*Quantum Communications Hub, UK*. We discuss parameters influencing space to ground quantum communication, addressing the enablers for continuous variable quantum key distribution (CV-QKD), provide simulation and emulation results and propose optimal architecture.

## QTu3A.7

Withdrawn

## QTu3A.8

**Deterministic Control of Spontaneous Emission in Hybrid Photonic–Plasmonic Cavities**, BELKIS GOKBULUT<sup>1</sup>, Naci Inci<sup>1</sup>; <sup>1</sup>*Bogazici Universitesi, Turkey*. We demonstrate deterministic quantum control of spontaneous emission using a hybrid photonic–plasmonic whispering-gallery resonator. Coupling perovskite nanowire emitters to hybrid modes reshapes the local density of states, accelerates emission dynamics, and enhances single-emitter cooperativity by 6.4.

## QTu3A.9

**Piezoelectric Properties of Thin Film Strontium Titanate**, Danut-Valentin Dinu<sup>1,2</sup>, Ahmed Khalil<sup>1,3</sup>, Anja Ulrich<sup>1,2</sup>, Kamal Brahim<sup>1,3</sup>, Andries Boelen<sup>1,3</sup>, Halil Cuma<sup>1,3</sup>, Ioannis Petrides<sup>1</sup>, Xavier Rottenberg<sup>1</sup>, Pol Van Dorpe<sup>1,3</sup>, Kristiaan De Greeve<sup>1,3</sup>, Clement Merckling<sup>1,3</sup>, Frédéric Peyskens<sup>1</sup>, Christian Haffner<sup>1</sup>; <sup>1</sup>*Interuniversitair Micro-Elektronica Centrum, Belgium*; <sup>2</sup>*Universiteit Gent, Belgium*; <sup>3</sup>*Katholieke Universiteit Leuven, Belgium*. We report an epitaxially grown thin film strontium titanate (SrTiO<sub>3</sub>) with an observed linear piezoelectric

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## QTu3A.10

Withdrawn

## QTu3A.11

**Entropy-Time Duality and Certified Min-Entropy in an SPDC-Based Quantum Random Number Generator**, Utkarsh K. Singh<sup>1</sup>, Afzal Saifi<sup>1</sup>, Devnath Dhirhe<sup>1</sup>; <sup>1</sup>*Defence Inst. of Advanced Technology, India*. We uncover an entropy–time duality in SPDC-based QRNGs, where certified min-entropy is governed by temporal coarse-graining. This physics-aware framework enables direct randomness certification from time correlations, replacing purely statistical validation with physical quantification.

## QTu3A.12

Withdrawn

## QTu3A.13

**Point Spread Function Engineering With Undetected Photons**, Emma P. Pearce<sup>1,2</sup>, Osian Wolley<sup>1</sup>, Simon P. Mekhail<sup>1</sup>, Thomas Gregory<sup>1</sup>, Miles J. Padgett<sup>1</sup>; <sup>1</sup>*School of Physics and Astronomy, Univ. of Glasgow, UK*; <sup>2</sup>*Institut für Physik, Humboldt-Universität zu Berlin, Germany*. We control the Fourier components of undetected photons using a spatial light modulator (SLM) in the detected beam, enabling point-spread function engineering. We demonstrate edge-enhanced, spiral phase-contrast infrared imaging without an infrared camera or SLM.

## QTu3A.14

Withdrawn

## QTu3A.15

**Stochastic Modeling of Photon Correlations of Single Quantum Emitters**, Felix Hitzelhammer<sup>1</sup>, Johannes Stowasser<sup>2</sup>, Lukas Hanschke<sup>2,3</sup>, Katarina Boos<sup>2,3</sup>, Tobias C. Sutter<sup>4</sup>, Michael Haider<sup>5</sup>, Christian Jirauschek<sup>2,6</sup>, Kai Mueller<sup>2,3</sup>, Gaby Slavcheva<sup>1,7</sup>, Ulrich Hohenester<sup>1</sup>; <sup>1</sup>*Universität Graz, Austria*; <sup>2</sup>*Technische Universität München, Germany*; <sup>3</sup>*Technische Universität München Walter Schottky Inst. Center for Nanotechnology and Nanomaterials, Germany*; <sup>4</sup>*Faculty of Physics, Universität Wien, Austria*; <sup>5</sup>*Department of Electrical Power Systems and Information Technology, Univ. of the Bundeswehr Munich, Germany*; <sup>6</sup>*TUM Center for Quantum Engineering (ZQE), Germany*; <sup>7</sup>*Quantopticon, USA*. We present a quantum-classical hybrid approach to simulate key quantum correlations of an optically driven single emitter. Recasting the dynamics into stochastic differential equations enables coupling with a finite-difference time-domain Maxwell solver.

## QTu3A.16

**Optimal Beam Displacement Measurements Using High-Order Structured Light Modes**, Andre Junior<sup>1</sup>, Juscelino Carvalho Junior<sup>1</sup>, Marcos Gil de Oliveira<sup>1</sup>, Elton Cubas<sup>1</sup>, Rafael F. Barros<sup>2</sup>, Antonio Zelaquett<sup>1</sup>, Gabriel B. Alves<sup>1</sup>; <sup>1</sup>*Physics, Universidade Federal Fluminense, Brazil*; <sup>2</sup>*Physics, Universidade de Sao Paulo, Brazil*. A new technique uses high-order HG and LG modes and a parity sorter to measure beam displacements. Signal-to-noise ratio improvements of up to 41-fold were reported, offering high-precision metrology without quantum light or homodyne detection.

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## QTu3A.17

**Multi-Level Quantum Circuit Visualization Framework for Comparative Analysis and Optimization**, Chungheon Baek<sup>1</sup>, Sanguk Lim<sup>1,2</sup>, Taewan Kim<sup>1</sup>; <sup>1</sup>*Electronics and Telecom Research Inst, Korea (the Republic of)*; <sup>2</sup>*Kyung Hee Univ., Korea (the Republic of)*. We present a quantum circuit visualization framework for comparative analysis across multiple levels, supporting examples including quantum algorithms, fault-tolerance compilations, and hardware-specific optimizations.

## QTu3A.18

**Benchmarking Noisy-Intermediate Scale Hardware With the Quantum Permutation Algorithm: a Case Study on IBM Sherbrooke**, Ashley N. Blackwell<sup>1</sup>, Evan M. Reeves<sup>1</sup>, Amirali Khannejad<sup>1</sup>, Erin M. Strickland<sup>2</sup>, Sara A. Metwalli<sup>1</sup>, Emanuel Gomez<sup>1</sup>, Cornelius Salonis<sup>2</sup>, Zizwe A. Chase<sup>1</sup>, Ryan T. Glasser<sup>3</sup>, Brian T. Kirby<sup>3,4</sup>, Sanjaya Lohani<sup>5</sup>, Thomas A. Searles<sup>1</sup>; <sup>1</sup>*Electrical and Computer Engineering, Univ. of Illinois Chicago, USA*; <sup>2</sup>*IBM HBCU Quantum Center, USA*; <sup>3</sup>*Tulane Univ. School of Science & Engineering, USA*; <sup>4</sup>*US Army Research Laboratory Sensors and Electron Devices Directorate, USA*; <sup>5</sup>*Southern Methodist Univ. Lyle School of Engineering, USA*. We benchmark IBM Sherbrooke quantum hardware with two- and three-qubit quantum permutation algorithm (QPA) circuits, comparing simulator and device outputs. Shallow circuits agree, but deeper multi-qubit gates lose fidelity. QPA looks to be a promising benchmark algorithm.

## QTu3A.19

**Photonic Physical Neural Networks.**, Joshua Burns<sup>2</sup>, Gerard J. Milburn<sup>1,2</sup>; <sup>1</sup>*National Quantum Computing Centre, UK*; <sup>2</sup>*Univ. of Sussex, UK*. We describe how optomechanical crystals can be used to implement physical neural networks with data encoded on photon number pulses. As an example, we show how a physical recurrent neural network can be implemented for causal discovery.

## QTu3A.20

**Experimental Verification of Quantum Correlations Using Four-Qubit Dicke States With Measurement Cross-Talk Certification**, Harsh Mehta<sup>1</sup>, Tomis Prajapati<sup>2,3</sup>, Yash Verma<sup>4</sup>, V. Narayanan<sup>2,1</sup>; <sup>1</sup>*Quantum Information and Computation (IDRP), Indian Inst. of Technology Jodhpur, India*; <sup>2</sup>*Department of Physics, Indian Inst. of Technology Jodhpur, India*; <sup>3</sup>*Department of Physics, Tata Inst. of Fundamental Research, India*; <sup>4</sup>*Department of Materials Engineering, Indian Inst. of Technology Jodhpur, India*. Multipartite Bell violations on superconducting QPUs can be compromised by measurement cross-talk and signaling. By combining four-qubit Dicke Bell inequality with interleaved pairwise CHSH no-signaling tests, we show that observed violations arise from genuine quantum correlations under statistically certified device-level no-signaling conditions.

## QTu3A.21

**A Quantum-Inspired Algorithm for Graph Isomorphism**, Innes Maxwell<sup>2,1</sup>, Stefan van den Hoven<sup>1</sup>, Jelmer Renema<sup>2,1</sup>; <sup>1</sup>*Universiteit Twente, Netherlands*; <sup>2</sup>*Technische Universiteit Eindhoven, Netherlands*. Inspired by a photonic quantum algorithm (Bradler et. al., *Special Matrices*, 9(1):166–196, 2021) for graph isomorphism and formulate a new necessary condition and classical algorithm. Using sampler mode correlations our method identifies non-isomorphic graphs with computational cost comparable to the quantum method.

## QTu3A.22

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**Entropy Enhancement in Quantum Key Distribution via a Dynamic Polarization Controller**, Abdulhay C. Kara<sup>2,1</sup>, Suheyl Token<sup>1</sup>, Kaan Yildiz<sup>3</sup>, Ekmel Ozbay<sup>2,3</sup>, Ibrahim Ozdur<sup>4</sup>; <sup>1</sup>*Bilkent Universitesi Nanoteknoloji Arastirma Merkezi, Turkey*; <sup>2</sup>*Physics, Bilkent Universitesi, Turkey*; <sup>3</sup>*Electrical and Electronics Engineering, Bilkent Universitesi, Turkey*; <sup>4</sup>*Electrical and Electronics Engineering, TOBB Ekonomi ve Teknoloji Universitesi, Turkey*. We enhance security in polarization-encoded BB84 by mitigating entropy loss from detector-efficiency mismatch via dynamic polarization control. Random switching balances SPAD counts, raising min-entropy from 0.91 to 0.985 without increasing QBER (~4%).

## QTu3A.23

**Probing Temporal Quantum Correlation via Leggett–Garg Inequality in an Atom Coupled Dual Microresonator System**, Abhishek Mandal<sup>1</sup>, Joy Ghosh<sup>1</sup>, Maruthi Manoj Brundavanam<sup>1</sup>, Shailendra K. Varshney<sup>1</sup>; <sup>1</sup>*Indian Inst. of Technology Kharagpur, India*. We investigate temporal quantum correlation in an atom–coupled dual microresonator system by testing the violation of Leggett–Garg inequality. The dynamics uncover how strong light–matter interactions, coupling, and coherent mode hybridization violate macrorealistic bounds and establish quantum correlation.

## QTu3A.24

**Entanglement Distribution Over an Actively Polarization-Stabilized Commercial Fiber Link**, Akriti Raj<sup>1</sup>, Tobias Bauer<sup>1</sup>, Christian Haen<sup>1</sup>, David Lindler<sup>1</sup>, Quankui Yang<sup>2</sup>, Thorsten Passow<sup>2</sup>, Marko Härtelt<sup>2</sup>, Jürgen Eschner<sup>1</sup>, Christoph Becher<sup>1</sup>; <sup>1</sup>*Universitat des Saarlandes, Germany*; <sup>2</sup>*Fraunhofer-Institut für Angewandte Festkörperphysik IAF, Germany*. We present a polarization-entangled photon pair source at telecom wavelength from an AlGaAs Bragg reflection waveguide. We demonstrate preservation of entanglement after distribution over an actively stabilized 28 km metropolitan dark fiber link.

## QTu3A.25

**Optical Routing with Arrays of Cold Atoms Around a Nanofiber**, Alban Urvoy<sup>1</sup>, Jérémy Berroir<sup>1,2</sup>, Tridib Ray<sup>1,2</sup>, Julien Laurat<sup>1</sup>; <sup>1</sup>*Laboratoire Kastler Brossel, France*; <sup>2</sup>*Welinq, France*. We present optical routing of single-photon-level pulses based on EIT with Bragg-ordered arrays of cesium atoms trapped around a nanofiber. The propagation direction (reflection/transmission) is controlled with ultralow power down to tens of photons.

## QTu3A.26

**Twelve-Mode Frequency-bin Domain-Engineered Entangled Photon Source**, Ana Maria Torres<sup>1</sup>, Fabrizio Chiriano<sup>1</sup>, Joseph Ho<sup>1</sup>, Alessandro Fedrizzi<sup>1</sup>; <sup>1</sup>*Heriot Watt Univ., UK*. We report on a twelve-mode frequency-bin entangled photon source based on an extended-length nonlinearity-engineered crystal. Our source is compatible with DWDM-based multi-user quantum networks.

## QTu3A.27

**Experimental Comparison of Twin-Field QKD Compensation Schemes**, Anagha Gayathri<sup>1,2</sup>, Nilesh Sharma<sup>1,2</sup>, Anil Prabhakar<sup>1,2</sup>; <sup>1</sup>*Electrical Engineering, Indian Inst. of Technology Madras, India*; <sup>2</sup>*Centre for Quantum Information, Communication and Computing (CQuICC), Indian Inst. of Technology Madras, India*. We benchmark three phase and polarisation compensation schemes for twin-field QKD, plug-and-play (PnP), PnP with post-processing, and Sagnac-based PnP. The Sagnac-based PnP sustains 90% visibility over 50 km, making it suitable for metro-access TF-QKD links.

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## QTu3A.28

**Entanglement Distribution with Quantum - White Rabbit Coexistence Over Metropolitan Distances**, Annick Teepe<sup>3</sup>, Federica Facchin<sup>1</sup>, Mario Castaneda<sup>1</sup>, Shane Andrewski<sup>2</sup>, Mael Flament<sup>2</sup>; <sup>1</sup>*Single Quantum B V, Netherlands*; <sup>2</sup>*Qunnect NL, Netherlands*; <sup>3</sup>*European Organization for Nuclear Research, Switzerland*. We demonstrate the distribution of polarization-entangled photon pairs over 29.5 km of deployed optical fiber coexisting with White Rabbit timing signals, proving its role as a key synchronization method for quantum communication.

## QTu3A.29

**Benchmarking a Universal Frequency Reference for a Multi-Node Quantum Network**, Anthony Del Valle<sup>1</sup>, Chase Wallace<sup>1</sup>, Tsering Lodhen<sup>1</sup>, Chi-Chih Chen<sup>1</sup>, Leonardo Castillo-Veneros<sup>1</sup>, Dounan Du<sup>1</sup>, Eden Figueroa<sup>1</sup>; <sup>1</sup>*SUNY Stony Brook, USA*. We discuss how two independent frequency-locked laser systems deployed between distant nodes of a quantum network can be used for a Hong-Ou-Mandel Interference experiment to create a closed loop minimizing the frequency difference between quantum fields.

## QTu3A.30

**Digital Reconstruction of Entanglement in Continuous Variable States**, Benjamin L. Larsen<sup>1</sup>, Huy Q. Nguyen<sup>1</sup>, Adnan Hajomer<sup>1</sup>, Tobias Ghering<sup>1</sup>, Jonas S. Neergaard-Nielsen<sup>1</sup>, ulrik lund L. andersen<sup>1</sup>; <sup>1</sup>*Danmarks Tekniske Universitet, Denmark*. In continuous-variable quantum optics, measurements are often implemented by feedback locking between a local-oscillator and a signal. Here we forgo the locking by digitally reconstructing the phase of a strong pilot distributed alongside the signal.

## QTu3A.31

**Correlation-Based Information Reconciliation for High-Dimensional Quantum Key Distribution**, Bo Yang<sup>1,2</sup>, Hao Yu<sup>1,3</sup>, Hao Kun Mao<sup>2</sup>, Qiong Li<sup>2</sup>, Lipket Chin<sup>1,3</sup>, Hong Cai<sup>1,3</sup>, AiQun Liu<sup>1,3</sup>; <sup>1</sup>*Research Inst. for Quantum Technology, The Hong Kong Polytechnic Univ., Hong Kong*; <sup>2</sup>*Faculty of Computing, Harbin Inst. of Technology, China*; <sup>3</sup>*Department of Electrical and Electronic Engineering, The Hong Kong Polytechnic Univ., Hong Kong*. We demonstrated an optimized reconciliation scheme for four-dimensional time-bin quantum key distribution that exploits inter-layer error correlations and selective discarding, achieving improved secret key extraction with efficiencies of 1.026 for Cascade and 1.096 for LDPC.

## QTu3A.32

**Capacity and SKR Trade-off in Coexisting Classical and CV-QKD Metro-Reach Links**, Cagla Ozkan<sup>1</sup>, Lucas Alves Zischler<sup>2</sup>, Kadir Gümüs<sup>1</sup>, João dos Reis Frazão<sup>1</sup>, Cristian Antonelli<sup>2</sup>, Chigo Okonkwo<sup>1</sup>; <sup>1</sup>*Technische Universiteit Eindhoven, Netherlands*; <sup>2</sup>*Universita degli Studi dell'Aquila Biblioteca dell'Area di ingegneria, Italy*. We evaluate the coexistence impairments of CV-QKD in metropolitan DWDM networks. Using a comprehensive interference model, we develop guardband rules where band-edge placement with 100–150 GHz guardbands doubles SKR with minimal classical capacity loss.

## QTu3A.33

**Fourier-Transform Quantum State Tomography of Time-Bin Qubits**, Carla M. Richter<sup>1,2</sup>, Michael Antesberger<sup>1,2</sup>, Philipp K. Jenke<sup>3,2</sup>, Philip Walther<sup>1,4</sup>, Lee A. Rozema<sup>1</sup>; <sup>1</sup>*Vienna Center for Quantum Science and Technology (VCQ), Research Network Quantum Aspects of Space Time (TURIS), Boltzmannngasse 5, 1090 Vienna, Austria, Universitat Wien, Austria*; <sup>2</sup>*Vienna Doctoral School in Physics, Universitat Wien Fakultat*

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## QTu3A.34

### **The ESA QSVF Project for QKD Implementation Security and Support to**

**Certification**, Carlo Liorni<sup>1</sup>, Federico Grasselli<sup>1</sup>, Filippo Cerocchi<sup>1</sup>, Massimiliano Proietti<sup>1</sup>, Massimiliano Dispenza<sup>1</sup>; <sup>1</sup>*Leonardo S.p.A., Italy*. The ESA QSVF project will tackle the arduous problem of probing the implementation security of commercial and experimental QKD and PQC implementations to pave the way towards certification of quantum-safe communications technologies.

## QTu3A.35

### **Polarization to Time-bin Qubit Conversion of Atom-Photon Entanglement From**

**a <sup>40</sup>Ca<sup>+</sup> ion**, Christian Haen<sup>1</sup>, Julian Groß-Funk<sup>1,2</sup>, Max Bergerhoff<sup>1</sup>, Tobias Bauer<sup>1</sup>, Pascal Baumgart<sup>1</sup>, Christoph Becher<sup>1</sup>, Jürgen Eschner<sup>1</sup>; <sup>1</sup>*Experimentalphysik, Universitat des Saarlandes, Germany*; <sup>2</sup>*Deutsches Zentrum fur Luft- und Raumfahrt DLR Institut fur Quantentechnologien, Germany*. We generate atom-photon entanglement using a <sup>40</sup>Ca<sup>+</sup> ion and convert it from polarization to telecom time-bin qubits using a telecom fiber interferometer, thereby enabling hybrid quantum networks.

## QTu3A.36

### **Coincident Spectral Filtering for Source Matching in Cascaded**

**Downconversion**, Mohammed Charafi<sup>1</sup>, Alexandre Z. Leger<sup>1</sup>, Samridhi Gambhir<sup>1,2</sup>, Deny R. Hamel<sup>1</sup>; <sup>1</sup>*Physique et astronomie, Universite de Moncton, Canada*; <sup>2</sup>*Quantum Bridge Technologies Inc., Canada*. We demonstrate heralded spectral matching in cascaded downconversion using coincident filtering, enabling efficient conversion between spectrally mismatched nonlinear sources and yielding a 66% increase in detected photon triplet rates for a fixed heralding detection rate.

## QTu3A.37

### **Multi-Color Continuous Variables Unconditional Quantum Teleportation: From Near-**

**Infrared to Telecommunications' L-Band**, Felipe L. Gewers<sup>1</sup>, Gabriel da Cruz Borba de Andrade<sup>1</sup>, Beatriz Moura<sup>1</sup>, Túlio Brasil<sup>4</sup>, Rayssa B. de Andrade<sup>2</sup>, Igor Konieczniak<sup>3</sup>, Paulo Nussenzveig<sup>1</sup>, Marcelo Martinelli<sup>1</sup>; <sup>1</sup>*Universidade de Sao Paulo Instituto de Fisica, Brazil*; <sup>2</sup>*NKT Photonics Ltd, Denmark*; <sup>3</sup>*Universidade Federal do Parana, Brazil*; <sup>4</sup>*Kobenhavns Universitet Niels Bohr Instituttet, Denmark*. We demonstrate an unconditional quantum teleportation system between Rubidium D1 line and telecommunications' L-band. For a coherent input state, a fidelity of  $F = 56.2(5)\%$  was achieved.

## QTu3A.38

### **Agile Tunable High Power Transform Limited Pump Laser for Quantum Frequency**

**Conversion**, Akshay Soni<sup>1</sup>, Mehmetcan Akbulut<sup>1</sup>; <sup>1</sup>*The Univ. of Arizona James C Wyant College of Optical Sciences, USA*. An agile frequency-tunable pump laser architecture for Quantum Frequency Conversion is presented. Tuning range of up to 126 GHz, tuning speed of

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50 ns, high average power, pulsing capability, and transform limited performance are demonstrated.

## QTu3A.39

**Phase-Sensitive Characterisation of Quantum Frequency Conversion by Spectral Interferometry**, Mateusz J. Olszewski<sup>1</sup>, Kasper Alexander<sup>2</sup>, Michael Woodley<sup>1</sup>, Leah Murphy<sup>1</sup>, Alex O. Davis<sup>1</sup>; <sup>1</sup>*Univ. of Bath, UK*; <sup>2</sup>*Danmarks Tekniske Universitet, Denmark*. We introduce a scheme for complete phase-sensitive characterization of quantum frequency conversion. We experimentally recover the complex spectral transfer function of a Bragg-scattering four-wave mixing module based on photonic crystal fibre.

## QTu3A.40

**Low-Loss Stress-Optic Switch in Standard Optical Fiber for Quantum Networks**, Alice Christian-Edwards<sup>1</sup>, Paolo L. Mennea<sup>1</sup>, Rex H. Bannerman<sup>1</sup>, Peter Smith<sup>1</sup>, Corin B. Gawith<sup>1</sup>, Patrick Ledingham<sup>1</sup>, James C. Gates<sup>1</sup>; <sup>1</sup>*Univ. of Southampton, UK*. We demonstrate a low-loss, stress-optic switch in standard fibre using the thermal expansion of a Joule heated stressor wire, achieving 0.92 switching ratio with 250 ns rise time, 675 ns full width at half maximum.

## QTu3A.41

**Cavity-Enhanced Narrow-Band SPDC Source in Type-II PpKTP Crystal: Design and Optimization**, Barshodeep Deb<sup>1</sup>, Ankit Kaushik<sup>1</sup>, Joyee Ghosh<sup>1</sup>; <sup>1</sup>*Indian Inst. of Technology Delhi, India*. We present the design and numerical optimization of a cavity-enhanced SPDC source based on a ppKTP crystal for generating bright, narrow-band photons suitable for quantum communication and memory. Simulations predict sub-MHz bandwidth and enhanced spectral brightness.

## QTu3A.42

**On-Chip Continuous Variable Entanglement From Si<sub>3</sub>N<sub>4</sub> Ring Molecule Squeezers**, Cheng-Ting Liao<sup>1</sup>, Ming-Chang Lee<sup>1,2</sup>; <sup>1</sup>*Inst. of Photonics Technologies, National Tsing Hua Univ., Taiwan*; <sup>2</sup>*Department of Electrical Engineering, National Tsing Hua Univ., Taiwan*. We demonstrate on-chip generation of Einstein-Podolsky-Rosen entangled states by producing and manipulating two single-mode squeezed vacua from Si<sub>3</sub>N<sub>4</sub> ring molecule squeezers. Entanglement was verified by an inseparability criterion  $I = 0.87 \pm 0.01 < 1$

## QTu3A.43

**A Broadband, on-Demand, Telecom-Wavelength Quantum Memory in Pr:YSO for Quantum Dot Single-Photon Sources**, Frederik Brooke Barnes<sup>1</sup>, Meysam Setodeh Kheirabady<sup>1</sup>, Sean Keenan<sup>1</sup>, Lorenzo Peruccio<sup>2</sup>, Mattia Vidotto<sup>2</sup>, Ori Mor<sup>3</sup>, Patrick M. Ledingham<sup>3</sup>, Giacomo Corrielli<sup>2</sup>, Brian D. Gerardot<sup>1</sup>, Margherita Mazzera<sup>1</sup>; <sup>1</sup>*Heriot-Watt Univ., UK*; <sup>2</sup>*Istituto di Fotonica e Nanotecnologie, Consiglio Nazionale delle Ricerche (IFN-CNR), Italy*; <sup>3</sup>*Univ. of Southampton, UK*. We propose and present progress towards the implementation of a broadband, on-demand, telecom-wavelength quantum memory-quantum dot interface based on two-photon absorption and an atomic frequency comb in a fibre-pigtailed Pr:YSO waveguide.

## QTu3A.44

**HARLEQUIN: Deployed Cold Atom Interferometer for Inertial Navigation**, Jan-Simon Hennig<sup>1</sup>, Adam Selyem<sup>1</sup>, Alex Webber-Date<sup>2</sup>, Maxwell Rowley<sup>2</sup>, Paul F. Osborn<sup>2</sup>, Loyd J. McKnight<sup>1</sup>, Ed Boughton<sup>2</sup>; <sup>1</sup>*Fraunhofer UK Research Limited, UK*; <sup>2</sup>*CPI TMD Technologies Ltd, UK*. We present the design of a deployable cold atom interferometer system for augmenting

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classical inertial navigation for drift-free GNSS-denied navigation. Results from a marine field trial are also presented.

## QTu3A.45

**Advanced Fabrication of Alkali Vapor Cells for Quantum Sensors: Alkali Metal Dispensers and Getter Integration,** Alessio Corazza<sup>1</sup>, Luca Mauri<sup>1</sup>, Enea Rizzi<sup>1</sup>, Sonja Ceulemans<sup>2</sup>; <sup>1</sup>*Saes Getters Spa, Italy*; <sup>2</sup>*RG&G Consultancy, Belgium*. This work presents important advances for fabrication of miniaturized cesium and rubidium vapor cells, focusing on two enabling technologies: alkali metal dispensers for precise in-situ vapor generation and integrated getter films for gas purity control.

## QTu3A.46

**PI-MIRRA-Net: Physics-Informed Deep Learning for Magnetic Inverse Problem,** Ankit Khandelwal<sup>2</sup>, Anuj Bathla<sup>1</sup>, Prabhat Anand<sup>2</sup>, Kasturi Saha<sup>1</sup>, M G. Chandra<sup>2</sup>; <sup>1</sup>*Indian Inst. of Technology Bombay, India*; <sup>2</sup>*Tata Consultancy Services Limited, India*. We present PI-MIRRA-Net, a physics-informed deep network for current reconstruction. The method outperforms prior approaches, producing sharper reconstructions and physically consistent results across diverse geometries and stand-off distances.

## QTu3A.47

**A Fractured-Loop Framework for Periodically Modulated Atomic Systems,** Bartosz Kasza<sup>1</sup>, Jan Nowosielski<sup>1</sup>, Wiktor Krokosz<sup>1</sup>, Sebastian Borówka<sup>1</sup>, Mateusz Mazelanik<sup>1</sup>, Wojciech Wasilewski<sup>1</sup>, Michal Parniak<sup>1</sup>; <sup>1</sup>*Univ. of Warsaw, Poland*. We introduce a fractured-loop framework for periodically driven multi-level atomic systems, formulated using a Floquet-Liouville supermatrix approach. We apply this framework to atomic superheterodyne detectors and frequency-comb transducers.

## QTu3A.48

**Correlation Plenoptic Microscopy with Entangled Beams,** Davide Giannella<sup>1,2</sup>, Rosa Vaira<sup>1</sup>, Gianlorenzo Massaro<sup>1,2</sup>, Francesco V. Pepe<sup>1,2</sup>, Milena D'Angelo<sup>1,2</sup>; <sup>1</sup>*Dipartimento Interuniversitario di Fisica, Universita degli Studi di Bari Aldo Moro, Italy*; <sup>2</sup>*Istituto Nazionale di Fisica Nucleare Sezione di Bari, Italy*. We discuss a correlation plenoptic imaging (CPI) architecture oriented to microscopy, exploiting intensity correlations between entangled beams produced by spontaneous parametric down conversion (SPDC), analysing its refocusing capability and optical performance.

## QTu3A.49

**Axial Imaging via Fourth-Order Interference With Thermal Light,** Giuseppe Lerario<sup>1</sup>, Gianlorenzo Massaro<sup>1,2</sup>, Fabrizio Sgobba<sup>1,2</sup>, Milena D'Angelo<sup>1,2</sup>; <sup>1</sup>*Fisica, Universita degli Studi di Bari, Italy*; <sup>2</sup>*Istituto Nazionale di Fisica Nucleare, Italy*. We demonstrate an axial imaging scheme exploiting fourth-order interference with thermal light. Coincidence measurements are shown to enable HOM-like robustness against dispersion and phase noise, allowing low-cost quantum-enhanced ranging, axial tracking, and access to output-state statistics.

## QTu3A.50

**Correlation-Enhanced Optical Ranging Using a Double Optomechanical Cavity,** Greeshma Gopinath<sup>1</sup>, Sankar Davuluri<sup>1</sup>; <sup>1</sup>*Birla Inst. of Technology & Science, India*. We develop a correlation-driven optical ranging protocol for low-reflectivity targets, where quantum cross-correlated homodyne detection plays a central role. Strong probe-idler correlations from a double optomechanical cavity enable ranging without quantum storage of the idler.

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## QTu3A.51

### **Entanglement-Based Optical Fiber Temperature Sensor With Multi-Pair**

**Correlations**, Gregory R. Krueper<sup>1</sup>, Austin Campbell<sup>1</sup>, Michael B. Grayson<sup>2</sup>, Lynden K. Shalm<sup>2,1</sup>, Juliet T. Gopinath<sup>1</sup>; <sup>1</sup>*Univ. of Colorado Boulder, USA*; <sup>2</sup>*National Inst. of Standards and Technology, USA*. We implement real-time temperature tracking with an entanglement-based fiber-optic sensor. By recording two, three, and four-photon coincidences simultaneously, we report a temperature sensitivity of  $120 \mu\text{C} / \sqrt{\text{Hz}}$  with only 200 fW of power in the sensor.

## QTu3A.

### **Rejecting Excitation Light with Electronically Gated Superconducting Nanowire Single-Photon Detectors**

Hendrikus Vlot<sup>1</sup>, Martin Caldarola<sup>1</sup>, Lieuwe Loch<sup>1</sup>, Antonio Guardiani<sup>1</sup>, Andreas Fognini<sup>1</sup>; <sup>1</sup>*Single Quantum B.V., Netherlands*. A test setup was developed to quantify the suppression ratio of our electronically gated Superconducting Nanowire Single-Photon Detectors (SNSPDs). A suppression ratio of 50 dB was found, with peak power up to 67 uw.

## QTu3A.53

### **High Saturation Regime Limit for Molecular Single-Photon Sources**

Hugo Levy-Falk<sup>1</sup>, Daniele De Bernardis<sup>1</sup>, Elena Fanella<sup>1</sup>, Louise Morlaes<sup>1</sup>, Marco Arzilli<sup>1</sup>, Maja Colautti<sup>1</sup>, Costanza Toninelli<sup>1</sup>; <sup>1</sup>*CNR-INO, Italy*. We investigated the phenomenon known as anomalous saturation exhibited by single molecules embedded in molecular crystals. These excellent quantum emitters deviate from a perfect two-levels system in the high optical excitation intensity regime. Explaining this behavior is important for applications of single-molecules in quantum technologies.

## QTu3A.54

### **Distributed Quantum Sensing Using Multimode N00N States**

Dong-Hyun Kim<sup>1,2</sup>, Seongjin Hong<sup>2</sup>, yong-Su Kim<sup>1,3</sup>, Kyoungwan Oh<sup>2</sup>, Su-Yong Lee<sup>4</sup>, Changhyoup Lee<sup>5</sup>, Hyang-Tag Lim<sup>1,3</sup>; <sup>1</sup>*Center for Quantum Technology, Korea Inst. of Science and Technology, Korea (the Republic of)*; <sup>2</sup>*Department of Physics, Yonsei Univ., Korea (the Republic of)*; <sup>3</sup>*Division of Quantum Information, Korea University of Science and Technology, Korea (the Republic of)*; <sup>4</sup>*Agency for Defense Development, Korea (the Republic of)*; <sup>5</sup>*Department of Physics, Hanyang Univ., Korea (the Republic of)*. Distributed quantum sensing aims to estimate global parameters across distant nodes. We propose multi-mode N00N states achieving Heisenberg scaling, verified by CRB and QCRB, and demonstrate a 2.74 dB sensitivity gain using a N00N state.

## QTu3A.55

Withdrawn

## QTu3A.56

### **Comparative Investigation of Inverse Designed, Super-Compact Beam Splitters for Photonic Quantum Computing**

Emre Akman<sup>1</sup>, Mehmet Unlu<sup>1,2</sup>; <sup>1</sup>*TOBB Ekonomi ve Teknoloji Universitesi, Turkey*; <sup>2</sup>*Kuantum Entegre Teknolojiler ve Sistemler, Turkey*. We investigate a genetic-algorithm-optimized, manufacturable 2x2 silicon beam splitter with a super-compact footprint. Although a 0.07 dB splitting imbalance is achieved, a 1.29 dB excess loss reveals

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## QTu3A.57

**A Web-Based Platform for Real-Time Monitoring and Control of Quantum-Classical Hybrid Material Simulations**, Jieun Choi<sup>1</sup>, Changhyoup Lee<sup>2</sup>, Changwoo Kim<sup>3</sup>, Junghee Ryu<sup>1</sup>; <sup>1</sup>*Korea Inst of Science & Technology Info, Korea (the Republic of)*; <sup>2</sup>*Hanyang Univ., Korea (the Republic of)*; <sup>3</sup>*Chonnam National Univ., Korea (the Republic of)*. We present a web-based graphical interface for quantum-classical hybrid simulations, enabling real-time monitoring and control of distributed VQE workflows across simulators and emulators, improving usability and accessibility for molecular and materials quantum computing applications.

## QTu3A.58

**Thermodynamic Limits of Intrinsic Time in Dense Diamond Quantum Networks**, Ibrahim M. Abdulrahman<sup>3,2</sup>, Ahmed A. Albashir<sup>1,2</sup>, Wala Emran<sup>1,2</sup>; <sup>1</sup>*Department of Physics, Libyan Academy for Postgraduate Studies, Libya*; <sup>2</sup>*Department of Physics, Univ. of Tripoli Faculty of Science, Libya*; <sup>3</sup>*Department of Physics, Wadi Alshatti Univ., Faculty of Education, Libya*. We propose a thermodynamic square-root law to maximize entanglement in diamond networks. Our results identify an intrinsic time  $\tau_{\text{opt}} \approx \sqrt{\tau_{\text{int}} T_2^*} \approx 0.67 \mu\text{s}$ , providing a precise blueprint for high-efficiency quantum repeater design.

## QTu3A.59

**Coherent SiV Center in Diamond Nanophotonic Waveguide for Quantum Information**, Althéa Housset<sup>1</sup>; <sup>1</sup>*Laboratoire Kastler Brossel, France*. Single photon sources from solid-state, like color centers in diamond, can be integrated into photonic systems for quantum information by coupling them to nanofibers. Nanowaveguides with adiabatic tapers as well as cryogenic operation improve photon transfer, quality, and directionality.

## QTu3A.60

**Three-User Time-Bin Entanglement Distribution Over Deployed-Fiber Using a Wavelength-Selective Switch for Quantum Networking**, Boseong Kim<sup>1</sup>, Jiho Park<sup>1</sup>, Min-su Kim<sup>1</sup>, Jung Jin Ju<sup>1</sup>; <sup>1</sup>*Electronics and Telecommunications Research Inst., Korea (the Republic of)*. We distribute three-user, wavelength-multiplexed time-bin entanglement using a 1550.12-nm CW-pumped PPLN source and a wavelength-selective switch for metropolitan-scale quantum networking. In-lab and deployed-fiber loopback tests violate CHSH and quantify loss- and timing-drift-limited performance in-field operation.

## QTu3A.61

**Quantum Science Gateways**, Diana Y. Jiménez Núñez<sup>1</sup>, Braulio M. Villegas Martínez<sup>1,2</sup>, Sandra Gesing<sup>3</sup>, Gustavo Rojo Velazquez<sup>4</sup>, Jacob Licea Rodriguez<sup>1</sup>, Omar Palillero Sandoval<sup>1</sup>, Roberto Beltran Vargas<sup>1</sup>, Jose Marban Salgado<sup>1</sup>, Jorge Sandoval Espino<sup>1</sup>, Jesus Escobedo Alatorre<sup>1</sup>; <sup>1</sup>*Univ Autonoma del Estado de Morelos, Mexico*; <sup>2</sup>*Loyola Univ. Chicago, USA*; <sup>3</sup>*San Diego Supercomputer Center at UC San Diego, USA*; <sup>4</sup>*Instituto Tecnológico de Piedras Negras, Mexico*. Science gateways simplify access to advanced cyberinfrastructure. As quantum computing matures, gateway-based approaches are needed to address fragmented platforms and workflows. This paper reviews quantum science gateways, focusing on challenges in Latin America and their role in supporting education, research, and workforce development

## QTu3A.62

**Phase-Based Spin-Photon Interactions for Color Centers in Photonic Crystal Cavities**, Daniel Bedialauneta Rodriguez<sup>1</sup>, Niv Bharos<sup>1</sup>, Tim Turan<sup>1</sup>, Jonas Kolker<sup>1</sup>, Ronald

# Optica Quantum 2.0 Conference and Exhibition

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## QTu3A.63

**A Modular and Generalized Time-Domain Solver for Quantum Memory Protocols in Rare-Earth Ion Doped Crystals.**, Finley Giles-Book<sup>2</sup>, Tymon Fellmann<sup>2</sup>, Yashar Alizadeh<sup>1</sup>, Margherita Mazzera<sup>2</sup>; <sup>1</sup>*Electronics and Nanoscale Engineering Division, James Watt School of Engineering, Univ. of Glasgow, UK*; <sup>2</sup>*Inst. of Photonics and Quantum Sciences, Scottish Univ. Physics Alliance, Heriot-Watt Univ. School of Engineering and Physical Sciences, UK*. We have developed a modular generalized time-domain solver for two-level quantum memory protocols in rare-earth doped crystals. This tool enables the understanding of fundamental limitations of existing protocols and the exploration of new protocols.

## QTu3A.64

**Towards Sub-Shot-Noise Absorption Measurement Tolerant to Inefficient Detection,** Aditya Sudharsanam<sup>1,2</sup>, Maria V. Chekhova<sup>1,2</sup>; <sup>1</sup>*Max-Planck-Inst Physik des Lichts, Germany*; <sup>2</sup>*Friedrich-Alexander-Universitat Erlangen-Nurnberg, Germany*. Sub-shot-noise absorption measurement and imaging with twin beams relies heavily on the detection efficiency. We aim to overcome this problem by employing phase-sensitive amplification of both twin beams before detection.

## QTu3A.65

**Applied Hyperspectral Mid-IR Imaging with Undetected Photons,** Anna Romanova<sup>4</sup>, Marlon Placke<sup>4</sup>, Chiara Lindner<sup>3</sup>, Felix Mann<sup>4</sup>, Inna Kviatkovsky<sup>4</sup>, Helen Chrzanowski<sup>4</sup>, Frank Kühnemann<sup>3,2</sup>, Sven Ramelow<sup>4,1</sup>; <sup>1</sup>*Ferdinand-Braun-Institut gGmbH, Germany*; <sup>2</sup>*Physikalisches Institut, Universität Freiburg, Germany*; <sup>3</sup>*Fraunhofer-Institut für Physikalische Messtechnik IPM, Germany*; <sup>4</sup>*Humboldt-Universität zu Berlin, Germany*. We demonstrate hyperspectral mid-infrared quantum imaging using sensing with undetected photons in a nonlinear interferometer, enabling label-free compositional analysis with visible-light detection. We validate the method on polymers, microplastics, and biological tissue.

## QTu3A.68

**Rigorous, All-Optical Quantum State Characterization for Continuous Variable Systems,** Manthan Badbaria<sup>1</sup>, Fumiya Hanamura<sup>2</sup>, Ulysse Chabaud<sup>3</sup>, Rajveer Nehra<sup>1</sup>; <sup>1</sup>*Univ. of Massachusetts Amherst, USA*; <sup>2</sup>*Applied Physics, Univ. of Tokyo, Japan*; <sup>3</sup>*École Normale Supérieure de Paris, France*. We propose a loss-resilient, all-optical measurement scheme using high-gain phase-sensitive optical parametric amplifiers to rigorously characterize non-Gaussian resources, crucial for continuous-variable quantum information processing. Our scheme can be readily realized with current quantum photonic technologies.

## QTu3A.69

Withdrawn

## QTu3A.70

**Integrated Photon Pairs Source in Silicon Carbide Based on Micro-Ring Resonators for Quantum Storage at Telecom Wavelengths,** Roberto Ramirez Alarcón<sup>1</sup>; <sup>1</sup>*Centro de Investigaciones en Optica AC, Mexico*. We present the design of an on-chip integrated photon pair source based on Spontaneous Four Wave Mixing (SFWM), implemented on a ring

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## QTu3A.71

### **Nonlinear Dispersion INduced MULTimode SQueezing in Coupled**

**Kerr Microresonators**, Nianqin Li<sup>1</sup>, Zijun Shu<sup>1</sup>, Yang Shen<sup>1</sup>, Bo Ji<sup>1</sup>, Haodong Xu<sup>1</sup>, Guangqiang He<sup>1</sup>; <sup>1</sup>*Shanghai Jiao Tong Univ., China*. We demonstrate large-scale multimode bright squeezing among 512×2 frequency modes in a Si<sub>3</sub>N<sub>4</sub> microresonator molecule. Utilizing morphing supermode theory, we verify 29.74 dB squeezing in the single soliton state, driven by coupling-modulated nonlinear dispersion.

## QTu3A.72

### **Coherent Combining of \$N\$ Optical Modes With Cross-Kerr-Induced Phase**

**Control**, Mojdeh Shikhali Najafabadi<sup>1</sup>, Luis Lorenzo Sánchez-Soto<sup>2,1</sup>, Gerd Leuchs<sup>1</sup>; <sup>1</sup>*Max-Planck-Inst Physik des Lichts, Germany*; <sup>2</sup>*Universidad Complutense de Madrid Departamento de Optica, Spain*. We propose a cross-Kerr-based phase-control scheme to enhance coherent combining of \$N\$ noisy optical modes. By using nonlinear phase interactions, we show, our approach improves phase alignment and combining efficiency beyond conventional linear interferometric architectures.

**16:00 -- 18:00**

**Room: Alsh 1**

## **QTu4A • Photonic Technologies for Quantum Computing II**

*Presider: To Be Announced*

### **QTu4A.1 • 16:00**

#### **Ultracoherent GHz Diamond Nanomechanical Resonators with Enhanced Spin-**

**Mechanical Coupling**, Philip Andrango<sup>1</sup>, xinzhu li<sup>1</sup>, Lexington Mandachi<sup>1</sup>, Hailin Wang<sup>1</sup>; <sup>1</sup>*Univ. of Oregon, USA*. We report the design, fabrication, and characterization of ultracoherent diamond Lamb wave resonators with a GHz frequency and with one order-of-magnitude enhancement in strain coupling, opening a path to the quantum regime of spin-mechanics.

### **QTu4A.2 • 16:15**

#### **Hybrid-Cavity of Subwavelength Emitters Array for Quantum Control**

, Neta Mimran<sup>1</sup>, Itai David<sup>1</sup>, Rivka Bekenstein<sup>1</sup>; <sup>1</sup>*Racah Inst. of Physics, Hebrew Univ. of Jerusalem Faculty of Science, Israel*. We analyze a hybrid-cavity system by integrating a subwavelength emitters array with a classical mirror, forming a system with unique selective collective states, capable of quantum controlling photonic qubits by manipulation of a single spin.

### **QTu4A.3 • 16:30**

#### **Heralding Sub-50 ps Time-Bin Photonic States via Temporal Imaging**

, Antoni Skoczypiec<sup>1</sup>, Jan Krzyzanowski<sup>1</sup>, Sanjay Kapoor<sup>1</sup>, Michal Mikolajczyk<sup>1</sup>, Michal Karpinski<sup>1</sup>; <sup>1</sup>*Uniwersytet Warszawski Wydział Fizyki, Poland*. We implement a temporal imaging system to magnify sub-50 ps time-bin states, overcoming detector jitter limits. We report resolving 30 ps photon delays, enabling ultrafast clock rates for high-dimensional quantum logic.

### **QTu4A.4 • 16:45**

#### **Photonic Circuit of Subwavelength Array for Many-Body Entanglement**

**Generation**, Yonatan Ben-Haim<sup>1</sup>, Shlomo Winberg<sup>1</sup>, Rivka Bekenstein<sup>1</sup>; <sup>1</sup>*Racah Inst. of*

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*Physics, Hebrew Univ. of Jerusalem Faculty of Science, Israel.* We propose a scalable protocol for deterministic tree cluster state generation employing waveguide coupled one-dimensional atomic arrays, utilizing conditional scattering based on collective resonances, for advantageous high-fidelity gates within versatile photonic circuit architectures.

## QTu4A.5 • 17:00

**ERC Individual and Synergy Grants**, Alessandro Comolli<sup>1</sup>; <sup>1</sup>ERC Executive Agency, Belgium. The ERC, set up by the European Union in 2007, is the premier European funding organisation for excellent frontier research. It funds creative researchers of any nationality and age, to run projects based across Europe. In this talk, I will present the opportunities for funding of frontier research offered by the ERC.

## QTu4A.6 • 17:15

**High-Dimensional Entanglement and Topological Protection in Nonlinear Waveguide Arrays**, Alessandro Zecchetto<sup>1</sup>, Arnault Raymond<sup>1</sup>, Jean-René Coudeville<sup>2</sup>, Martina Morassi<sup>2</sup>, Aristide Lemaître<sup>2</sup>, Fabrice Raineri<sup>3</sup>, Maria Amanti<sup>1</sup>, Sara Ducci<sup>1</sup>, Florent Baboux<sup>1</sup>; <sup>1</sup>Université Paris Cité, France; <sup>2</sup>Centre National de la Recherche Scientifique, France; <sup>3</sup>Université Côte d'Azur, France. We demonstrate on-chip generation and control of high-dimensional spatially entangled photon pairs in AlGaAs nonlinear waveguide arrays. We further show that topological effects can stabilize photon-pair properties against disorder, paving the way toward experimental realizations of robust multi-source quantum interference in integrated platforms.

**16:00 -- 18:00**

**Room: Alsh 2**

## QTu4B • Interferometry-based Quantum Sensing

*Presider: Sven Ramelow; Humboldt Universität zu Berlin, Germany*

### QTu4B.1 • 16:00

Withdrawn

### QTu4B.2 • 16:15

**Inverted Behaviour of Quantum Imaging With Undetected Photons via Three-Crystal Interferometry**, Nathan G. Gemmill<sup>1</sup>, Yue Ma<sup>1</sup>, Caiyi Liu<sup>1</sup>, Vladimir Kornienko<sup>1</sup>, Tamzin Ellis<sup>2</sup>, Alex S. Clark<sup>2</sup>, M. S. Kim<sup>1</sup>, Chris Phillips<sup>1</sup>, Rupert Oulton<sup>1</sup>; <sup>1</sup>Imperial College London, UK; <sup>2</sup>Univ. of Bristol, UK. We demonstrate a theoretical model of a three-crystal nonlinear interferometer; showing novel inverted behaviour. We further demonstrate the same behaviour in a single-crystal folded experimental setup, with key performance implications for “imaging with undetected photons”.

### QTu4B.3 • 16:30

**Mid-Infrared Fourier-Transform Spectroscopy and Hyperspectral Imaging With Undetected Photons**, Chiara Lindner<sup>1,2</sup>, Marlon Placke<sup>3</sup>, Jachin Kunz<sup>1</sup>, Simon J. Herr<sup>1</sup>, Jens Kießling<sup>1</sup>, Sven Ramelow<sup>3,4</sup>, Frank Kühnemann<sup>1,5</sup>; <sup>1</sup>Fraunhofer-Institut für Physikalische Messtechnik IPM, Germany; <sup>2</sup>School of Physics and Astronomy, Univ. of Glasgow, UK; <sup>3</sup>Inst. for Physics, Humboldt-Universität zu Berlin, Germany; <sup>4</sup>Ferdinand-Braun-Institut gGmbH, Germany; <sup>5</sup>Inst. of Physics, Albert-Ludwigs-Universität Freiburg, Germany. Quantum Fourier-Transform Infrared Spectroscopy (QFTIR) enables high-resolution, accurate spectroscopy. When combined with quantum imaging, it allows for hyperspectral imaging using undetected

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## QTu4B.4 • 16:45

**Rapid Polymer Identification via Undetected Photon**, Atta Ur Rehman Sherwani<sup>1</sup>, Daniel Gould<sup>1</sup>, Emma P. Pearce<sup>1,3</sup>, Philipp Hildenstein<sup>2</sup>, Felix Mauerhoff<sup>2</sup>, Alexander Sahn<sup>2</sup>, Katrin Paschke<sup>2</sup>, Helen Chrzanowski<sup>1</sup>, Sven Ramelow<sup>1,2</sup>; <sup>1</sup>*Humboldt-Universität zu Berlin, Germany*; <sup>2</sup>*Ferdinand-Braun-Institut gGmbH, Germany*; <sup>3</sup>*Univ. of Glasgow, UK*. We present 3060-2790 cm<sup>-1</sup> mid-IR undetected-photon spectroscopy with near-IR detection using a micro-integrated interferometer-module. At 100 Hz measurement rates SNRs are 34, with ongoing work exploring brighter sources for multi-kHz spectroscopy and hyperspectral imaging.

## QTu4B.5 • 17:00

**A Multimode Seeded High-Gain SU(1,1) Interferometer Towards Sub-Shot-Noise Imaging**, Yizhar Amir<sup>1</sup>, Avi Pe'er<sup>2</sup>, Yaron Bromberg<sup>1</sup>; <sup>1</sup>*The Racah Inst. of Physics, Hebrew Univ. of Jerusalem Faculty of Science, Israel*; <sup>2</sup>*Physics Department and BINA Center for Nanotechnology, Bar-Ilan Univ. Faculty of Exact Sciences, Israel*. We demonstrate a seeded, high-gain SU(1,1) interferometer using a nonlinear crystal. Preliminary low detection-efficiency measurements show 1.5 dB sensitivity gain over the shot noise limit, highlighting the potential for quantum-enhanced phase imaging.

## QTu4B.6 • 17:15

**Mid-Infrared Optical Coherence Tomography With Undetected Photons for Subsurface Ceramic Inspection**, Felipe L. Gewers<sup>5,1</sup>, Fabian Wendt<sup>1</sup>, Emma P. Pearce<sup>2</sup>, Gunnar Blume<sup>3</sup>, Ivan Zorin<sup>4</sup>, Helen Chrzanowski<sup>5</sup>, Katrin Paschke<sup>1</sup>, Sven Ramelow<sup>5,1</sup>; <sup>1</sup>*Fraunhofer-Institut für Lasertechnik ILT, Germany*; <sup>2</sup>*Univ. of Glasgow, UK*; <sup>3</sup>*Ferdinand-Braun-Institut gGmbH, Germany*; <sup>4</sup>*Research Center for Non Destructive Testing GmbH, Austria*; <sup>5</sup>*Humboldt-Universität zu Berlin, Germany*. We image ceramics via mid-infrared OCT with undetected 3.3–4.3 μm photons by incorporating a micro-integrated quantum-module into an industry inspection machine. Subsurface imaging through ZrO<sub>2</sub> thicker than 1 mm establishes this as a cost-effective tool for applications.

## QTu4B.7 • 17:30

**Unconditional Sub-Shot-Noise Phase Sensing via Nonlinear Interferometry and Photon-Number-Resolving Detection**, Gerard Jimenez Machado<sup>1,2</sup>, Yazeed K. Alwehaibi<sup>2</sup>, Guillaume Thekkadath<sup>3</sup>, Zhenghao Li<sup>2</sup>, Shang Yu<sup>2</sup>, Juan P. Torres<sup>4,5</sup>, Raj B. Patel<sup>2</sup>, Ian A. Walmsley<sup>1,2</sup>; <sup>1</sup>*Univ. of Oxford, UK*; <sup>2</sup>*Imperial College London, UK*; <sup>3</sup>*National Research Council Canada, Canada*; <sup>4</sup>*Institut de Ciències Fotoniques, Spain*; <sup>5</sup>*Universitat Politècnica de Catalunya, Spain*. We demonstrate unconditional quantum-enhanced phase sensing using nonlinear interferometry and photon-number-resolving detection, exploiting full photon statistics to achieve sub-shot-noise sensitivity without post-selection and establishing a robust route to practical quantum metrology.

## QTu4B.8 • 17:45

**A Quantum Shield Against Classical Light**, Xin Huang<sup>1</sup>, Chloé Vernière<sup>1</sup>, Shaurya Aarav<sup>1</sup>, Hugo Defienne<sup>1</sup>; <sup>1</sup>*Institut des NanoSciences de Paris, France*. We propose a "Quantum Shield" where active phase scrambling renders channels opaque to separable states but transparent to entanglement. Our experiment recovers entanglement-encoded images through this interface, as it disturbs incoherent ones.

# Optica Quantum 2.0 Conference and Exhibition

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**16:00 -- 18:00**

**Room: Carron**

**QTu4C • Quantum Communication**

*Presider: To Be Announced*

## **QTu4C.1 • 16:00 (Invited)**

**Control and Management of Quantum Networks via Blended Classical Optical Signaling**, Prem Kumar<sup>1</sup>, Gamze Gul<sup>1</sup>, Shannon G. Tan<sup>1</sup>, James van Howe<sup>2</sup>, Gregory S. Kanter<sup>1</sup>, Roberto Proietti<sup>3</sup>, S.J. Ben Yoo<sup>4</sup>; <sup>1</sup>*Northwestern Univ., USA*; <sup>2</sup>*Augustana College, USA*; <sup>3</sup>*Politecnico di Torino, Italy*; <sup>4</sup>*Univ. of California Davis, USA*. We present our work on quantum wrapper networking, a control and management protocol that leverages blended classical optical signals to monitor, stabilize, switch and route quantum information in photonic quantum networks in a scalable manner.

## **QTu4C.2 • 16:30**

**Long-Range Distribution of Cluster States via Multi-Level Time-Bin Encoding**, Michael Kues<sup>1</sup>, Philip Ruebeling<sup>1</sup>, Robert Johanning<sup>1</sup>, Jan Heiner<sup>1</sup>, Oleksandr Marchukov<sup>1</sup>; <sup>1</sup>*Leibniz Universitat Hannover, Germany*. We demonstrate the first distribution of a cluster state. This is achieved via multi-level time-bin encoding and chirped pulse modulation over 29.5 km fiber. Our work paves the way to multipartite entangled long-distance quantum networking and distributed photonic computing.

## **QTu4C.3 • 16:45**

**Entanglement-Based Quantum key Distribution With Active Polarization Control in Deployed Fiber Infrastructure**, Thorsten A. Goebel<sup>1</sup>, Rodrigo M. Gomez<sup>1</sup>, Saili Naik<sup>1</sup>, Pritom Paul<sup>1</sup>, Philippe Ancsin<sup>1</sup>, Nico L. Doll<sup>1</sup>, Sarika Mishra<sup>1</sup>, Natasa Pavlovic Tucakovic<sup>1</sup>, Jansen Dwan<sup>1</sup>, Gregor Sauer<sup>1,2</sup>, Christopher Spiess<sup>1</sup>, Fabian Steinlechner<sup>1,2</sup>; <sup>1</sup>*Fraunhofer-Institut fur Angewandte Optik und Feinmechanik IOF, Germany*; <sup>2</sup>*Inst. of Applied Physics, Friedrich-Schiller-Universitat Jena, Germany*. We demonstrate entanglement-based quantum key distribution over deployed fiber, using a polarization-entangled photon-pair source and fast polarization control, achieving secure key generation across metropolitan distances and enabling quantum-secured communication networks.

## **QTu4C.4 • 17:00**

**Turning Imperfect Single-Photon Sources Into a Practical Advantage for Quantum Key Distribution**, Yuval Bloom<sup>1</sup>, Yoad Ordan<sup>1</sup>, Ralfy Kenaz<sup>1</sup>, Tamar Levin<sup>1</sup>, Kfir Sulimany<sup>2</sup>, Eric Bowes<sup>3</sup>, Jennifer A. Hollingsworth<sup>3</sup>, Ronen Rapaport<sup>1</sup>; <sup>1</sup>*Hebrew Univ. of Jerusalem, Israel*; <sup>2</sup>*Massachusetts Inst. of Technology, USA*; <sup>3</sup>*Los Alamos National Laboratory, USA*. We experimentally demonstrate enhanced quantum key distribution protocols using imperfect quantum emitters that outperform state-of-the-art weak coherent states. These protocols can be generalized to various sub-Poissonian sources, achieving superior security and higher channel-loss tolerance.

## **QTu4C.5 • 17:15**

**Correlations in High-Speed Quantum Key Distribution Sources With Phase Modulators**, Francesco Picciariello<sup>1</sup>, Massimo Giacomini<sup>2</sup>, Ainhoa Agulleiro<sup>3,4</sup>, Margarida Pereira<sup>3,4</sup>, Guillermo Currás-Lorenzo<sup>3,4</sup>, Davide Rusca<sup>3,4</sup>; <sup>1</sup>*European Space Research and*

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*Technology Centre, Netherlands; <sup>2</sup>Universita degli Studi di Padova, Italy; <sup>3</sup>Vigo Quantum Communication Center, Spain; <sup>4</sup>Universidade de Vigo Escola de Enxenaria de Telecomunicacion, Spain.* Intensity and phase correlations in high-speed QKD sources are analyzed. Experimental modulation schemes and simulations show that symmetric designs in Sagnac-based interferometers reduce correlations, improving secret key rates and enhancing system security.

## QTu4C.6 • 17:30

**Twin-Field Quantum Key Distribution With Thin-Film Lithium Niobate Photonic Chips,** Huihong Yuan<sup>1</sup>, Jinping Lin<sup>1</sup>, Wenda Shi<sup>1,2</sup>, Lai Zhou<sup>1</sup>, Zhichuan Liao<sup>1,2</sup>, Zhengyu Yan<sup>1</sup>, Tingting Shi<sup>1</sup>, Yuanbin Fan<sup>1</sup>, Zhiliang Yuan<sup>1</sup>; <sup>1</sup>Beijing Academy of Quantum Information Sciences, China; <sup>2</sup>Chinese Academy of Sciences Inst. of Physics, China. We develop a coherent dual-band thin-film lithium niobate photonic chip enabling compact user node and an open-channel architecture for twin-field quantum key distribution. We obtain a secure key rate that surpasses the fundamental rate-distance limit over a 508 km fiber link.

## QTu4C.7 • 17:45

**Reference Beam Attacks Against Twin-Field Quantum Key Distribution Using Optical Injection Locking,** Sergio Juarez<sup>1,2</sup>, Alessandro Marcomini<sup>2,3</sup>, Mikhail Petrov<sup>2,3</sup>, Robert Woodward<sup>1</sup>, Toby Dowling<sup>1</sup>, R. Mark Stevenson<sup>1</sup>, Marcos Curty<sup>2,3</sup>, Davide Rusca<sup>2,3</sup>; <sup>1</sup>Toshiba Europe Limited Cambridge Research Laboratory, UK; <sup>2</sup>Universidade de Vigo Escola de Enxenaria de Telecomunicacion, Spain; <sup>3</sup>Vigo Quantum Communication Center, Universidade de Vigo, Spain. We present the first security analysis of Twin-Field QKD systems using Optical Injection Locking, demonstrating two potential side-channel attacks: fast intensity modulation of the reference laser, and Trojan-wavelength signals in the reference light. We propose practical countermeasures that neutralize both threats without degrading performance.

**16:00 -- 18:00**

**Room: Lomond Auditorium**

**QTu4D • Quantum Memories**

*Presider: Peter Mosley; Univ. of Bath, UK*

## QTu4D.1 • 16:00

**Solid-State Quantum Memory Array for Single Photons,** Susana Plascencia<sup>2</sup>, Aya Mneimneh<sup>2</sup>, Jonathan Hänni<sup>2</sup>, Manuel Gundín<sup>2</sup>, Samuele Grandi<sup>2</sup>, Markus Teller<sup>2</sup>, Hugues de Riedmatten<sup>2,1</sup>; <sup>1</sup>Institucio Catalana de Recerca i Estudis Avancats, Spain; <sup>2</sup>Institut de Ciències Fotoniques, Spain. We realize single photon storage in a spatially multiplexed solid state quantum memory containing ten independently addressable spin wave cells supporting on demand read out and temporal multiplexing, and we measure highly non classical correlations from every memory cell.

## QTu4D.2 • 16:30

**Standalone Mobile Quantum Memory System,** Martin Jutisz<sup>1</sup>, Alexander Erl<sup>2,3</sup>, Janik Wolters<sup>2,3</sup>, Mustafa Gündoğan<sup>1</sup>, Markus Krutzik<sup>1</sup>; <sup>1</sup>Institut of Physics, Humboldt-Universität zu Berlin Mathematisch Naturwissenschaftliche Fakultät, Germany; <sup>2</sup>Institut für Weltraumforschung, Deutsches Zentrum für Luft- und Raumfahrt DLR, Germany; <sup>3</sup>Inst. for Optics and Atomic Physic, Technische Universität Berlin, Germany. We present the implementation and performance analysis of a mobile and standalone warm-vapor quantum

# Optica Quantum 2.0 Conference and Exhibition

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## QTu4D.3 • 16:45 (Invited)

**Multimode Telecom Quantum Memory in Warm Vapour**, Sarah E. Thomas<sup>1</sup>; <sup>1</sup>*Univ. of Oxford, UK*. Multimode quantum memories at telecom wavelengths are key components for scalable quantum networks. We present a new method that enables temporal multimode storage in a warm vapour telecom memory via dynamic rephasing.

## QTu4D.4 • 17:15

**Single-Photon-Level Atomic Frequency Comb Storage in Room Temperature Alkali Vapour**, Zakary Schofield<sup>1</sup>, Vanderli Laurindo Junior<sup>1</sup>, Ori Mor<sup>1</sup>, Patrick M. Ledingham<sup>1</sup>; <sup>1</sup>*Univ. of Southampton, UK*. We realise a room-temperature rubidium-vapour atomic frequency comb memory that stores and retrieves single-photon-level pulses with 6.59(5)% efficiency after 7.5ns, supporting multimode time-bin operation and polarisation-insensitive storage for photonic qubits.

## QTu4D.5 • 17:45

**Development of a Room-Temperature Absorptive Multiplexed Quantum Memory**, Siddharth Sehgal<sup>1</sup>, Eden Figueroa<sup>1</sup>; <sup>1</sup>*SUNY Stony Brook, USA*.

The ability to effectively store multiple entangled modes is essential to build high repetition-rate long-distance quantum repeaters based upon quantum memory banks. We present a multiplexed room-temperature quantum memory system, where we can store 9 independent modes, with the short-term goal of scaling this method up to 49 modes.

## QTu4D.6 • 18:00 (Invited)

Withdrawn

# Optica Quantum 2.0 Conference and Exhibition

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## Wednesday, 17 June

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**09:00 -- 10:00**

**Room: Lomond Auditorium**

**QW1A • Keynote Session III**

*Presider: To Be Announced*

### **QW1A.1 • 09:00 (Plenary)**

**Improved Performance of Spin-Based Quantum Computing Devices in Silicon**, Seigo Tarucha<sup>1</sup>; <sup>1</sup>*RIKEN, Japan*. Semiconductor-based QC has rapidly attracted increasing interest. Despite emerging several years later than other hardware platforms, it offers compelling advantages, including the small footprint of qubit devices and fabrication processes compatible with standard CMOS technology. This trend is particularly prominent for silicon spin qubits in quantum dots. Key challenges toward practical spin-qubit processors include fault-tolerant qubit operation, quantum error correction and scalable qubit architectures. Notably, recent progress in qubit control has enabled single- and two-qubit gate fidelities that exceed commonly discussed fault-tolerance thresholds. Nevertheless, scaling up qubit devices remains one of the central challenges across all quantum computing platforms. For silicon-based approaches, advanced industrial fabrication technologies provide a promising route to accelerate the development of large-scale architectures. In this talk, I will first review recent advances in improving performance in qubit control fidelities and discuss the dominant error mechanisms that currently limit qubit performance. I will then highlight recent efforts toward scalable device geometries and integration strategies for silicon spin-qubit processors.

**10:30 -- 12:30**

**Room: Alsh 1**

**QW2A • Applications Beyond QKD**

*Presider: Jameson O'Reilly; Univ. of Oregon, USA*

### **QW2A.1 • 10:30 (Invited)**

**Cryptographic Applications of Advanced Quantum Networks**, Eleni Diamanti<sup>2,1</sup>; <sup>1</sup>*LIP6, Sorbonne Universite, France*; <sup>2</sup>*Centre National de la Recherche Scientifique, France*. We discuss the theoretical analysis and experimental demonstration of quantum networking applications, from ultrasecure communication to unforgeable money and privacy-preserving protocols in distributed architectures, leveraging quantum certification techniques and advanced quantum photonic resources.

### **QW2A.2 • 11:00**

**Experimental Quantum Electronic Voting**, Nicolas S. Laurent-Puig<sup>1</sup>, Matilde Baroni<sup>1</sup>, Federico Centrone<sup>2</sup>, Eleni Diamanti<sup>1</sup>; <sup>1</sup>*Sorbonne Université LIP6, France*; <sup>2</sup>*ICFO, Spain*. Quantum information protocols may improve security, anonymity, and privacy. We demonstrate an information-theoretically secure, authority-free quantum voting protocol using high-fidelity Greenberger-Horne-Zeilinger states, supporting up to 8 voters and 16 candidates, ideal for secure small-scale elections in organizations and governments.

# Optica Quantum 2.0 Conference and Exhibition

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## **QW2A.3 • 11:15**

**Demonstration of Non-Local Optical Interferometry in a Quantum Network**, Yan-Cheng Wei<sup>8</sup>, Pieter-Jan Stas<sup>8</sup>, Maxim Sirotnin<sup>1,8</sup>, Yan Qi Huan<sup>8</sup>, Umut Yazlar<sup>2,8</sup>, Francisca Abdo Arias<sup>8</sup>, Eugene Knyazev<sup>8</sup>, Gefen Baranes<sup>1,8</sup>, Bart Machielse<sup>3,4</sup>, Samuele Grandi<sup>5,8</sup>, Daniel Riedel<sup>4</sup>, Johannes Borregaard<sup>8</sup>, HongKun Park<sup>6,8</sup>, Marko Loncar<sup>3</sup>, Aziza Suleymanzade<sup>7,8</sup>, Mikhail Lukin<sup>8</sup>; <sup>1</sup>*Department of Physics and Research Laboratory of Electronics, Massachusetts Inst. of Technology, USA*; <sup>2</sup>*Division of Materials Science & Engineering, Boston Univ., USA*; <sup>3</sup>*John A. Paulson School of Engineering and Applied Sciences, Harvard Univ., USA*; <sup>4</sup>*IonQ Inc., USA*; <sup>5</sup>*Institut de Ciències Fotoniques, Spain*; <sup>6</sup>*Department of Chemistry and Chemical Biology, Harvard Univ., USA*; <sup>7</sup>*Physics, Univ. of California Berkeley, USA*; <sup>8</sup>*Department of Physics, Harvard Univ., USA*. The sensitivity of non-local optical measurements in long-baseline telescope arrays can be improved by harnessing remote entanglement. We experimentally perform such non-local phase measurements using entangled Silicon-vacancy centers in nanocavities.

## **QW2A.4 • 11:30**

**Experimental (n,n)-Quantum Secret Sharing Using GHZ States**, Joseph Ho<sup>1</sup>; <sup>1</sup>*Heriot-Watt Univ., UK*. We experimentally implement a symmetric quantum secret sharing protocol among four users by generating a four-photon GHZ state, achieving a peak secret key rate of 745 bits/sec and demonstrating practical multi-party quantum communication.

## **QW2A.5 • 11:45**

**Development of a Long-Distance Quantum Network as a Virtual Laboratory**, Chase Wallace<sup>2</sup>, Tsering Lodhen<sup>2</sup>, Chi-Chih Chen<sup>2</sup>, Anthony Del Valle<sup>2</sup>, Leonardo Castillo-Veneros<sup>2</sup>, Samuel Woronick<sup>1</sup>, Dounan Du<sup>2</sup>, Dimitrios Katramatos<sup>2</sup>, Julian Martinez-Rincon<sup>1</sup>, Sonali Gera<sup>2</sup>, Eden Figueroa<sup>2,1</sup>; <sup>1</sup>*Instrumentation, Brookhaven National Laboratory, USA*; <sup>2</sup>*Stony Brook Univ., USA*. We highlight the development of a scalable, deployed quantum network for long-distance quantum operations in our five-node 275 km network testbed on Long Island, New York, by showing entanglement distribution across the network.

## **QW2A.6 • 12:00**

**Experimental Realisation of Indefinite Causal Ordered QKD Within a Quantum Switch**, Yann Valibouise<sup>1,2</sup>, Martí Cladera Rosselló<sup>2,1</sup>, Michael Antesberger<sup>2,1</sup>, Hector Spencer-Wood<sup>3</sup>, Kyrlo Simonov<sup>4</sup>, Philip Walther<sup>2,5</sup>, Lee A. Rozema<sup>2</sup>; <sup>1</sup>*VDSP, Universitat Wien Fakultat fur Physik, Austria*; <sup>2</sup>*Vienna Center for Quantum Science and Technology, Austria*; <sup>3</sup>*Univ. of Glasgow School of Physics and Astronomy, UK*; <sup>4</sup>*Fakultät für Mathematik, Universitat Wien, Austria*; <sup>5</sup>*Christian Doppler Forschungsgesellschaft, Austria*. We experimentally realize nondestructive polarization measurements inside an interferometer, preserving path coherence via ancilla coupling and path-information erasure. Implemented within a quantum switch, the protocol enables QKD and the measurement of a causal witness.

## **QW2A.7 • 12:15**

**Nonclassical Photon Number Correlations in Frequency Encoded Quantum Networks**, Theresa Keuter<sup>1</sup>, Patrick Folge<sup>1</sup>, Abhinandan Bhattacharjee<sup>1</sup>, Sebastian Lengeling<sup>1</sup>, Benjamin Brecht<sup>1</sup>, Christine Silberhorn<sup>1</sup>; <sup>1</sup>*Paderborn Univ., Integrated Quantum Optics, Inst. for Photonic Quantum Systems (PhoQS), Germany*. We demonstrate the preservation and manipulation of non-classical photon number correlations in a multi-output quantum pulse gate (mQPG). This establishes mQPGs as a basis for fully programmable frequency-encoded quantum networks.

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**10:30 -- 12:30**

**Room: Alsh 2**

**QW2B • Quantum Frontiers in Photonic Detection**

*Presider: Katyayani Seal; Single Quantum B.V., USA*

**QW2B.1 • 10:30**

**Single-Photon Wavefront Sensing With Shack-Hartmann Sensor and Fast Time-Stamping**

**TimePix3 Camera**, Bohnishikha Ghosh<sup>2</sup>, Jakub Lewandowski<sup>1</sup>, Bernard Gorzkowski<sup>1</sup>, Andrei Nomerotski<sup>3,4</sup>, Radek Lapkiewicz<sup>1</sup>; <sup>1</sup>*Inst. of Experimental Physics, Uniwersytet Warszawski Wydział Fizyki, Poland*; <sup>2</sup>*Inst. of Photonics and Quantum Sciences, Heriot-Watt Univ., UK*; <sup>3</sup>*Faculty of Nuclear Sciences and Physical Engineering, Ceske vysoke uceni technicke v Praze, Czechia*; <sup>4</sup>*Department of Electrical and Computer Engineering, Florida International Univ., USA*. A Shack–Hartmann measurement of single-photon local wavevectors is demonstrated using an intensified TimePix3 camera, enabling transverse momentum and orbital angular momentum reconstruction in low-light conditions from a single experimental realization.

**QW2B.2 • 10:45**

**Evidence of Quantum-Enhanced Interferometric Telescoping**, David O. Diaz<sup>2</sup>, Yujie Zhang<sup>1</sup>,

Yunkai Wang<sup>1</sup>, Virginia O. Lorenz<sup>2</sup>, Paul Kwiat<sup>2</sup>; <sup>1</sup>*Univ. of Waterloo, Canada*; <sup>2</sup>*Univ. of Illinois Urbana-Champaign, USA*. We demonstrate a quantum advantage for interferometric telescoping using a single-photon source as a reference signal over a weak coherent source, and experimentally comparing the mean-squared error of each.

**QW2B.3 • 11:00**

**Multiphoton Interference Outperforms Pairwise Overlaps for Distinguishability**

**Characterization**, Stefan van den Hoven<sup>1</sup>, Malaquias Correa Anguita<sup>1</sup>, Sara Marzban<sup>1</sup>, Jelmer Renema<sup>2,1</sup>; <sup>1</sup>*Universiteit Twente Applied Nanophotonics Cluster, Netherlands*; <sup>2</sup>*Technische Universiteit Eindhoven, Netherlands*. We propose a protocol that characterizes the pairwise overlaps of the internal modes of single photons more efficiently than pairwise Hong-Ou-Mandel characterization experiments. We experimentally demonstrate this outperformance while characterizing pairwise overlaps of three photons.

**QW2B.4 • 11:15**

**Optical Sensing Near the Quantum Limit With Enhanced Dynamic Range by Resolving the Spectra of Interfering Photons**, Russell M. Brooks<sup>1</sup>; <sup>1</sup>*Heriot-Watt Univ., UK*. We

demonstrate an optical sensing technique based on frequency-resolved two-photon interference. Our method restores interference beyond the photon coherence time and extends the dynamic range by a factor of 20, while approaching the quantum limit, enabling scan-free sensing.

**QW2B.5 • 11:30**

**Harnessing Optical Disorder for Bell Inequalities Violation**, Baptiste Courme<sup>1</sup>, Malo Joly<sup>1</sup>, Adrian Makowski<sup>3</sup>, Sylvain Gigan<sup>1</sup>, Hugo Defienne<sup>2</sup>; <sup>1</sup>*Laboratoire Kastler Brossel, UK*; <sup>2</sup>*Institut des NanoSciences de Paris, France*; <sup>3</sup>*Inst. of Experimental Physics, Faculty of Physics, Univ. of Warsaw, Poland*. We demonstrate that optical disorder in a multimode fiber can be harnessed to certify entanglement. By spatially resolving the output speckle, we access random polarization projections sufficient to violate Bell inequalities without active correction.

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## QW2B.6 • 11:45

**High-Dimensional Multi-Partite Nonlocality Test**, Jinwon Yoo<sup>1</sup>, Stefania Sciara<sup>1</sup>, Nicola Montaut<sup>1</sup>, Agnes George<sup>1</sup>, Roberto Morandotti<sup>1</sup>; <sup>1</sup>*Institut national de la recherche scientifique Centre energie Materiaux Telecommunications, Canada*. We verify high-dimensional multipartite nonlocality by testing Mermin's inequality on a three-qutrit GHZ state. A measurement of Mermin's operator gives an expectation value of 8.612(44), exceeding the local-realism limit of 6 by 59 standard deviations.

## QW2B.7 • 12:00

**Hyperentangled Bell States at an Ultra-High Flux: Generation and Complete Detection**, Netanel P. Yaish<sup>1</sup>, Samata Gokhale<sup>1</sup>, Yoad Michael<sup>1</sup>, Avi Pe'er<sup>1</sup>; <sup>1</sup>*Bar-Ilan Univ., Israel*. We generate an ultra-high flux of  $\sim 10^{11}$  polarization entangled bi-photons/sec and demonstrate ultrafast complete detection of all Bell-states. Using a dual-polarization SU(1,1) interferometer we overcome traditional detector bottlenecks, achieving  $\times 10^5$  detection speedup over standard methods.

## QW2B.8 • 12:15

**Generation of Frequency Entanglement With an Effective Quantum dot-Waveguide two-Photon Quadratic Interaction**, Mohamed Meguebel<sup>1</sup>, Maxime Federico<sup>2</sup>, Simone Felicetti<sup>3,4</sup>, Nadia Belabas<sup>5</sup>, Nicolas Fabre<sup>1</sup>; <sup>1</sup>*Telecom Paris, France*; <sup>2</sup>*Laboratoire Interdisciplinaire Carnot de Bourgogne, France*; <sup>3</sup>*Inst. for Complex Systems, National Research Council (ISC-CNR), Italy*; <sup>4</sup>*Physics Department, Sapienza Univ., Italy*; <sup>5</sup>*Centre for Nanosciences and Nanotechnology, CNRS, France*. We theoretically propose the use of a quantum dot embedded into a waveguide for generating frequency entanglement of two single photons, exploiting a four-level atomic structure for suppressing single-photon processes while enhancing two-photon transitions, further revealing entanglement trade-offs.

## 10:30 -- 12:30

### Room: Carron

## QW2C • Quantum Sensing and Imaging of Complex Systems

### QW2C.1 • 10:30 (Tutorial)

**From Quantum Physics to the Clinic: the Future of Biosensing**, Andre Pointner<sup>2</sup>, Tim Ascherl<sup>2</sup>, Johannes Wessler<sup>2</sup>, Rainer Tietze<sup>1</sup>, Christoph Alexiou<sup>1</sup>, Regine Schneider-Stock<sup>1,2</sup>, Roland Nagy<sup>2</sup>; <sup>1</sup>*Universitätsklinikum Erlangen, Germany*; <sup>2</sup>*Friedrich-Alexander-Universität Erlangen-Nürnberg, Germany*. Over the last decade, diamond NV centers have revolutionized sensing by detecting NMR, temperature, and electric fields. These multimodal capabilities now drive medical applications, offering advantages in monitoring free radicals, pH, and nerve currents. This tutorial provides an overview of key findings in this emerging biomedical field.

### QW2C.2 • 11:30

**An SNSPD-Based Camera for Time-Domain Diffuse Optics Experiments**, Amin Fakhree<sup>1</sup>, Adrian van Eik<sup>1</sup>, Henri Vlot<sup>1</sup>, Andreas Fognini<sup>1</sup>, Martin Caldarola<sup>1</sup>, Jessie Qin-Dregely<sup>1</sup>; <sup>1</sup>*Single Quantum B.V., Netherlands*. We present a 100-channel SNSPD platform for diffuse optical measurements, incorporating a  $10 \times 10$  array with individually addressable detectors. The system achieves detection efficiencies exceeding 55% at 1064 nm, dark count rates below 100 CPS, and timing jitter under 100 ps.

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## QW2C.3 • 11:45

**Saturable Absorption in a Dense NV Diamond Microcavity**, Nicholas Sorensen<sup>2</sup>, Christopher Coutts<sup>2</sup>, Sean McNaney<sup>2</sup>, Elham Zohari<sup>1,2</sup>, Sigurd Flågan<sup>2</sup>, Paul Barclay<sup>2</sup>; <sup>1</sup>*Department of Physics, Univ. of Alberta, Canada*; <sup>2</sup>*Physics and Astronomy, Univ. of Calgary, Canada*. We demonstrate and characterize saturable absorption in a dense NV diamond microcavity. Power-dependent cavity spectroscopy indicates that the absorption is consistent with a hydrogen-related defect, revealing an important material loss mechanism in diamond nanophotonic devices.

## QW2C.4 • 12:00

**Single-Shot Resolved Complex-Field Imaging of Spatially Multimodal BSV**, Moshe Labaz<sup>1</sup>, Nitzan Haviv<sup>1</sup>, Michael Birk<sup>1</sup>, Maria V. Chekhova<sup>1</sup>, Oren Cohen<sup>1</sup>, Pavel Sidorenko<sup>1</sup>; <sup>1</sup>*Technion Israel Inst. of Technology, Israel*. We demonstrate single-shot amplitude and phase measurements of multimode bright squeezed vacuum using digital holography. Reconstructed complex fields are used to compute spatial correlations, whose singular value decomposition reveals statistically independent modes of the source

## QW2C.5 • 12:15

**Magnetic Position Finding With an NV-Integrated Silicon Nitride Photonic Integrated Circuit**, Joseph Smith<sup>1</sup>; <sup>1</sup>*Univ. of Sheffield, UK*. We demonstrate a scalable, site-defined NV centre in diamond quantum sensing array coupled to foundry-optimised silicon nitride photonics in an all-integrated device. Parallel excitation and edge-coupled collection enable simultaneous multi-site magnetic sensing via optically-detected magnetic resonance.

10:30 -- 12:30

Room: Lomond Auditorium

## QW2D • Quantum Devices for Quantum Networks

Presider: Peter Mosley; *Univ. of Bath, UK*

### QW2D.1 • 10:30 (Invited)

**Quantum Networks for Verifying Position**, Lynden K. Shalm<sup>1</sup>; <sup>1</sup>*National Inst of Standards & Technology, USA*. Abstract not available.

### QW2D.2 • 11:00

**High Operating Temperature Integrated Single Photon Detectors on Thin-Film Lithium Niobate**, Myriam Rihani<sup>1</sup>, Odiel Hooybergs<sup>1</sup>, Giovanni Finco<sup>1</sup>, Alessandro Palermo<sup>1</sup>, Sjoerd Telkamp<sup>1</sup>, Werner Wegscheider<sup>1</sup>, Rachel Grange<sup>1</sup>, Robert J. Chapman<sup>1</sup>; <sup>1</sup>*Eidgenössische Technische Hochschule Zurich, Switzerland*. We present NbTiN superconducting nanowire single-photon detectors integrated on thin-film lithium niobate waveguides operated at 5K, demonstrating high critical temperature, low dark counts and fast reset, towards fully integrated and scalable quantum photonic systems.

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## **QW2D.3 • 11:15**

### **Fast, Efficient, Number-Resolving SNSPDs With Scalable Room Temperature**

**Readout,** Daniel Sorensen<sup>1,2</sup>, Lynden K. Shalm<sup>1,2</sup>, Martin J. Stevens<sup>1</sup>, Dileep V.

Reddy<sup>1,3</sup>; <sup>1</sup>*Physical Measurement Laboratory, National Inst. of Standards and Technology, USA*; <sup>2</sup>*Department of Electrical, Computer, and Energy Engineering, Univ. of Colorado Boulder, USA*; <sup>3</sup>*Department of Physics, Univ. of Colorado Boulder, USA*. We present a new SNSPD platform that achieves near-unity detection efficiency, state of the art count rate, and high-fidelity photon number resolution in a single pixel read out with only room-temperature electronics.

## **QW2D.4 • 11:30**

### **Ultrafast and Photon-Number Resolving SNSPDs as Enablers for Quantum Networks and Photonic Quantum Computers,**

Thomas Produit<sup>1</sup>, Johan Capua<sup>1</sup>, Giovanni V. Resta<sup>1</sup>, Matthieu Perrenoud<sup>1</sup>, Boris Korzh<sup>2</sup>, Alexandre Hanna<sup>1</sup>, Hanan Jaffal<sup>1</sup>, Félix Bussi eres<sup>1</sup>; <sup>1</sup>*ID QUANTIQUE, Switzerland*; <sup>2</sup>*Universite de Geneve, Switzerland*. We present advances in SNSPD devices and architectures, including ultrafast photon-number-resolving SNSPDs, and show how these enable quantum networks (metro and OGS QKD, QPU interconnects, data center operation) and photonic quantum computing platforms.

## **QW2D.5 • 11:45**

### **Two-Photon Interference of Photons Emitted by Remote tin-Vacancy Centers in**

**Diamond,** Vladislav Bushmakin<sup>1,2</sup>, Sreehari Jayaram<sup>1</sup>, Colin Sauerzapf<sup>1</sup>, andrej denisenko<sup>1</sup>, Vadim Vorobyov<sup>1</sup>, J org Wrachtrup<sup>1,2</sup>; <sup>1</sup>*Universitat Stuttgart, Germany*; <sup>2</sup>*Max-Planck-Institut fur Festkorperforschung, Germany*. This work demonstrates two-photon interference of Sn<sup>V</sup> centers separated by 70 meters. Stark tuning compensates for spectral mismatches, achieving 80(6)% visibility at zero detuning and 63(8)% under significant detuning. These results highlight the scalability of Sn<sup>V</sup> centers for robust quantum networking.

## **QW2D.6 • 12:00**

### **Demonstration of Entanglement Swapping in a Deployable Payload,**

Sofiane Merkouche<sup>1</sup>, Cameron Taggesell<sup>1</sup>, Danny Kim<sup>1</sup>, Jennifer Ellis<sup>1</sup>, Makan Mohageg<sup>2</sup>; <sup>1</sup>*HRL Laboratories LLC, USA*; <sup>2</sup>*The Boeing Company, USA*. A quantum network spanning intercontinental distances will require satellite payloads that can swap entanglement. We report on results from the Q4S mission, successfully demonstrating entanglement swapping in a deployable payload.

## **QW2D.7 • 12:15**

### **Quantum Communication Using Frequency-Encoded Photons,**

Ali Binai motlagh<sup>1</sup>, Richard Oliver<sup>2,1</sup>, Alexander Gaeta<sup>1</sup>; <sup>1</sup>*Columbia Univ., USA*; <sup>2</sup>*Google LLC, USA*. We demonstrate a quantum communication system employing frequency qubits via Bragg-scattering four-wave mixing. Our work enables the use of an additional degree of freedom for quantum networks which offers distinct advantages over other encodings.

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**14:00 -- 16:00**

**Room: Hall 2**

**QW3A • Poster Session II**

## **QW3A.1**

**Towards Bell Violations With Gottesman-Kitaev-Preskill States**, Juba Chebini<sup>2</sup>, Rafael Alexander<sup>3</sup>, Khabat Heshami<sup>1,2</sup>, Milica Banic<sup>1</sup>; <sup>1</sup>*National Research Council Canada, Canada*; <sup>2</sup>*Univ. of Ottawa, Canada*; <sup>3</sup>*Xanadu, Canada*. We explore the feasibility of Clauser-Horne-Shimony-Holt (CHSH) tests on realistic Gottesman-Kitaev-Preskill (GKP) states, accounting for loss, non-idealities in physical GKP states, and imperfect measurement precision.

## **QW3A.2**

**Ultra-Precise Characterization of Retardance in Birefringent Optics**, Irene Bonanomi<sup>1,2</sup>, Michael B. Grayson<sup>1,2</sup>, Martin J. Stevens<sup>2</sup>, Lynden K. Shalm<sup>2,1</sup>, Michael D. Mazurek<sup>2,1</sup>; <sup>1</sup>*Univ. of Colorado Boulder, USA*; <sup>2</sup>*NIST Boulder Laboratories, USA*. We present and demonstrate two novel, automated methods for measuring the retardance in birefringent samples that achieve an order of magnitude reduction in uncertainty compared to the standard method while remaining simple to implement.

## **QW3A.2**

**A Tantalum on Silicon Terahertz Metamaterial Polarisation Modulator Chip**, Haonan He<sup>1</sup>, Shima Poorgholam Khanjari<sup>1</sup>, Yusheng Xiong<sup>1</sup>, Samane Kalhor<sup>1</sup>, Yongyu Zou<sup>1</sup>, Muhammad Imran<sup>1</sup>, Martin Weides<sup>1</sup>, Kaveh Delfanazari<sup>1</sup>; <sup>1</sup>*James Watt School of Engineering, Univ. of Glasgow, UK*. We demonstrate a strong polarisation dependent resonant response in an integrated tantalum on silicon terahertz (THz) metamaterial, achieving a 0.15 THz modulation bandwidth and a room temperature phase shift exceeding 21°, establishing a robust platform for chip scale THz polarisation control.

## **QW3A.3**

**Impact of Generalized Amplitude Damping Channel on Quantum Phase Estimation and Grover Search Algorithms**, Amber Riaz<sup>1</sup>, Muhammad Faryad<sup>1</sup>; <sup>1</sup>*Lahore Univ. of Management Sciences, Pakistan*. The impact of a generalized amplitude damping channel on the estimated value of the phase in the quantum phase estimation algorithm and the success probability of the Grover search algorithm was simulated in Qiskit.

## **QW3A.4**

**Achieving Accurate Molecular Ground-State Energies on NISQ Devices Through a Combination of Shallow Quantum Circuits and Error Mitigation**, Nirmal M R<sup>1</sup>, Ankit Khandelwal<sup>1</sup>, M G. Chandra<sup>1</sup>, Manoj Nambiar<sup>1</sup>; <sup>1</sup>*Tata Consultancy Services Limited, India*. We provide evidence that accurate ground-state energies of molecules can be obtained from NISQ devices through the use of shallow quantum circuits and a combination of error mitigation techniques with an appropriate choice of hyper-parameters.

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## QW3A.5

**Brain-Inspired Complexity Metrics for Quantum Neuromorphic Systems**, Oliver D. Neill<sup>1</sup>, Connor Kalkman<sup>1</sup>, Daniele Faccio<sup>1</sup>; <sup>1</sup>*Univ. of Glasgow, UK*. Neuromorphic systems are a promising approach for efficient next-generation computing. We apply concepts developed in neuroscience to a photonic neuromorphic system to compare the behaviour and scaling under classical and quantum operation.

## QW3A.6

Withdrawn

## QW3A.7

Withdrawn

## QW3A.8

**Exploring Synchronization of Multimode Squeezed States of Light in a Continuous Variable Quantum Optical Network**, Radivoje Prizia<sup>1</sup>, Francesca Sansavini<sup>2</sup>, Iris Paparella<sup>1,3</sup>, Johan Henaff<sup>1</sup>, Nicolas Treps<sup>1</sup>, Roberta Zambrini<sup>3</sup>, Valentina Parigi<sup>1</sup>; <sup>1</sup>*Laboratoire Kastler Brossel, France*; <sup>2</sup>*Department of Physics and Oregon Center for Optical, Molecular, and Quantum Science, Univ. of Oregon, USA*; <sup>3</sup>*Instituto de Fisica Interdisciplinar y Sistemas Complejos, Spain*. We study the synchronization of two bosonic oscillators dissipating into an environment of bosonic oscillators. We propose an experimental CV optical platform to look at synchronization of the quadrature variances of two squeezed vacuum states.

## QW3A.9

**A QRNG Semiconductor Chip Based on Mode-Competition in a Gain-Switched VCSEL**, Blanca Mir<sup>1</sup>, Tomás Fernández Martos<sup>1</sup>, Miquel Rudé<sup>1</sup>, Gabriel I. Senno<sup>1</sup>, Carlos Abellán<sup>1</sup>, Waldimar Amaya<sup>1</sup>, Domenico Tulli<sup>1</sup>; <sup>1</sup>*QuSide Technologies Inc, Spain*. We present a quantum random number generator (QRNG) based on polarization-mode-competition in a gain-switched vertical-cavity surface-emitting laser (VCSEL). Built with mass-manufacturable commercial components, it provides 50 Mbps random numbers whose information-theoretical security is proven measurement-device-independently.

## QW3A.10

**Lithium Niobate Photonic Integrated Circuits for Entanglement Distribution**, Giovanni Finco<sup>1</sup>, Giovanni Vio<sup>1</sup>, Andreas Maeder<sup>1</sup>, Robert J. Chapman<sup>1</sup>, Rachel Grange<sup>1</sup>; <sup>1</sup>*Inst. for Quantum Electronics, Eidgenössische Technische Hochschule Zurich Departement Physik, Switzerland*. We present integrated photonic circuits on thin-film lithium niobate generating, distributing and reconstructing entangled photonic qubits across distinct devices, highlighting the suitability of the platform for future quantum communication infrastructure.

## QW3A.11

**Influence of Polarization Inhomogeneity and Focusing on Second-Harmonic Generation in Type-II PpKTP**, Hrishit Das<sup>1</sup>, Amit Verma<sup>1</sup>, Joyee Ghosh<sup>1</sup>; <sup>1</sup>*Indian Inst. of Technology Delhi, India*. We experimentally investigate second-harmonic generation in type-II ppKTP using Gaussian and inhomogeneously polarized beams, demonstrating the influence of spatial polarization structure and focusing on phase-matching behavior, temperature tuning, and

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## QW3A.12

**Continuous Variable Quantum key Distribution With Broadband, Single-Pass Squeezed Light Source**, Huy Q. Nguyen<sup>1</sup>, Adnan Hajomer<sup>1</sup>, ulrik lund L. andersen<sup>1</sup>, Tobias Ghering<sup>1</sup>; <sup>1</sup>*Danmarks Tekniske Universitet Institut for Fysik, Denmark*. We demonstrate a continuous-variable quantum key distribution system using broadband, single-pass squeezed light source, achieving twice the repetition rate of cavity-based implementations and a secret key rate of 1.333 Mbit/s over 10 km fibre.

## QW3A.13

**Highly-Efficient Photonic Sources for Scalable Entanglement-Based Quantum Networks**, Ioanna Katsavou<sup>1</sup>, Iliana Tsoni<sup>1</sup>, Huazhuo Dong<sup>1</sup>, Priyanka Giri<sup>1</sup>, Lucas Aoyagi<sup>1</sup>, Eleni Diamanti<sup>2</sup>, Alban Urvoy<sup>1</sup>, Julien Laurat<sup>1</sup>; <sup>1</sup>*Laboratoire Kastler Brossel, Sorbonne Un, France*; <sup>2</sup>*Laboratoire d'Informatique de Paris 6, France*. We present frequency non-degenerate SPDC-based photon-pair sources compatible with atomic quantum memories and telecommunication fibers, delivering high efficiency and strong non-classical correlations for repeater deployment on the 50 km Paris-region testbed, within the Quantum Internet framework.

## QW3A.14

Withdrawn

## QW3A.15

Withdrawn

## QW3A.16

**Wafer-Scale Robotic Assembly of Ultraclean Carbon Nanotubes for Industrial-Grade Single-Photon Sources**, Jia Liu<sup>1</sup>; <sup>1</sup>*Chiral Nano AG, Switzerland*. We report a scalable manufacturing workflow for carbon nanotube (CNT) single-photon sources using automated, machine-learning-driven robotic assembly. By deterministically integrating ultraclean, individual CNTs, we overcome production bottlenecks, enabling high-yield, room-temperature quantum emitters.

## QW3A.17

**Quantum Memories and Slow-Light in Erbium-Doped Silicon Nanophotonic Waveguides**, Jonas Schmitt<sup>1,2</sup>, Stephan Rinner<sup>1,2</sup>, Florian Burger<sup>1,2</sup>, Andreas Gritsch<sup>1,2</sup>, Kilian Sandholzer<sup>1,2</sup>, Andreas Reiserer<sup>1,2</sup>; <sup>1</sup>*Physics Department, Technische Universitat Munchen, Germany*; <sup>2</sup>*TUM Center for Quantum Engineering (ZQE), Germany*. Erbium-doped silicon nanophotonic devices combine telecom-band optical coherence with scalable, CMOS-compatible nanofabrication. We demonstrate ensemble-based quantum memory experiments and engineered inhibition of radiative decay, enabling coherent storage and enhanced light-matter interaction.

## QW3A.18

**Demonstration of an Integrated Photonic two-Qubit Network Node**, Jonas Zatsch<sup>1,2</sup>, Tim Engling<sup>1,2</sup>, Jeldrik Huster<sup>1,2</sup>, Louis Hohmann<sup>1,2</sup>, Shreya Kumar<sup>1,2</sup>, Stefanie Barz<sup>1,2</sup>; <sup>1</sup>*Inst. for Functional Matter and Quantum Technologies, Germany*; <sup>2</sup>*Center for Integrated Quantum Science and Technology, Germany*. We present an integrated photonic circuit capable of preparing and analyzing two-qubit states and interfacing them to optical fibres. Its functionality is demonstrated by transmitting entanglement between two network nodes with a fidelity of

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90.0(16)%.

## QW3A.19

**Experimental Demonstration of Optimal Measurement for Unambiguous Asymmetric States Discrimination Using Orbital Angular Momentum Qudit States**, Kang-Min Hu<sup>1,2</sup>, Hyang-Tag Lim<sup>1,2</sup>, Min Namkung<sup>1</sup>; <sup>1</sup>*Korea Inst. of Science and Technology, Korea (the Republic of)*; <sup>2</sup>*Division of Quantum Information, Korea Univ. of Science and Technology, Korea (the Republic of)*. Unambiguous quantum-state discrimination is crucial for quantum information. While prior experiments targeted equiprobable symmetric qudit states, this work proposes an optimal scheme for arbitrary asymmetric qudit discrimination using orbital angular momentum, supporting practical quantum-technology advances.

## QW3A.20

**Spacetime-Verified Authentication for Quantum Networks in a Deployed Fiber Testbed**, Leonardo Castillo Veneros<sup>1</sup>, Chase Wallace<sup>1</sup>, Eden Figueroa<sup>1</sup>; <sup>1</sup>*Stony Brook Univ., USA*. We use relativistically constrained entanglement measurements to authenticate quantum network topology and certify the origin of distributed correlations. Following verification, high-rate MDI-QKD expands keys over the authenticated links, suppressing independent relay attacks.

## QW3A.21

Withdrawn

## QW3A.22

**Traceable CV-QKD Parameter Estimation for Composable Security**, Luiz Couto Correa Pinto Filho<sup>1</sup>, Jesper B. Christensen<sup>1</sup>, Mikael Lassen<sup>1</sup>; <sup>1</sup>*Danish Fundamental Metrology (DFM), Denmark*. Composable CV-QKD security depends on parameter estimation. Biases in loss and noise shift key-rate bounds. Traceable, standardized estimates enable uncertainty budgets and cross-lab comparisons. As an example, we demonstrate SI-traceable receiver-efficiency calibration with quantified uncertainty.

## QW3A.23

**Reverse Reconciliation with Soft Information for Discrete-Modulation CV-QKD at Long Range**, Marco Origlia<sup>1,2</sup>, Erdem E. Cil<sup>3</sup>, Laurent Schmalen<sup>3</sup>, Marco Secondini<sup>1</sup>; <sup>1</sup>*St Anna School of Advance Studies, Italy*; <sup>2</sup>*IEIT, Consiglio Nazionale delle Ricerche, Italy*; <sup>3</sup>*CEL, Karlsruhe Institut fur Technologie, Germany*. We recently introduced a reverse reconciliation scheme with soft information. In this paper, we assess its performance at ultra-low SNR, thus proving that such scheme is a versatile solution to the reverse reconciliation problem.

## QW3A.24

**Informationally Complete Orbital-Angular-Momentum Tomography With Intensity Measurements**, Marcos Gil de Oliveira<sup>2,3</sup>, Andre Junior<sup>1</sup>, Patrick Lima<sup>4</sup>, Altilano Barbosa<sup>1</sup>, Braian Silva<sup>3</sup>, Sebastião Padua<sup>4</sup>, Antonio Zelaquett<sup>2</sup>; <sup>1</sup>*Universidade Federal Fluminense*,

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*Brazil; <sup>2</sup>Física, Universidade Federal Fluminense, Brazil; <sup>3</sup>Centro Universitário SENAI CIMATEC, Brazil; <sup>4</sup>Universidade Federal de Minas Gerais, Brazil.* We present a method for quantum state tomography of the spatial structure of light within fixed-order subspaces. Using two spatially resolved intensity measurements, one after an astigmatic transformation via a tilted lens, we show the method to be informationally complete. This is confirmed by experiments in the intense and photocount regimes.

## QW3A.25

**Polarisation Resource Compensation on an Active Quantum Network**, Marcus J. Clark<sup>1</sup>, Nicole Luc<sup>1</sup>, Ruizhi Yang<sup>1</sup>, Rui Wang<sup>1</sup>, Dimitra Simeonidou<sup>1</sup>, Siddarth Joshi<sup>1</sup>; <sup>1</sup>*Univ. of Bristol, UK.* We present work towards polarisation resource correction on an active quantum network, with counter-propagated entanglement and polarisation control signals simultaneously in deployed fibre links.

## QW3A.26

**Reconfigurable Encoder for Discrete-Variable and Continuous-Variable Quantum Key Distribution**, Mattia Sabatini<sup>1</sup>, Tommaso Bertapelle<sup>1</sup>, Paolo Villorosi<sup>1,2</sup>, Giuseppe Vallone<sup>1,2</sup>, Marco Avesani<sup>1</sup>; <sup>1</sup>*Dipartimento di Ingegneria dell'Informazione, Università degli Studi di Padova, Italy; <sup>2</sup>Padua Quantum Technologies Research Center, Università degli Studi di Padova, Italy.* We demonstrate a reconfigurable encoder for both discrete-variable and continuous-variable quantum key distribution. Built from commercial components, it supports polarization and phase encoding, enabling dynamic protocol selection in heterogeneous networks to optimize key distribution.

## QW3A.27

**Building Blocks for a Hybrid Quantum Repeater**, Max Bergerhoff<sup>1</sup>, Pascal Baumgart<sup>1</sup>, Tobias Bauer<sup>1</sup>, David Lindler<sup>1</sup>, Christian Haen<sup>1</sup>, Marlon Schäfer<sup>1</sup>, Jonas Meiers<sup>1</sup>, Christoph Becher<sup>1</sup>, Jürgen Eschner<sup>1</sup>; <sup>1</sup>*Universität des Saarlandes, Germany.* We demonstrate key building blocks for a hybrid quantum repeater that interfaces SnV color centers with trapped calcium ions, including fiber-distributed frequency references, wavelength conversion, telecom-band two-photon interference, and simulations of Hong–Ou–Mandel visibility.

## QW3A.28

**Sustainable Chip Scale Coherent Terahertz Source Based on a Layered High Temperature Superconductor**, Mingqi Zhang<sup>1</sup>, Shungo Nakagawa<sup>2</sup>, Yuki Enomoto<sup>2</sup>, Yoshihiko Kuzumi<sup>2</sup>, Ryuta Kikuchi<sup>2</sup>, Yuki Yamauchi<sup>2</sup>, Toshiaki Hattori<sup>2</sup>, Richard Klemm<sup>3</sup>, Kazuo Kadowaki<sup>2</sup>, Takanari Kashiwagi<sup>2</sup>, Kaveh Delfanazari<sup>1</sup>; <sup>1</sup>*Univ. of Glasgow, UK; <sup>2</sup>Tsukuba Daigaku, Japan; <sup>3</sup>Univ. of Central Florida, USA.* We demonstrate a sustainable chip scale coherent terahertz (THz) source engineered from layered high temperature superconductors, generating photon level THz radiation detectable across a nearly half meter free space link, highlighting its potential for future wireless THz quantum technologies.

## QW3A.29

Withdrawn

## QW3A.30

**Multi-Path Entanglement Distribution in Limited-Resource Quantum Networks**, Nadav Lavi<sup>1</sup>, Nir Gutman<sup>1</sup>, Ido E. Kaminer<sup>1</sup>, Ariel Orda<sup>1</sup>; <sup>1</sup>*Technion Israel Inst. of Technology, Israel.* Optimizing connection quality in resource-constrained quantum networks remains an open question. We introduce a topology-aware multi-path approach. We analyze scheduling of

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## QW3A.31

**Interference of Deterministic and Highly Indistinguishable Single Photons in the Telecom C-Band**, Nico Hauser<sup>1</sup>, Matthias Bayerbach<sup>1</sup>, Jochen Kaupp<sup>2</sup>, Yorick Reum<sup>2</sup>, Giora Peniakov<sup>2</sup>, Johannes Michl<sup>2</sup>, Martin Kamp<sup>2</sup>, Tobias Huber-Loyola<sup>2,3</sup>, Andreas Pfenning<sup>2</sup>, Sven Höfling<sup>2</sup>, Stefanie Barz<sup>1</sup>; <sup>1</sup>*Univ. of Stuttgart, Germany*; <sup>2</sup>*Julius-Maximilians-Universität Würzburg, Germany*; <sup>3</sup>*Karlsruher Institut für Technologie, Germany*. We present the deterministic generation of indistinguishable single photons within the telecom C-band using indium arsenide quantum dots. We explore different optical excitation schemes and demonstrate two-photon interference visibilities of up to 91%.

## QW3A.32

**Parallel CHSH Games on a Multi-User Entanglement Network**, Nicole Luc<sup>1</sup>, Marcus Clark<sup>1</sup>, Siddarth Joshi<sup>1</sup>; <sup>1</sup>*Univ. of Bristol, UK*. We present experimental progress towards using CHSH games in a quantum network with 48 simultaneous entanglement links to demonstrate a computational advantage over classical linear circuits.

## QW3A.33

**Impact of Timing Jitter on COW-QKD System Performance**, Nilesh Sharma<sup>1</sup>, Anil Prabhakar<sup>1</sup>; <sup>1</sup>*Indian Inst. of Technology Madras, India*. This research evaluates COW-QKD performance under timing jitter by modelling timing uncertainties as a Gaussian distribution. Results establish a 538 ps jitter threshold for security, illustrating how temporal uncertainties limit transmission distance and secure key rate performance of COW-QKD.

## QW3A.34

**Indistinguishable Raman Photons from Trapped Ions for Quantum Repeater Applications**, Pascal Baumgart<sup>1</sup>, Max Bergerhoff<sup>1</sup>, Jonas Meiers<sup>1</sup>, Stephan Kucera<sup>1,2</sup>, Jürgen Eschner<sup>1</sup>; <sup>1</sup>*Universität des Saarlandes, Germany*; <sup>2</sup>*Luxembourg Inst. of Science and Technology Belvaux, Luxembourg*. We experimentally investigate the effects of spontaneous decays back to the ground state on the indistinguishability of single Raman photons from trapped  $40\text{Ca}^+$  ions excited by few-nanosecond laser pulses.

## QW3A.35

**Squeezed Light Source Based on a Periodically Poled Thin-Film Lithium Niobate Chip**, Hu Yuyang<sup>1</sup>, Chenyu Wang<sup>2</sup>, Xiao-Hui Tian<sup>1,2</sup>, Zishuo Gu<sup>2</sup>, Wei Wang<sup>1</sup>, Hong Cai<sup>1</sup>, Sijin Li<sup>1</sup>, Zhenda Xie<sup>2</sup>, AiQun Liu<sup>1</sup>; <sup>1</sup>*Hong Kong Polytechnic Univ., Hong Kong*; <sup>2</sup>*Nanjing Univ., China*. By periodically poling and dry etching of submicron size thin-film lithium niobate, we realize chip-scale squeezed light source with 150 nm bandwidth and 0.45 dB squeezing, highlighting potential for integrated quantum communication and computation.

## QW3A.36

**Phonon Thermometry of a Gallium Phosphide Optomechanical Crystal**, Javier Naya Hernandez<sup>1</sup>, Thomas Karg<sup>1</sup>, Benjamin Lloyd<sup>1</sup>, Henrik Tuschla<sup>1</sup>, Aleksandar Jovanovic<sup>1,2</sup>, David Indolese<sup>1</sup>, Paul Seidler<sup>1</sup>; <sup>1</sup>*IBM Research Zurich, Switzerland*; <sup>2</sup>*Physics, Eidgenössische Technische Hochschule Zurich, Switzerland*. We quantify optical-absorption-induced heating of a gallium phosphide optomechanical crystal cavity using Stokes/anti-Stokes sideband asymmetry. Measurements with resonant and detuned optical pulses yield power- and

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## QW3A.37

**Phononic Crystal Resonators on GaAs for Single Phonon-Photon Interactions**, Joey Bush<sup>1,2</sup>, Karthik Myilswamy<sup>2</sup>, Zixuan Wang<sup>2,1</sup>, Poolad Imany<sup>3,2</sup>, Kevin Silverman<sup>2</sup>; <sup>1</sup>*Univ. of Colorado Boulder, USA*; <sup>2</sup>*National Inst. of Standards and Technology, USA*; <sup>3</sup>*Icarus Quantum, USA*. We design, fabricate, and measure suspended GaAs phononic crystal acoustic resonators embedded with quantum dots to enhance the optomechanical interaction for single phonon-photon interactions.

## QW3A.38

**Scalable Fabrication of Freestanding Diamond Nanophotonic Structures via Reactive Ion Beam Angled Etching**, Jonathan Enßlin<sup>1</sup>; <sup>1</sup>*Univ. of Stuttgart PI3, Germany*. We demonstrate a robust fabrication process for freestanding diamond nanophotonic structures using reactive ion beam angled etching. We achieve high mask selectivity and precise control over diamond waveguide geometries, enabling scalable quantum hardware integration.

## QW3A.39

**Laser Induced V2 Centers in Bulk Grown Silicon Carbide**, Laurens J. Feije<sup>1,2</sup>, Gerben Timmer<sup>1,2</sup>, Rana Karababa<sup>1,2</sup>, Yihong Yun<sup>1,2</sup>, Guido van de Stolpe<sup>1,2</sup>, Tobias Martens<sup>1,2</sup>, Sjoerd Loenen<sup>1,2</sup>, Theo Durant<sup>1,2</sup>, Antarksha Das<sup>1,2</sup>, Tim Hugo Taminiu<sup>1,2</sup>; <sup>1</sup>*QuTech, Netherlands*; <sup>2</sup>*Kavli Inst. of Nanoscience Delft, Netherlands*. We investigate the generation of V2 centers in SiC using a pulsed UV laser. Initial characterisation shows that laser induced V2 centers have optical and spin properties comparable to naturally occurring V2 centers.

## QW3A.40

**Towards Cavity-Enhanced Rydberg Superatoms as Deterministic Quantum Network Nodes**, Lena K. Schumacher<sup>1</sup>, Félix HOFFET<sup>1</sup>, Hugues de Riedmatten<sup>1,2</sup>; <sup>1</sup>*ICFO -Institut de Ciències Fotoniques, Spain*; <sup>2</sup>*Institucio Catalana de Recerca i Estudis Avancats, Spain*. We present an experimental setup, in which we want to combine cavity-enhanced efficient single-photon generation with deterministic atom-photon entanglement generation to realize a quantum repeater protocol using atomic Rydberg ensembles.

## QW3A.41

**Single Erbium Ions for Quantum Technologies**, Luca Mastrangelo<sup>1</sup>, Emanuele Urbinati<sup>1</sup>, Annalise Lennon<sup>1</sup>, Kieran Smith<sup>1</sup>, Gaia Da Prato<sup>1</sup>, Yong Yu<sup>2</sup>, Simon Groblacher<sup>1</sup>; <sup>1</sup>*Technische Universiteit Delft, Netherlands*; <sup>2</sup>*Univ. of Science and Technology of China, China*. We study single erbium ions implanted in lithium niobate and silicon, coupled to nanophotonic resonators. Purcell-enhanced emission enables single-ion spectroscopy, revealing how the host material affects spectral diffusion and optical coherence required for indistinguishable telecom photons.

## QW3A.42

**Highly Uniform Photonic Crystal Fibers for Photon Pair Generation**, Mateusz J. Olszewski<sup>1</sup>, Robbie Mears<sup>1</sup>, Leah Murphy<sup>1</sup>, Alex O. Davis<sup>1</sup>, Peter Mosley<sup>1</sup>; <sup>1</sup>*Univ. of Bath, UK*. Longitudinal variations in photonic crystal fibers broaden four-wave mixing, limiting photon-pair source performance. We present precise characterization of highly uniform PCF, where non-

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uniformities are minimized by tight tolerances and high drawing tension.

## QW3A.43

### **Lithium Niobate Photonic Molecule Towards Single-Mode Squeezed Light**

**Generation,** Michelle Schweizer<sup>1,2</sup>, Tumas Napoleon Arge<sup>1,2</sup>, Iven F. Welp<sup>1,2</sup>, Odiel Hooybergs<sup>1,3</sup>, Robert J. Chapman<sup>1,2</sup>, Werner Wegscheider<sup>3</sup>, Rachel Grange<sup>1,2</sup>; <sup>1</sup>*Optical Nanomaterials Group, Inst. for Quantum Electronics, Eidgenossische Technische Hochschule Zurich, Switzerland*; <sup>2</sup>*Quantum Center, Eidgenossische Technische Hochschule Zurich, Switzerland*; <sup>3</sup>*Solid State Physics Laboratory, Eidgenossische Technische Hochschule Zurich, Switzerland*. We demonstrate lithium niobate photonic molecules designed to enable single-mode squeezed light generation via selective resonance splitting. We experimentally validate preserved quality factors together with lossless full-range thermal tunability.

## QW3A.44

### **Contextuality Enhancement in Identifying Quantum States With Fixed Failure**

**Probability,** Min Namkung<sup>1</sup>, Hyang-Tag Lim<sup>1,2</sup>; <sup>1</sup>*Center for Quantum Technology, Korea Inst. of Science & Technology, Korea (the Republic of)*; <sup>2</sup>*Division of Quantum Information, Korea Univ. of Science and Technology, Korea (the Republic of)*. We theoretically verify the contextuality enhancement in identifying quantum states with a fixed failure probability. This suggests that the nonclassicality is unveiled by a simple prepare-and-measure scheme that covers minimum-error, unambiguous, and maximal-confidence discriminations.

## QW3A.45

**Tunable Quantum Light Generation in Integrated Photonic Waveguides,** Muskan Arora<sup>2</sup>, Pranav Chokkara<sup>1</sup>, Jasleen Lugani<sup>1</sup>; <sup>1</sup>*Indian Inst. of Technology Delhi, India*; <sup>2</sup>*Indian Inst. of Technology Delhi, India*. We investigate the tunability of photon-pair sources based on LNOI waveguides. Focussing on the group-index engineering, a singly poled source could be tuned to generate photons in NIR–MIR range, catering to versatile quantum applications

## QW3A.46

Withdrawn

## QW3A.47

**Repetition Rate Enhancement of Photon-Pair Rates in Micro-Ring Resonators,** Nathan Moses<sup>1</sup>, Marcus Clark<sup>1</sup>, Alex S. Clark<sup>1</sup>, Siddarth Joshi<sup>1</sup>, Imad Faruque<sup>2,1</sup>; <sup>1</sup>*Univ. of Bristol, UK*; <sup>2</sup>*The Univ. of Sheffield, UK*. We demonstrate optimization of photon-pair rates from a micro-ring resonator source while keeping a high coincidence-to-accidental ratio by adjusting the repetition rate of the laser.

## QW3A.48

**Tracking of Moving Objects Using Spatial Mode Demultiplexing,** Jakob G. Budde<sup>1,2</sup>, Emma Tamayo<sup>1</sup>, Giacomo Sorelli<sup>1</sup>; <sup>1</sup>*Fraunhofer-Institut fur Optronik Systemtechnik und Bildauswertung IOSB Standort Ettlingen, Germany*; <sup>2</sup>*Inst. of Physics, Albert-Ludwigs-Universitat Freiburg, Germany*. We present a method to track an object using spatial mode demultiplexing instead of pixel-based direct imaging. This allows for high precision when estimating parameters like position below the diffraction limit.

## QW3A.49

**Coherent THz Field Imaging via Rydberg Atoms Enabled THz-to-Optical Conversion,** Jan Nowosielski<sup>1</sup>, Marcin Jastrzebski<sup>1</sup>, Mateusz Mazelanik<sup>1</sup>, Wojciech Wasilewski<sup>1</sup>, Michal

# Optica Quantum 2.0 Conference and Exhibition

**Disclaimer:** this guide is limited to technical program with abstracts and author blocks as of 02 June. For updated and complete information with special events, reference the online schedule or mobile app Parniak<sup>1</sup>; <sup>1</sup>*Uniwersytet Warszawski, Poland*. We present a novel method of coherent THz field imaging using a room-temperature Rydberg atom-based sensor, allowing for measuring both amplitude and phase distribution of the oncoming field.

## QW3A.50

Withdrawn

## QW3A.51

### **Physically Coherent Pulsed Light From Mathematically Incoherent Density**

**Matrices**, Joscelyn van der Veen<sup>1</sup>, Daniel F. James<sup>1</sup>; <sup>1</sup>*Univ. of Toronto, Canada*. The interference measurements of pulsed lasers can arise from both multimode coherent nonstationary light or Poissonian distributed incoherent stationary light. The comparison between the two descriptions' correlations elucidates methods for combining statistical and ultrafast optics.

## QW3A.52

### **Experimental Multi-Parameter Estimation of the State of Two Interfering Photonic**

**Qubits**, Joseph Niblo<sup>1</sup>, Luca Maggio<sup>2</sup>, Russell M. Brooks<sup>1</sup>, Joseph Ho<sup>1</sup>, Vincenzo Tamma<sup>2</sup>; <sup>1</sup>*Inst. of Photonics and Quantum Sciences, Heriot-Watt Univ., UK*; <sup>2</sup>*School of Mathematics and Physics, Univ. of Portsmouth, UK*. We present an experimental demonstration of multi-parameter estimation approaching the ultimate quantum Cramér-Rao bound in the polar angle and relative phase of two photons, using a polarisation-resolving interferometer.

## QW3A.53

### **Overcoming Fiber Dispersion Effects With Biphoton Correlations for Long-Range Sub-Centimeter Resolution**

Lior Cohen<sup>1</sup>, Leonid Vidro<sup>1</sup>, Noam Radziner<sup>1</sup>, Yishai Albeck<sup>1</sup>, Hagai Eisenberg<sup>1</sup>; <sup>1</sup>*Physics, Hebrew Univ. of Jerusalem Racah Inst. of Physics, Israel*. We formulate and demonstrate a method to overcome dispersion effects and achieve arbitrarily high reflection range resolution by utilizing biphoton spectral correlations. We demonstrate subcentimeter resolution at 45km and discuss the method's practical limits.

## QW3A.54

### **Laser Threshold Magnetometry With a Second Active Medium for High-Sensitivity Magnetic-Field Detection**

Lukas Lindner<sup>1</sup>, Yves Rottstaedt<sup>1,2</sup>, Florian Schall<sup>1</sup>, Janina Schindler<sup>1</sup>, Takeshi Ohshima<sup>3,4</sup>, Alexander M. Zaitsev<sup>5</sup>, Roman Bek<sup>6</sup>, Marcel Rattunde<sup>1</sup>, Rüdiger Quay<sup>1</sup>, Jan Jeske<sup>1</sup>; <sup>1</sup>*Fraunhofer-Institut für Angewandte Festkörperphysik IAF, Germany*; <sup>2</sup>*Institut für Theoretische Physik, Universität Leipzig, Germany*; <sup>3</sup>*National Inst.s for Quantum Science and Technology (QST), Japan*; <sup>4</sup>*Department of Materials Science, Tohoku Univ., Japan*; <sup>5</sup>*College of Staten Island, USA*; <sup>6</sup>*Twenty-One Semiconductors GmbH, Germany*. We present two-media NV-diamond laser threshold magnetometry using a VECSEL gain medium which compensates cavity losses, demonstrating a magnetic-field-dependent laser threshold, and deriving a shot-noise-limited sensitivity of 49 pT/ $\sqrt{\text{Hz}}$  through an improved shot-noise sensitivity formula.

## QW3A.55

### **Dispersion-Tailored Ta<sub>2</sub>O<sub>5</sub> Integrated Photonic Waveguides for Telecom-Band Nonlinear**

**Quantum Photonics**, Maksim Lipkin<sup>1,2</sup>, Grigori Vydrevich<sup>1,2</sup>, Rijil Thomas<sup>2</sup>, Stephan Suckow<sup>2</sup>, Max C. Lemme<sup>1,2</sup>; <sup>1</sup>*Chair of Electronic Devices, Rheinisch-Westfälische Technische Hochschule Aachen, Germany*; <sup>2</sup>*AMO GmbH, Germany*. We demonstrate 600 nm thick Ta<sub>2</sub>O<sub>5</sub> waveguides with 0.55 dB/cm and racetrack resonators with Q  $\sim 2 \times 10^5$ . Dispersion engineering and phase-

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matching simulations show suitability for  $\chi^3$  nonlinear interactions and photon-pair generation in the telecom band.

## QW3A.56

**Massively Parallel TCPSC at kHz Rates for Cardiac Electrophysiology**, Gordon Robertson<sup>1</sup>, Eline Huethorst<sup>4</sup>, Euan Millar<sup>1</sup>, Richard Walker<sup>2</sup>, Daniele Faccio<sup>1</sup>, Godfrey Smith<sup>4,3</sup>, Marie-Caroline Muellenbroich<sup>1</sup>; <sup>1</sup>*School of Physics & Astronomy, Univ. of Glasgow, UK*; <sup>2</sup>*Photon Force Ltd, UK*; <sup>3</sup>*Clyde Biosciences Ltd, UK*; <sup>4</sup>*School of Cardiovascular & Metabolic Health, Univ. of Glasgow, UK*. High-speed fluorescence lifetime photometry using massively parallel TCSPC on a SPAD array enables kilohertz lifetime estimation. A two-state calcium-indicator binding model accurately predicts lifetime dynamics during calcium transients in beating cardiomyocytes, showing strong agreement with experiment.

## QW3A.57

**All-Fiber Microsensor of Polarization at Single-Photon Level Aided by Deep Learning**, Martin Bielik<sup>1</sup>, Dominik Vařinka<sup>1</sup>, Miroslav Jezek<sup>1</sup>; <sup>1</sup>*Univerzita Palackeho v Olomouci, Czechia*. We demonstrate a single-shot, all-fiber polarization microsensor exploiting intermodal speckle interference and deep learning, enabling complete polarization-state reconstruction with single-photon sensitivity, long-term stability, and practical applicability in imaging and metrology.

## QW3A.58

**Room Temperature Single Photon Detector for 1550 nm**, Martin Brunzell<sup>1</sup>, Patrick Mutter<sup>1</sup>, Max Widarsson<sup>1</sup>; <sup>1</sup>*Svenska Laserfabriken AB, Sweden*. We demonstrate room-temperature single-photon detection at 1550 nm using a compact, PPKTP waveguide up-conversion setup, converting telecom photons to the visible for efficient silicon SPAD detection with dead time below 25 ns.

## QW3A.59

**Biologically-Inspired Spatial Filtering for Photon-Event LiDAR With Neural Networks**, Matthias Aquilina<sup>1</sup>, Pietro Bartoli<sup>2</sup>, Ashley Lyons<sup>1</sup>; <sup>1</sup>*Univ. of Glasgow, UK*; <sup>2</sup>*Politecnico di Milano, Italy*. We present a neural network approach to reconstructing a scene, which uses biologically-inspired preprocessing to separate individually detected photons and then asynchronously process them, generating temporal histograms that highlight different features in the scene.

## QW3A.60

**Robust Quantum Multi-Phase Sensing With Definite Photons**, Min Namkung<sup>1</sup>, Changhyoup Lee<sup>2</sup>, Hyang-Tag Lim<sup>1,3</sup>; <sup>1</sup>*Korea Inst. of Science & Technology, Korea (the Republic of)*; <sup>2</sup>*Department of Physics, Hanyang Univ., Korea (the Republic of)*; <sup>3</sup>*Division of Quantum Information, Korea Univ. of Science and Technology, Korea (the Republic of)*. Simultaneously estimating multi-phases with quantum-advantaged precision is promising for quantum sensing. However, quantum states used in the scheme experience photon loss. We propose a methodology exploiting definite photons, guaranteeing persistent quantum advantage under the loss.

## QW3A.61

**Conditions for Time-Independence of N-Level Systems Under the Rotating Wave Approximation (RWA) and Dipole Selection Rules**, Myint Myat Paing<sup>1</sup>, Daniel F. James<sup>1</sup>; <sup>1</sup>*Department of Physics, Univ. of Toronto, Canada*. We present conditions for

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Hamiltonian time-independence of multilevel systems under the Rotating Wave Approximation. We conclude that systems with only one odd- or even-parity level are unconditionally time-independent, whereas others require a detuning condition.

## QW3A.62

### **Beyond the Rotating Wave Approximation: Conditional Squeezing and Quantum non-Demolition Readout in the Jaynes-Cummings Model**, Myint Myat Paing<sup>1</sup>, Daniel F.

James<sup>1</sup>; <sup>1</sup>*Department of Physics, Univ. of Toronto, Canada*. A first-principles Magnus expansion treatment of the Jaynes-Cummings model beyond the Rotating Wave Approximation reveals second-order energy shifts and  $\sigma_z$ -dependent field squeezing, suggesting a natural route towards a quantum non-demolition readout.

## QW3A.63

### **Compact and Robust Laser Modules and Light Control Units for Quantum Sensing and Quantum Computing**, Nora C. Goossen-Schmidt<sup>1</sup>, Angana Bhattacharya<sup>1</sup>, Marcel Bursy<sup>1</sup>, Jörg

Fricke<sup>1</sup>, Luzie Günther<sup>1</sup>, Jonas Hamperl<sup>1</sup>, Norbert Müller<sup>1</sup>, Viktor Romanov<sup>1</sup>, Max Schiemangk<sup>1</sup>, Sandy Szermer<sup>1</sup>, Hans Wenzel<sup>1</sup>, Andreas Wicht<sup>1</sup>; <sup>1</sup>*Ferdinand-Braun-Institut gGmbH, Germany*. We develop compact and robust lasers and Light Control Units with low size, weight and power as well as low frequency noise, specifically tailored to quantum technology applications such as optical clocks and quantum computers.

## QW3A.64

### **Towards a Rydberg-Atoms-Based and Wideband RFsensor With all-Glass**

### **Microfabricated Vapor Cells**, Davide Sera<sup>4,1</sup>, Yasin Taheri Mazinani<sup>1</sup>, Prajal Chettri<sup>2</sup>, Vito

Giovanni Lucivero<sup>3,1</sup>; <sup>1</sup>*Universita degli Studi di Bari Aldo Moro, Italy*; <sup>2</sup>*Politecnico di Bari, Italy*; <sup>3</sup>*Institut de Ciencies Fotoniques, Spain*; <sup>4</sup>*Thales Alenia Space Italia, Italy*. We develop an RF sensor using Rydberg-atom EIT in a cesium vapor cell. RF driven Autler–Townes splitting enables field readout. We characterize performance versus temperature, buffer gas, beam size, and laser powers to guide LWVC design.

## QW3A.65

### **A Noise-Resilient Calibration Framework for Quantum and Optical Neural Network**

### **Inference**, Tian CHEN<sup>1,2</sup>, Wei Wang<sup>2,3</sup>, Zan Tang<sup>2,3</sup>, Lipket Chin<sup>2,3</sup>, Hong Cai<sup>2,3</sup>, Lap-Pui

Chau<sup>2,3</sup>, Jinjing Shi<sup>1</sup>, AiQun Liu<sup>2,3</sup>; <sup>1</sup>*School of Electronic Information, Central South Univ., China*; <sup>2</sup>*Research Inst. for Quantum Technology (RIQT), The Hong Kong Polytechnic Univ., Hong Kong*; <sup>3</sup>*Department of Electrical and Electronic Engineering, The Hong Kong Polytechnic Univ., Hong Kong*. To mitigate hardware noise, we propose a noise-resilient calibration framework for quantum and optical neural network inference. Calibration achieves near-perfect fidelity. In classification tasks, accuracy improves by up to 66.98% (16-mode) and 74.85% (32-mode), demonstrating that larger-scale optical chips yield greater performance benefits.

## QW3A.66

### **Scalable Generation of GHZ States in a Temporal Multiplexed Architecture**, Philip Held<sup>1</sup>,

Jonas Lammers<sup>1</sup>, Fabian Schlue<sup>1</sup>, Federico Pegoraro<sup>1</sup>, Benjamin Brecht<sup>1</sup>, Christine Silberhorn<sup>1</sup>; <sup>1</sup>*Paderborn Univ., Integrated Quantum Optics, Inst. for Photonic Quantum Systems*

(PhoQS), Germany. We present a scalable generation scheme for temporal multiplexed photonic GHZ states in a single spatial mode. We demonstrate its feasibility by generating 3-photon GHZ states and verify the high quality of our generation circuit.

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## QW3A.67

Withdrawn

## QW3A.68

**Q-SHARE: Quantum State-Reuse for Extending NISQ Computation Under Noise**, Krishna Garigipati<sup>2</sup>, Nagadevi Naradasu<sup>1</sup>, Iswarya Obiliseti<sup>1</sup>, Venkatesh Maganti<sup>1</sup>; <sup>1</sup>*AIML, Aditya Univ., India*; <sup>2</sup>*Aditya Univ., India*. Near-term quantum devices suffer rapid state degradation under noise, limiting iterative computation. We present Q-SHARE, a state-centric execution framework experimentally demonstrating stable quantum state reuse, sustaining fidelity and preserving physical observables across noisy NISQ iterations.

## QW3A.69

**Quantum Material BP Based Plasmonic Optical Sensor for Label Free Colorectal Cancer**, Md Al Amin I. Utshob<sup>1</sup>, Maymona Binte Juwel<sup>1</sup>, Khandakar Mohammad Ishtiaq<sup>1</sup>; <sup>1</sup>*Ahsanullah Univ. of Science and Technology Department of Electrical & Electronic Engineering, Bangladesh*. In this paper, we propose a novel biosensor that uses SiO<sub>2</sub>/HfO<sub>2</sub>/Ag/CeO<sub>2</sub>/BP layers for the ultra-sensitive, label-free detection of colorectal cancer with improved biosensing capability compared to conventional biosensor structures for enhanced clinical applications. ©2026 The Author(s).

## QW3A.70

**Numerical Studies of Intrapulse Quantum Mode Structure of Kerr-Squeezed Light**, Nikolay Kalinin<sup>1</sup>, Luis Lorenzo Sánchez-Soto<sup>1,2</sup>, Gerd Leuchs<sup>1,3</sup>; <sup>1</sup>*Max-Planck-Institut für die Physik des Lichts, Germany*; <sup>2</sup>*Departamento de Optica, Facultad de Fisica, Universidad Complutense de Madrid, Spain*; <sup>3</sup>*Physik Department, Friedrich-Alexander-Universität Erlangen-Nürnberg, Germany*. We report on studying intrapulse quantum correlations arising from nonlinearity in  $\chi^{(3)}$  (Kerr) medium. We show that dispersion greatly affects the number of non-trivial quantum modes and can provide insights on observable squeezing.

## QW3A.71

**Synchronization of SPDC Photon Generation Using an Actively Switched Fiber Loop**, Xavier Barcons Planas<sup>1,2</sup>, Helen Chrzanowski<sup>1,2</sup>, Janik Wolters<sup>2,3</sup>; <sup>1</sup>*Humboldt-Universität zu Berlin, Germany*; <sup>2</sup>*Deutsches Zentrum für Luft- und Raumfahrt DLR Standort Berlin, Germany*; <sup>3</sup>*Technische Universität Berlin, Germany*. We demonstrate time-multiplexed synchronization of multiple heralded SPDC photons via a low-loss fiber loop. This approach enhances n-photon rates without introducing additional multiphoton contamination, offering a scalable strategy for clock-synchronized photonic quantum information applications.

**16:00 -- 18:15**

**Room: Alsh 1**

**QW4A • Quantum ML & Novel Computing Paradigms**

*Presider: To Be Announced*

**QW4A.1 • 16:00 (Invited)**

**Optically Wiring Quantum Modules for Scale**, Julien Laurat<sup>1</sup>; <sup>1</sup>*Laboratoire Kastler Brossel, France*. Scalable quantum technologies demand coherent photonic interconnects linking heterogeneous quantum modules. We realize a high-efficiency cold-atom quantum memory with deterministic temporal shaping of single photons, transforming a quantum memory into a

# Optica Quantum 2.0 Conference and Exhibition

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## QW4A.2 • 16:30

**Experimental Neuromorphic Computing Based on Quantum Memristor**, Mirela Selimovic<sup>1</sup>, Iris Agresti<sup>1</sup>, Michal Siemazko<sup>4</sup>, Joshua Morris<sup>1</sup>, Borivoje Dakić<sup>1</sup>, Riccardo Albiero<sup>3</sup>, Francesco Ceccarelli<sup>2,3</sup>, Andrea Crespi<sup>3</sup>, Roberto Osellame<sup>2,3</sup>, Magdalena Stobinska<sup>4</sup>, Philip Walther<sup>1</sup>; <sup>1</sup>Universität Wien, Austria; <sup>2</sup>Istituto di Fotonica e Nanotecnologie Consiglio Nazionale delle Ricerche, Italy; <sup>3</sup>Politecnico di Milano, Italy; <sup>4</sup>Uniwersytet Warszawski, Poland. We realize the first quantum reservoir computing protocol based on single photons manipulated by a quantum memristor. Performance on benchmark tasks, including vowel recognition, shows its potential for quantum machine learning and optical-based computing.

## QW4A.3 • 16:45

**Predicting Entanglement With a Quantum Extreme Learning Machine Trained by Classical Light**, Emanuele Brusaschi<sup>1</sup>, Marco Clementi<sup>1</sup>, Marco Liscidini<sup>1</sup>, Matteo Galli<sup>1</sup>, Daniele Bajoni<sup>2</sup>, Massimo Borghi<sup>1</sup>; <sup>1</sup>Università degli Studi di Pavia, Italy; <sup>2</sup>Dipartimento di Ingegneria Industriale e dell'Informazione, Università di Pavia, Italy. We report a photonic quantum extreme learning machine trained solely with classical light that attains 93% accuracy in entanglement prediction, while enhancing learning speed and signal-to-noise by two orders of magnitude.

## QW4A.4 • 17:00

**Photonic Quantum-Accelerated Machine Learning**, Markus Rambach<sup>3</sup>, Abhishek Roy<sup>3,1</sup>, Alexei Gilchrist<sup>1</sup>, Akitada Sakurai<sup>2</sup>, William J. Munro<sup>2</sup>, Kae Nemoto<sup>2</sup>, Andrew G. White<sup>3</sup>; <sup>1</sup>Macquarie Univ., Australia; <sup>2</sup>Okinawa Inst. of Science and Technology Graduate Univ., Japan; <sup>3</sup>The Univ. of Queensland, Australia. We demonstrate a photonic quantum accelerator for machine learning: boson-sampling-driven quantum reservoir features boost classification accuracy and data-efficiency, remain robust with imperfect photons, and are experimentally validated on a quantum processing unit, establishing scalable, practical quantum advantage pathways.

## QW4A.5 • 17:15

**Photonic Quantum Neural Networks via Adaptive Operations**, Léo Monbroussou<sup>4</sup>, Beatrice Polacchi<sup>1</sup>, Verena Yacoub<sup>4</sup>, Eugenio Caruccio<sup>1</sup>, Giovanni Rodari<sup>1</sup>, Francesco Hoch<sup>1</sup>, Gonzalo Carvacho<sup>1</sup>, Nicolò Spagnolo<sup>1</sup>, Taira Giordani<sup>1</sup>, Mattia Bossi<sup>2</sup>, Abhiram Rajan<sup>2</sup>, Niki Di Gianò<sup>2</sup>, Riccardo Albiero<sup>2</sup>, Francesco Ceccarelli<sup>2</sup>, Roberto Osellame<sup>2</sup>, Elham Kashefi<sup>3,4</sup>, Fabio Sciarrino<sup>1</sup>; <sup>1</sup>Univ degli Studi di Roma La Sapienza, Italy; <sup>2</sup>Istituto di Fotonica e Nanotecnologie, Consiglio Nazionale delle Ricerche (IFN-CNR), Italy; <sup>3</sup>School of Informatics, Univ. of Edinburgh, UK; <sup>4</sup>Sorbonne Université, France. We present a scheme for photonic quantum convolutional neural networks using linear optics with adaptive state injections and measurements. Validated experimentally with programmable integrated circuits and multi-photon states, this method highlights overall utility for near-term quantum hardware and quantum machine learning.

## QW4A.6 • 17:30

**Photonic Quantum-Controlled Classical Operations in a Wigner's Friend Framework**, Martí Cladera Rosselló<sup>1,2</sup>, Philip Walther<sup>2,3</sup>, Borivoje Dakić<sup>2</sup>, Lee A. Rozema<sup>2</sup>; <sup>1</sup>VDSP, Universität Wien Fakultät für Physik, Austria; <sup>2</sup>Vienna Center for Quantum Science and Technology, Austria; <sup>3</sup>Christian Doppler Forschungsgesellschaft, Austria. We study the interplay between Universal Quantum Computing and Wigner's friend paradox by

# Optica Quantum 2.0 Conference and Exhibition

**Disclaimer:** this guide is limited to technical program with abstracts and author blocks as of 02 June. For updated and complete information with special events, reference the online schedule or mobile app implementing quantum-controlled classical operations, realizing a photonic one-logical-qubit proof-of-principle and examining possible two-logical-qubit scenarios.

## QW4A.7 • 17:45

**Machine Learning of Quantum Data Using Optimal Similarity Measurements**, Zhenghao Li<sup>1</sup>, Hao Zhan<sup>3</sup>, Shana H. Winston<sup>1</sup>, Ewan Mer<sup>1</sup>, Zhenghao Yin<sup>4</sup>, Shang Yu<sup>1</sup>, Yazeed K. Alwehaibi<sup>1</sup>, Gerard J. Machado<sup>1,2</sup>, Dayne M. Lopena<sup>1</sup>, Lijian Zhang<sup>3</sup>, M. S. Kim<sup>1</sup>, Aonan Zhang<sup>1,2</sup>, Ian A. Walmsley<sup>1,2</sup>, Raj B. Patel<sup>1</sup>; <sup>1</sup>*Imperial College London, UK*; <sup>2</sup>*Univ. of Oxford, UK*; <sup>3</sup>*Nanjing Univ., China*; <sup>4</sup>*Universitat Wien, Austria*. We demonstrate sample-optimal similarity measurements for quantum data with bosonic interference on a programmable photonic processor. This hardware-scalable scheme achieves information-theoretic optimal scaling, providing a building block for efficient quantum machine learning.

## QW4A.8 • 18:00

**Entangling Dynamics in Open Quantum Systems**, Laura Ares<sup>1</sup>, Julien Pinske<sup>2</sup>, Nico Peters<sup>1</sup>, Benjamin Hinrich<sup>1</sup>, Martin Kolb<sup>1</sup>, Jan Sperling<sup>1</sup>; <sup>1</sup>*Universitat Paderborn, Germany*; <sup>2</sup>*Kobenhavns Universitet Niels Bohr Institutet, Denmark*. We address the entangling capabilities of realistic processes by comparing the dynamics with a separability-preserving evolution. We introduce a restricted Lindblad equation and Monte Carlo wave function method enabling the unambiguous identification of entangling dynamics.

**16:00 -- 18:00**

**Room: Alsh 2**

## QW4B • New Frontiers in Quantum Sensing

*Presider: To Be Announced*

### QW4B.1 • 16:00 (Invited)

**Ultralow-Loss Mechanical Resonators and Waveguides for Quantum and Classical Sensing**, Albert Schliesser<sup>1</sup>; <sup>1</sup>*Kobenhavns Universitet Niels Bohr Institutet, Denmark*.

Soft-clamped mechanical resonators and waveguides exhibit very long coherence times and propagation lengths for phonons. Optical detection allows monitoring the associated vibrations at or even below the standard quantum limit. Based on these platforms, we implement new detection modalities for forces, magnetic fields and spins, gas pressure and inertial sensing.

### QW4B.2 • 16:30

**Bell State Analysis Provides an Optimal Basis Saturating the Quantum Cramer-Rao Bound in Rotation Sensing**, Zhuoran Bao<sup>2</sup>, Daniel F. James<sup>1</sup>; <sup>2</sup>*Univ. of Toronto, Canada*.

The second-order anti-coherent state of light is known to saturate the Quantum Cramer-Rao Bound for rotation sensing; however, the corresponding positive-operator-valued measurement (POVM) for parameter extraction remains a challenge. We theoretically showed that the required POVM can be achieved by performing Bell state analysis.

### QW4B.3 • 16:45

**On the Quantum Optimality of SPADE for Incoherent Optical Sources**

**Discrimination**, Danilo Triggiani<sup>1,2</sup>, Cosmo Lupo<sup>1,2</sup>; <sup>1</sup>*Dipartimento di Fisica, Politecnico di Bari, Italy*; <sup>2</sup>*Istituto Nazionale di Fisica Nucleare, Italy*. SPADE enables sub-diffraction sensing of incoherent sources. We show it is not generally optimal for arbitrary incoherent-sources

discrimination tasks, and identify the optimality conditions. We provide a method to determine the best SPADE configuration.

# Optica Quantum 2.0 Conference and Exhibition

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## **QW4B.4 • 17:00**

**Quantum Sensor Networks With Graph-Based Topologies for Ultralight Dark Matter Detection**, Adriel I. Santoso<sup>1</sup>, Bin Ho Le<sup>1</sup>; <sup>1</sup>*Tohoku Univ., Japan*. We propose a quantum-sensor network based on superconducting qubits for detecting ultralight dark matter. By optimizing network topology, probe states, and measurements using variational quantum metrology and Bayesian inference, we show that quantum networks can surpass conventional entanglement-based sensing under realistic noise conditions.

## **QW4B.5 • 17:15**

**Observation of Quantum Noise Reduction in a Raman Amplifier via Quantum Correlation Between Atom and Light**, Zhe-Yu J. Ou<sup>1</sup>, Jianmin Wang<sup>1</sup>, Rong Zhu<sup>1</sup>, Yue Li<sup>1</sup>; <sup>1</sup>*City Univ. of Hong Kong, Hong Kong*. We report a quantum noise reduction of 3.5dB in an atomic Raman amplifier by placing atomic states and the input Stokes field in quantum correlation, which in turn can be characterized by the noise reduction.

## **QW4B.6 • 17:30**

**Towards Delta-Kick Squeezing in a Rb Free-Fall Atom Interferometer**, Nassim Mhammedi<sup>1</sup>, Baptist Piest<sup>1</sup>, Nathan Niess<sup>1</sup>, Robin Corgier<sup>1</sup>, Quentin Beauvil<sup>1</sup>, Franck pereira<sup>1</sup>; <sup>1</sup>*Observatoire de Paris, France*. We investigate delta-kick squeezing to enhance the sensitivity of a quantum gravimeter beyond the standard quantum limit. We studied and mitigated the impact of sources of classical noise in our sensor and demonstrated matter-wave lensing of BECs.

## **QW4B.7 • 17:45**

**Quantum Clock Interferometry With Multi-Photon Frequency-Bin Entanglement and Quantum Memories**, Mustafa Gündogan<sup>3</sup>, Roy Barzel<sup>1</sup>, Dennis Rätzel<sup>2,1</sup>; <sup>1</sup>*Universität Bremen, Germany*; <sup>2</sup>*Technische Universität Wien, Austria*; <sup>3</sup>*Humboldt-Universität zu Berlin, Germany*. We propose memory-assisted quantum clock interferometry using 2N-photon frequency-bin entangled states stored in vertically separated quantum memories. Gravitational redshift imprints an N-fold phase, producing collapse and revival of Hong–Ou–Mandel visibility and parity signals at meter scales.

**16:00 -- 18:15**

**Room: Carron**

## **QW4C • Quantum Light Sources**

*Presider: To Be Announced*

## **QW4C.1 • 16:00**

**Polarization-Entangled Spectral Vector Photons**, Niladri Modak<sup>1</sup>, Lea Kopf<sup>1</sup>, Robert Fickler<sup>1</sup>; <sup>1</sup>*Tampereen Yliopisto, Finland*. We experimentally demonstrate spectral vector photons (SVPs) with complex polarization patterns across their wavelength spectrum. By utilizing polarization-entangled photon pairs, we remotely prepare such SVPs and confirm entanglement via Bell-inequality violations.

## **QW4C.2 • 16:15**

**Cavity-Enhanced Polarization Entanglement Source Tuned for Operation With Atomic Quantum Memories**, Edoardo Buonocore<sup>1</sup>, Carrie Cox<sup>1</sup>, Sonali Gera<sup>1</sup>, Eden Figueroa Barragan<sup>1,2</sup>; <sup>1</sup>*SUNY Stony Brook, USA*; <sup>2</sup>*Instrumentation, Brookhaven National Laboratory, USA*. We show the performance of our field-deployable, cavity-enhanced entanglement pair

# Optica Quantum 2.0 Conference and Exhibition

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## QW4C.3 • 16:30

### Frequency-Multiplexed Spontaneous Parametric

**Down Conversion in Thin-Film Lithium Niobate**, Jack H. Lichtman<sup>1</sup>, jiaju yang<sup>2</sup>, Francesca Sansavini<sup>1</sup>, neil sinclair<sup>2</sup>, Marko Loncar<sup>2</sup>, Michael G. Raymer<sup>1</sup>, Brian J. Smith<sup>1</sup>; <sup>1</sup>*Univ. of Oregon, USA*; <sup>2</sup>*Harvard John A Paulson School of Engineering and Applied Sciences, USA*. We present a scalable, frequency-multiplexed spontaneous parametric down conversion source based on thin-film lithium niobate waveguides.

## QW4C.4 • 16:45

### Spectrally Pure Telecom O-Band Heralded Single-Photon Source via Gaussian Phase-Matched KTP

Wu-Hao Cai<sup>1</sup>, Soyoung Baek<sup>1</sup>, Rui-Bo Jin<sup>2</sup>, Fumihiko Kaneda<sup>1,3</sup>; <sup>1</sup>*Tohoku Univ., Japan*; <sup>2</sup>*Hunan Normal Univ., China*; <sup>3</sup>*PRESTO, Japan Science and Technology Agency, Japan*. We demonstrate a spectrally pure telecom O-band heralded single-photon source. Sum-frequency generation confirms Gaussian phase-matching with 30-dB lobe suppression. Unheralded  $g^{(2)}$  measurements yield a spectral purity of  $99.4 \pm 3.0\%$ .

## QW4C.5 • 17:00

### High-Purity Counter-Propagating SPDC Photon Pairs in LNOI

Jost Kellner<sup>1</sup>, Alessandra Sabatti<sup>1</sup>, Rachel Grange<sup>1</sup>, Tristan Kuttner<sup>1</sup>, Robert J. Chapman<sup>1</sup>; <sup>1</sup>*ETH Zurich, Switzerland*. We demonstrate a counter-propagating SPDC source in LNOI generating intrinsically separated, high-purity photon pairs while exploiting the strongest  $\chi^{(2)}$  tensor element of lithium niobate. Short-period poling enables 92% purity and two-source Hong--Ou--Mandel interference with 70% visibility.

## QW4C.6 • 17:15

### Configurable Projective Time-Bin Measurements for Photonic Quantum Information

**Processing**, Amy L. Soudachanh<sup>1</sup>, Francesca Sansavini<sup>1</sup>, Michael G. Raymer<sup>1</sup>, Brian J. Smith<sup>1</sup>; <sup>1</sup>*Department of Physics, Univ. of Oregon, USA*. We demonstrate reconfigurable projective measurements onto time-bin encoded single-photon quantum bits using fast optical switching (<250 ps) in an unbalanced interferometer. Measurement of time-bin entangled photon pairs is presented.

## QW4C.7 • 17:30

### Integrated Circuit for Generation and All-Optical Measurement of Squeezed States in

**Sidewall-Poled Thin-Film Lithium Niobate Platform**, Michael S. Bullock<sup>1</sup>, Aditya Tripathi<sup>1</sup>, Parash Thapalia<sup>2</sup>, Pooja Kulkarni<sup>2</sup>, Robert Kwolek<sup>1</sup>, Jaber Balalhabashi<sup>1</sup>, Rintaro Tsuchida<sup>1</sup>, Sasan Fathpour<sup>2</sup>, Rajveer Nehra<sup>1</sup>; <sup>1</sup>*Univ. of Massachusetts Amherst, USA*; <sup>2</sup>*Univ. of Central Florida, USA*. We demonstrate a thin-film lithium niobate circuit integrating sidewall-poled waveguides for squeezed-vacuum generation with low-loss pump filters, and Sagnac mirrors enabling loss-tolerant measurement. We characterize component performance and report on continuous-wave squeezing from single-pass pumping.

## QW4C.8 • 17:45

### Indistinguishable Heralded Single-Photon Source

**With a Local Oscillator Reference**, Michael B. Grayson<sup>1</sup>, shawn meyer<sup>2</sup>, Daniel Sorensen<sup>2</sup>, Abigail Gookin<sup>2</sup>, Markus Allgaier<sup>3</sup>, Nicholas Nardelli<sup>1</sup>, Tara M. Fortier<sup>1</sup>, Dileep V. Reddy<sup>1</sup>, Martin J. Stevens<sup>1</sup>, Michael D. Mazurek<sup>1</sup>, Juliet T. Gopinath<sup>2</sup>, L. K. Shalm<sup>1</sup>; <sup>1</sup>*NIST Boulder, USA*; <sup>2</sup>*Univ.*

# Optica Quantum 2.0 Conference and Exhibition

**Disclaimer:** this guide is limited to technical program with abstracts and author blocks as of 02 June. For updated and complete information with special events, reference the online schedule or mobile app of Colorado Boulder, USA; <sup>3</sup>Univ. of North Dakota, USA. We demonstrate a flexible quantum optical platform that produces indistinguishable single-photons, polarization entanglement, and a passively matched local oscillator. We obtain  $(96.3 \pm 0.6)\%$  indistinguishability,  $(99.11 \pm 0.01)\%$  entanglement visibility,  $(68.0 \pm 0.1)\%$  heralded efficiency, and  $(88.6 \pm 0.2)\%$  local-oscillator visibility.

## QW4C.9 • 18:00

**Biphoton State Generation and Engineering With Bright Hybrid III-v/Silicon Photonic Devices**, Lorenzo Lazzari<sup>1,2</sup>, Jeremie Schuhmann<sup>1,2</sup>, Othmane Meskine<sup>1</sup>, Martina Morassi<sup>2</sup>, Aristide Lemaitre<sup>2</sup>, Maria Amanti<sup>1</sup>, Frederic Boeuf<sup>3</sup>, Fabrice Raineri<sup>4</sup>, Florent Baboux<sup>1</sup>, Sara Ducci<sup>1</sup>; <sup>1</sup>Université Paris Cité, France; <sup>2</sup>Centre de Nanosciences et de Nanotechnologies, France; <sup>3</sup>STMicroelectronics, France; <sup>4</sup>Institut de Physique de Nice, France. We demonstrate a hybrid III-V/Silicon photonic device generating biphoton states via spontaneous parametric down-conversion with engineered joint spectral properties. Efficient coupling yields high brightness and entanglement control, supporting scalable on-chip quantum photonics.

16:00 -- 18:00

Room: Lomond Auditorium

QW4D • Quantum Repeaters

Presider: Julien Laurat, Laboratoire Kastler Brossel, France

## QW4D.1 • 16:00 (Invited)

**Metropolitan-Scale Multiplexed Quantum Repeaters: Bell Non-Localities and Applications**, Zong-Quan Zhou<sup>1</sup>; <sup>1</sup>Univ. of Science and Technology of China, China. I will introduce a multiplexed quantum repeater protocol based on time measurements (MQRTM). Utilizing this protocol, we demonstrate heralded entanglement distribution between two Eu:YSO crystal memories separated by 14.5 km and observe a violation of the CHSH-Bell inequality by 3.7 standard deviations [arXiv:2508.17940]. Furthermore, I will discuss quantum communication applications enabled by such metropolitan-scale multiplexed quantum repeaters.

## QW4D.2 • 16:30

**Distribution of Quantum Correlations Across a Metropolitan Deployed Network Using a Solid-State Quantum Memory Array.**, Aya Mneimneh<sup>1</sup>, Susana Plascencia<sup>1</sup>, Jonathan Hänni<sup>1</sup>, Manuel Gundín<sup>1</sup>, Samuele Grandi<sup>1</sup>, Markus Teller<sup>1</sup>, Hugues de Riedmatten<sup>1,2</sup>; <sup>1</sup>Institut de Ciències Fotoniques, Spain; <sup>2</sup>Institució Catalana de Recerca i Estudis Avançats, Spain. We report the multiplexed distribution of quantum correlations between a photon and an on-demand solid-state quantum memory array over a 39.1-km-long deployed fibre, resulting in a 150-fold heralding rate enhancement with respect to single-mode operation.

## QW4D.3 • 16:45

**Single-Photon Synchronization With Solid-State Quantum Memories for Entanglement Swapping**, Alberto Rodríguez-Moldes<sup>1</sup>, Jonathan Hänni<sup>1</sup>, Antariksha Das<sup>1</sup>, Leo Feldmann<sup>1</sup>, Lucía Guerrero<sup>1</sup>, Aya Mneimneh<sup>1</sup>, Felicien Appas<sup>1</sup>, Samuele Grandi<sup>1</sup>, Markus Teller<sup>1</sup>, Hugues de Riedmatten<sup>1,2</sup>; <sup>1</sup>Institut de Ciències Fotoniques, Spain; <sup>2</sup>Institució Catalana de Recerca i Estudis Avançats, Spain. Synchronized read-out of quantum nodes is essential for entanglement swapping in long-distance links. I will present experiments on the read-out of single-photons synchronized by two solid-state quantum memories and discuss ongoing efforts towards entanglement swapping.

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## **QW4D.4 • 17:00**

**High-Rate Scalable Entanglement Swapping Between Remote Entanglement Sources on Deployed New York City Fibers**, Alexander N. Craddock<sup>1</sup>, Tyler Cowan<sup>2</sup>, Dylan Robinson<sup>1</sup>, Suresh Yekasiri<sup>3</sup>, Gabriel Bello Portmann<sup>1</sup>, Aditya Verma<sup>1</sup>, Niccolo Bigali<sup>1</sup>, Ziyu Guo<sup>3</sup>, Michael Kilzer<sup>3</sup>, Peng Zhao<sup>3</sup>, Mael Flament<sup>1</sup>, Javad Shabani<sup>2</sup>, Reza Nejabati<sup>3</sup>, Mehdi Namazi<sup>1</sup>; <sup>1</sup>*Qunnect Inc., USA*; <sup>2</sup>*Physics, New York Univ., USA*; <sup>3</sup>*Cisco Quantum Labs, USA*. We showcase polarization entanglement swapping between two independent entanglement sources over deployed fiber in New York City. Our work is a key step in the development of the quantum internet.

## **QW4D.5 • 17:15**

**Heralded Generation of Atom-Photon Entanglement**, Pau Farrera<sup>1,2</sup>, Gianvito Chiarella<sup>1</sup>, Tobias Frank<sup>1</sup>, Leart Zuka<sup>1</sup>, Gerhard Rempe<sup>1</sup>; <sup>1</sup>*Max-Planck-Institut für Quantenoptik, Germany*; <sup>2</sup>*Munich Center for Quantum Science and Technology, Germany*. We generate atom-photon entanglement together with a herald signal, to track and discard errors present during the generation process. Our achievement is enabled by the cascaded two-photon emission of an atom into two fiber cavities.

## **QW4D.6 • 17:30**

**Toward Telecommunication-Band Quantum Networking With Neutral Atoms**, Eirini Mandopoulou<sup>1</sup>, Andrei Ruskuc<sup>1</sup>, Matthew Bilotta<sup>1</sup>, Brandon Grinkemeyer<sup>1</sup>, Danilo Shchepanovich<sup>1</sup>, Sophie W. Ding<sup>1</sup>, Shivam Mundhra<sup>1</sup>, Michel Tao<sup>1</sup>, Offek Tziperman<sup>1</sup>, Shankar G. Menon<sup>1</sup>, Kiyoul Yang<sup>1</sup>, Marko Loncar<sup>1</sup>, Vladan Vuletic<sup>2</sup>, Mikhail Lukin<sup>1</sup>; <sup>1</sup>*Harvard Univ., USA*; <sup>2</sup>*Massachusetts Inst. of Technology, USA*. In this work we present progress towards telecommunication-band quantum networking with single 87Rb atoms using the 5P3/2 → 4D5/2 transition. We demonstrate a photonic interface at 1530 nm and atom-based imaging of the cavity mode.

## **QW4D.7 • 17:45**

**Device-Independent QKD Benchmark With an Event-Ready Ion-Photon Link Over 25\,km**, Jonas Meiers<sup>1</sup>, Christian Haen<sup>1</sup>, Max Bergerhoff<sup>1</sup>, Pascal Baumgart<sup>1</sup>, Tobias Bauer<sup>1</sup>, Christoph Becher<sup>1</sup>, Jürgen Eschner<sup>1</sup>; <sup>1</sup>*Universität des Saarlandes, Germany*. We benchmark an event-ready ion-photon architecture toward device-independent QKD over 25\,km fiber using double quantum frequency conversion and active polarization stabilization. A trapped  $^{40}\text{Ca}^+$  memory setup yields atom-photon-entanglement with  $|S|=2.75\text{pm}0.15\text{\$}$ .

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## Thursday, 18 June

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**Lomond Auditorium**

**08:30 -- 09:30**

**QTh1A • Keynote IV**

*Presider: Title To Be Announced*

**QTh1A.1 • 08:30 (Plenary)**

**Distributed Quantum Computing Using a Trapped-Ion Quantum Network**, David M. Lucas<sup>1</sup>; <sup>1</sup>*Univ. of Oxford, UK*. Abstract not available.

**10:00 -- 12:30**

**Room: Lomond Auditorium**

**QTh2A • Special Symposium: Joseph Eberly Memorial**

**QTh2A.1 • 10:00 (Invited)**

**Attosecond Quantum Optics**, Misha Ivanov<sup>1</sup>; <sup>1</sup>*MBI, Germany*. Abstract not available.

**QTh2A.2 • 10:30 (Invited)**

**Creating and Sustaining Entanglement of Distant Emitters by Continuously Monitoring Their Joint Spontaneous Emission**, Andrew Jordan<sup>1</sup>; <sup>1</sup>*Chapman Univ., USA*. Abstract not available.

**QTh2A.3 • 11:00 (Invited)**

**Joe Eberly's Collapses and Revivals**, Peter Knight<sup>1</sup>; <sup>1</sup>*Imperial College London, UK*. Abstract not available.

**QTh2A.4 • 11:30 (Invited)**

**An Operational Distinction Between Classical Inseparability and Quantum Entanglement**, Gerd Leuchs<sup>1</sup>; <sup>1</sup>*Max-Planck-Inst Physik des Lichts, Germany*. Abstract not available.

**QTh2A.5 • 12:00 (Invited)**

**Classical Entanglement, an Experimental Point of View**, Elisabeth Giacobino<sup>1</sup>; <sup>1</sup>*CNRS, France*. Abstract not available.

**14:00 -- 16:00**

**Room: Hall 2**

**QTh3A • Poster Session III**

**QTh3A.1**

**Camera-Enabled Scalable Homodyne Detection of Multimode Quantum Light**, Young-Do Yoon<sup>1</sup>, Chan Roh<sup>1</sup>, Geunhee Gwak<sup>1</sup>, Young-Sik Ra<sup>1</sup>; <sup>1</sup>*Department of Physics, Korea Advanced Inst. of Science and Technology, Korea (the Republic of)*. We develop a scalable homodyne detection system based on a camera, operating in the shot-noise-limited regime. It enables

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simultaneous quadrature measurements of 60 modes, allowing the direct observation of nonclassical features in multimode quantum light.

## QTh3A.2

### **Experimental Demonstration of Adaptive Remapping on a Photonic Quantum**

**Microprocessor**, Zan Tang<sup>1,2</sup>, YuXiang Li<sup>1,3</sup>, Wei Wang<sup>1,2</sup>, MengLong Fang<sup>1,2</sup>, Daiqin Su<sup>1,2</sup>, Hong Cai<sup>1,2</sup>, Xiang Wu<sup>3</sup>, AiQun Liu<sup>1,2</sup>; <sup>1</sup>*Research Inst. for Quantum Technology (RIQT), The Hong Kong Polytechnic Univ., Hong Kong*; <sup>2</sup>*The Hong Kong Polytechnic Univ. Department of Electrical and Electronic Engineering, Hong Kong*; <sup>3</sup>*Fudan Univ. School of Information Science and Technology, China*. We experimentally implement Microprocessor Tailored Adaptive Remapping to address photonic loss and low sampling probability challenges in quantum optimization, boosting the success probability by five orders of magnitude and raising the approximation ratio from 0.682 to 0.907.

## QTh3A.3

### **Machine Learning-Enhanced Validation of Entanglement Distribution Over Quantum**

**Networks**, Sara A. Metwalli<sup>1,2</sup>, Aryan Iliat<sup>1</sup>, Connor Gambla<sup>1</sup>, Amirali Khannejad<sup>1</sup>, David McDermott<sup>3</sup>, Patrick Hall<sup>4</sup>, Roy Love IV<sup>5</sup>, Ali Abu-nada<sup>6</sup>, Thomas A. Searles<sup>1</sup>, Zizwe A. Chase<sup>1</sup>, Russell Ceballos<sup>5</sup>; <sup>1</sup>*Univ. of Illinois at Chicago, USA*; <sup>2</sup>*School of Informatics, The Univ. of Edinburgh, UK*; <sup>3</sup>*Univ. of Michigan, USA*; <sup>4</sup>*Univ. of the District of Columbia, USA*; <sup>5</sup>*City Colleges of Chicago Olive-Harvey College, USA*; <sup>6</sup>*Sharjah Marine Academy, United Arab Emirates*. In this work, we use SeQUeNCe to model entangled photon distribution under realistic conditions to implement the CHSH game in an E91 protocol, then use a machine learning-based optimization to improve performance and reach the theoretical quantum CHSH win rate of 85%.

## QTh3A.4

### **Symmetric Polarization-Maintaining Fibers for Preserving Polarization and Time-Energy Entanglement for Satellite Quantum Links**

Uday Chandrashekara<sup>1,2</sup>, Karen Lozano Méndez<sup>1</sup>, Meritxell Cabrejo<sup>1</sup>, Carlos Andres Melo Luna<sup>1</sup>, Fabian Steinlechner<sup>1</sup>; <sup>1</sup>*Fraunhofer IOF, Germany*; <sup>2</sup>*Friedrich-Schiller-Universitat Jena, Germany*. We implemented robust distribution of polarization and time-energy entanglement using polarization-maintaining fibers. By mitigating polarization scrambling, this approach reduces receiver complexity from three-dimensional polarization control to single-dimensional phase stabilization for satellite-based quantum communication.

## QTh3A.5

Withdrawn

## QTh3A.6

### **Laser Detuning from Temporal to Spatial Phase Conversion in an Atomic Cloud**

Jinwen Wang<sup>3</sup>, Sonja Franke-Arnold<sup>1</sup>, Thomas W. Clark<sup>2</sup>; <sup>1</sup>*Univ. of Glasgow, Hungary*; <sup>2</sup>*HUN-REN Wigner Fizikai Kutatóközpont, Hungary*; <sup>3</sup>*Xi'an Jiaotong Univ., China*. A new type of quantum sensing, we demonstrate how temporal laser detunings translate to transverse rotation of atomic absorption images. Coupling rubidium with shaped light, we transform megahertz of detuning to decadegrees of angle.

## QTh3A.7

**Real-Time Quantum Phase Distillation via Undetected Light**, Josue Leon Torres<sup>1,2</sup>, Patrick Hendra<sup>1</sup>, Yugant Mukeshbhai Hadiyal<sup>1</sup>, Christopher Spiess<sup>1</sup>, Fabian Steinlechner<sup>1,2</sup>, Frank Setzpfandt<sup>1,2</sup>, Markus Gräfe<sup>1,3</sup>, Valerio F. Gili<sup>1</sup>; <sup>1</sup>*Fraunhofer IOF, Germany*; <sup>2</sup>*Friedrich-Schiller-*

# Optica Quantum 2.0 Conference and Exhibition

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## QTh3A.8

**Optimum non-Gaussian State Engineering From Optical Catalysis**, Roger A. Kögler<sup>1</sup>, Julian Nauth<sup>2</sup>, Ananga Datta<sup>1</sup>, Nathan Walk<sup>2</sup>, Kurt Busch<sup>1</sup>, Jens Eisert<sup>2</sup>, Oliver Benson<sup>1</sup>; <sup>1</sup>*Humboldt Universität zu Berlin, Germany*; <sup>2</sup>*Freie Universität Berlin, Germany*. The breeding of optimum fidelity non-Gaussian states from the interference between squeezed and Fock states is analytically solved. The role of losses is evaluated through numerical computations of density matrices in truncated Hilbert spaces.

## QTh3A.9

**Experimental Verification of Compact Bell-Type Inequality for 8-Qubit GHZ State on IBM QPUs**, Tomis Prajapati<sup>1,2</sup>, Shreyansh S. Agarwal<sup>1</sup>, Harsh Mehta<sup>1</sup>, V. Narayanan<sup>1</sup>; <sup>1</sup>*Department of Physics, Indian Inst. of Technology Jodhpur, India*; <sup>2</sup>*Department of Physics, Tata Inst. of Fundamental Research, India*. We experimentally studied a compact Bell-type inequality using an 8-qubit GHZ state on IBM superconducting quantum processors. A reduced correlator set lowers measurement overhead, making it suitable for NISQ devices. Two state-preparation strategies - chain and star- were tested on *ibm\_fez* and *ibm\_marrakesh*.

## QTh3A.10

**Towards Time-Bin Entangled Photon Cluster States**, Siavash Qodratipour<sup>1</sup>, Thomas Häffner<sup>1</sup>, Oliver Benson<sup>1</sup>; <sup>1</sup>*Department of Physics, Humboldt-Universität zu Berlin, Germany*. We propose an experimental pathway to generate time-bin encoded cluster states using spontaneous parametric down conversion (SPDC). Photon pairs with high fidelity to Bell states are fused to form larger entangled states. We estimate the three-photon cluster state rate based on our experimental results.

## QTh3A.11

Withdrawn

## QTh3A.12

**Transmon-Induced Kerr non-Linearity in Resonator Chains Implementing the Su-Schrieffer-Heeger Model**, Wei-Chen Chien<sup>1</sup>, Chih-Hong Fang<sup>2</sup>, Raveendharan Sundaram<sup>1</sup>, Yu-Han Chang<sup>1</sup>, Cen-Shawn Wu<sup>2</sup>, Watson Kuo<sup>1</sup>; <sup>1</sup>*National Chung Hsing Univ., Taiwan*; <sup>2</sup>*Physics, National Changhua Univ. of Education, Taiwan*. Cross-Kerr effect is experimentally investigated in a linear chain of microwave resonators implementing the Su-Schrieffer-Heeger model coupled to a transmon. This Kerr interaction is significantly weaker between edge and bulk modes, which we attribute to the minimal spatial overlap of their respective wavefunctions.

## QTh3A.13

**A Platform for Fully Programmable Frequency Domain Quantum Networks**, Patrick Folge<sup>2</sup>, Abhinandan Bhattacharjee<sup>1</sup>, Theresa Keuter<sup>2</sup>, Sebastian Lengeling<sup>2</sup>, Christof Eigner<sup>2</sup>, Michael Stefszky<sup>2</sup>, Benjamin Brecht<sup>2</sup>, Christine Silberhorn<sup>2</sup>; <sup>1</sup>*Integrated Quantum Optics, Inst. for Photonic Quantum Systems (PhoQS), Paderborn Univ., Germany*; <sup>2</sup>*Paderborn Univ., Integrated Quantum Optics, Inst. for Photonic Quantum Systems (PhoQS), Germany*. We demonstrate a scalable platform for fully programmable quantum networks in the frequency domain. The

# Optica Quantum 2.0 Conference and Exhibition

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## QTh3A.14

**Rethinking Quantum Networking with Advances in Fiber Technology**, Prateek Mantri<sup>1</sup>, Michael S. Bullock<sup>1</sup>, Robert Kwolek<sup>1</sup>, Aditya Tripathi<sup>1</sup>, Rajveer Nehra<sup>1</sup>, Don Towsley<sup>1</sup>; <sup>1</sup>*Univ. of Massachusetts Amherst, USA*. We compare emerging hollow-core fibers (HCF) against single-mode fibers in quantum networks, and show a four-fold improvement in secret-key rates using HCF and memory-native transmission. At telecom, HCF enables sparser repeater placement, improving rate-cost tradeoffs.

## QTh3A.15

**Experimental Demonstration of Free-Space Gaussian-Modulated Unidimensional CV-QKD**, Rachita Nandan<sup>2,1</sup>, Jayanth Ramakrishnan<sup>2</sup>, Ravindra P. Singh<sup>2</sup>, Shashi Prabhakar<sup>2</sup>; <sup>1</sup>*Department of Physics, Indian Inst. of Technology Gandhinagar, India*; <sup>2</sup>*Quantum Science and Technology Laboratory, Physical Research Laboratory, India*. We demonstrate free-space Gaussian-modulated unidimensional continuous-variable quantum key distribution (CV-QKD) with the signal and local oscillator co-propagating in the same spatial mode. Key rates are analyzed under trusted and untrusted detector noise models, yielding a secure key rate of 0.4 bits per pulse.

## QTh3A.16

**Accidental Coincidences in Camera-Based High-Dimensional Entanglement Certification**, Raphael Gmitter<sup>1</sup>, Baptiste Courme<sup>1,2</sup>, Chloé Vernière<sup>1</sup>, Peter Svihira<sup>3</sup>, Andrei Nomerotski<sup>3</sup>, Hugo Defienne<sup>1</sup>; <sup>1</sup>*Inst. of NanoSciences of Paris, France*; <sup>2</sup>*Laboratoire Kastler Brossel, France*; <sup>3</sup>*Ceske vysoke uceni technicke v Praze Fakulta jaderna a fyzikalne inzenyrska, Czechia*. We certify entanglement in photon pairs produced by Spontaneous Parametric Down Conversion without the usual need for accidental coincidences subtraction, using a single photon sensitive Tpx3Cam camera to measure photon correlations in position and momentum.

## QTh3A.17

Withdrawn

## QTh3A.18

**Classical-DEcisive Quantum Internet by Integrated Photonics**, Yichi Zhang<sup>1</sup>, Robert Broberg<sup>1</sup>, Alan Zhu<sup>1</sup>, Li Ge<sup>2</sup>, Gushu Li<sup>1</sup>, Jonathan Smith<sup>1</sup>, Liang Feng<sup>1</sup>; <sup>1</sup>*Univ. of Pennsylvania, USA*; <sup>2</sup>*CUNY Graduate Center, USA*. **Abstract:** We report a classical-decisive quantum internet architecture for entanglement distribution over commercial fiber networks. On-chip synchronization between quantum and classical data enables dynamic routing, while classical readout mitigates propagation errors, preserving high-fidelity and ensuring scalability.

## QTh3A.19

**A Continuous Variable Quantum Access Network With Finite Size Effects**, Runjia Zhang<sup>1</sup>, Huy Q. Nguyen<sup>1</sup>, Akash nag Oruganti<sup>2</sup>, Ivan Derkach<sup>2</sup>, Adnan Hajomer<sup>1</sup>, ulrik lund L. andersen<sup>1</sup>, Vladyslav C. Usenko<sup>2</sup>, Tobias Ghering<sup>1</sup>; <sup>1</sup>*Danmarks Tekniske Universitet, Denmark*; <sup>2</sup>*Univerzita Palackeho v Olomouci, Czechia*. We demonstrate the first continuous variable quantum access network with finite size security under an untrusted protocol. With four users with SKR = 0.069, 0.074, 0.059, 0.050 bits/channel use, paving the way for practical adoption by telecommunication application.

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## QTh3A.20

### **Postprocessing Methods for Continuous Wave Four-Fold Hong-Ou-Mandel**

**Interference**, Sabine Häussler<sup>1,2</sup>, Meritxell Cabrejo-Ponce<sup>1,2</sup>, Ana Maria Torres<sup>2,3</sup>, Karen Lozano Méndez<sup>2</sup>, Baghdasar Baghdasaryan<sup>1</sup>, Fabian Steinlechner<sup>1,2</sup>; <sup>1</sup>*Friedrich Schiller Univ. Jena, Inst. of Applied Physics, Abbe Center of Photonics, Germany*; <sup>2</sup>*Fraunhofer Inst. for Applied Optics and Precision Engineering, Germany*; <sup>3</sup>*Heriot-Watt Univ. Edinburgh Campus, UK*. We present a comprehensive postprocessing framework for four-fold Hong-Ou-Mandel interference in continuous wave operation using microring resonators and superconducting nanowire detectors, enabling optimization of visibility for scalable quantum network applications.

## QTh3A.21

**A Classical Digital Twin Framework for Predictive Management of Metropolitan Quantum Networks**, sachin panicker<sup>1</sup>; <sup>1</sup>*Fulcrum Digital Inc, USA*. I propose a classical digital twin framework for metropolitan quantum network management that maintains a predictive model of entanglement link states, enabling proactive decoherence-aware routing and resource allocation without modifying the underlying quantum hardware stack.

## QTh3A.22

**Advancements in Optical Microcavities for Efficient Qubit-Photon Interfaces and Networked Quantum Computing**, Sarah Benaissa<sup>1</sup>, Ben Walker-Pearl<sup>1</sup>, Laiyi Weng<sup>1</sup>, Huili Hou<sup>1</sup>, Dmitrii Ushmaev<sup>1</sup>, Erik Williams<sup>1</sup>, Holly Eade<sup>1</sup>, Harry Bostock<sup>1</sup>; <sup>1</sup>*Nu Quantum, UK*. Efficient qubit-photon interfaces are one of the key bottlenecks to achieving distributed quantum computing. Here we present the progress of our optical microcavity and its ion trap integration. This system is suitable for extracting NIR photons from atomic qubits and supporting entanglement rates and fidelities of 10kHz and 98% respectively.

## QTh3A.23

### **Spectrally Multiplexed Hanbury Brown–Twiss Interference for Quantum**

**Applications**, Sergei Kulkov<sup>1</sup>, Ondrej Matousek<sup>1</sup>, Dmitrij Sevaev<sup>1</sup>, Yury Kurochkin<sup>2</sup>, Stephen Vintskevich<sup>2</sup>, Claudio Bruschini<sup>3</sup>, Tommaso Milanese<sup>3</sup>, Edoardo Charbon<sup>3</sup>, Peter Svihra<sup>1,4</sup>, Andrei Nomerotski<sup>1,4</sup>; <sup>1</sup>*Czech Technical Univ. in Prague, Czechia*; <sup>2</sup>*Technology Innovation Inst., United Arab Emirates*; <sup>3</sup>*Ecole polytechnique federale de Lausanne, Switzerland*; <sup>4</sup>*Czech Academy of Sciences, Czechia*. Demonstrating parallel, wavelength-resolved photon bunching, we observe HBT correlations across tens of spectral channels using a single-photon spectrometer. This preserves flux, enables high-dimensional spectro-temporal interference, and scales frequency-multiplexed quantum photonics.

## QTh3A.24

### **Impact of Delay and Measurement Error on Remote Gate Fidelity in Quantum Data**

**Centers**, Seyed Navid Elyasi<sup>1</sup>, Paolo Monti<sup>1</sup>, Rui Lin<sup>1</sup>; <sup>1</sup>*Chalmers Univ. of Technology, Sweden*. We experimentally study how execution delay and measurement error affect remote two-qubit gate performance in quantum data centers, benchmarking readout asymmetry and protocol dependence across shot counts, and comparing results against hardware-reported measurement error baselines.

## QTh3A.25

Withdrawn

## QTh3A.26

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**Transmission of Entangled Light Through Scattering Media Using Coherence-Entanglement Transfer**, Shaurya Aarav<sup>1</sup>, Hugo Defienne<sup>1</sup>; <sup>1</sup>*Institut des NanoSciences de Paris, INSP, Sorbonne Universite, France*. We demonstrate transmission of high-dimensional spatially entangled two-photon states through scattering media by learning the transmission matrix with a separable two-photon state, toggled via pump shaping. This eliminates the conventional need for a classical beacon.

## QTh3A.27

**Enhanced Spatial Mode Overlap and Nonlinear Performance Using Air-Hole Ring-Core Fibers**, shruti jain<sup>1</sup>, Deepak Jain<sup>1</sup>; <sup>1</sup>*Optics and Photonics Centre, Indian Inst. of Technology Delhi, India*. We propose an air-hole ring-core fiber that enhances nonlinear parametric interactions and enables flexible signal and idler generation with conventional pump lasers, through improved spatial overlap between fundamental and higher-order modes and reduced effective area.

## QTh3A.28

**Noise-Protected State Transfer Between Distant Nodes in a Quantum Network**, Syeda Aliya Batool<sup>2,1</sup>; <sup>1</sup>*Technische Universität Munchen, Germany*; <sup>2</sup>*Walther-Meißner-Institut, Germany*. Low-frequency noise degrades coherence in cavity QED, limiting state transfer fidelity. We study continuous and pulsed dynamical decoupling to suppress slow fluctuations and enable high-fidelity transfer across diverse regimes. Together, they provide a practical framework for achieving high-fidelity state transfer in long-distance quantum networks.

## QTh3A.29

**Towards a Versatile Continuous-Variable Quantum Key Distribution Transceiver for Reconfigurable Networks**, Tommaso Bertapelle<sup>1</sup>, Thomas Liege<sup>2,3</sup>, Alexis Rosio<sup>2</sup>, Giuseppe Vallone<sup>1</sup>, Eleni Diamanti<sup>2</sup>, Paolo Villorosi<sup>1</sup>, Marco Avesani<sup>1</sup>, Yoann Piétri<sup>1,2</sup>; <sup>1</sup>*Universita degli Studi di Padova, Italy*; <sup>2</sup>*Sorbonne Universite, France*; <sup>3</sup>*DOTA, Office National d'Etudes et de Recherches Aerospatiales, France*. This study presents a CV-QKD architecture integrating a coherent receiver at the transmitter, enabling secure quantum randomness generation and in-line estimation of key parameters for secret-key-rate computation, advancing the deployment over existing telecom networks.

## QTh3A.30

**Active and Passive Network Architectures for Entanglement-Based QKD**, Vasile-Laurentiu Dosan<sup>1,2</sup>, Alek Lagarrigue<sup>2</sup>, Alessandro Zannotti<sup>2</sup>, Pablo Vazquez<sup>2</sup>, Yannick Folwill<sup>2</sup>, René Heilmann<sup>2</sup>, Oliver de Vries<sup>2</sup>; <sup>1</sup>*Friedrich Schiller Univ. Jena, Germany*; <sup>2</sup>*Quantum Optics Jena GmbH, Germany*. We experimentally compare active and passive optical network architectures for entanglement-based quantum key distribution using highly non-degenerate photons. Passive networks enable simultaneous key generation, while active switching improves secret key rates, scalability, and resource efficiency.

## QTh3A.31

**Atmospheric Modelling of Continuous Variable Quantum Key Distribution (CV-QKD) for Satellite-Based Communication**, Vedant A. Dhawale<sup>1</sup>, V. Narayanan<sup>1,2</sup>; <sup>1</sup>*Department of Physics, Indian Inst. of Technology Jodhpur, India*; <sup>2</sup>*IDRP-QIC, Indian Inst. of Technology Jodhpur, India*. We investigate the propagation of squeezed light in the atmosphere for satellite-based quantum communication. The atmospheric modelling of squeezed light includes probability-distribution models, extinction effects, and their impact on post-selection optimised

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## QTh3A.32

### **Field-Deployable QKD Chip System With Pilot-Assisted Real-Time Polarization**

**Tracking,** Xiaopeng Wang<sup>1,2</sup>, Hao Yu<sup>1,2</sup>, Xinjie Zhang<sup>1,2</sup>, Liwang Lu<sup>2</sup>, Wei Wang<sup>1,2</sup>, Yaxi Yan<sup>2</sup>, Kangping Zhong<sup>2</sup>, Shihai Sun<sup>3</sup>, Hong Cai<sup>1,2</sup>, Alan Pak-tao Lau<sup>1,2</sup>, AiQun Liu<sup>1,2</sup>; <sup>1</sup>*Research Institute for Quantum Technology, The Hong Kong Polytechnic Univ., Hong Kong;* <sup>2</sup>*Department of Electrical and Electronic Engineering, The Hong Kong Polytechnic Univ., Hong Kong;* <sup>3</sup>*School of Electronics and Communication Engineering, Sun Yat-Sen Univ., China.* We demonstrate a field-deployable silicon-photonics polarization QKD system with single-photon pilot-assisted real-time polarization tracking. Over 55.41 km deployed metro fiber (27.7 dB), we sustain ~5% QBER and achieve a 52.16 kbps secure key rate.

## QTh3A.33

### **Hardware-Software Co-Optimized 1.25-GHz Integrated QKD System Using Pre-Emphasis and Temporal Filtering,**

Xinjie Zhang<sup>1,2</sup>, Hao Yu<sup>1,2</sup>, Tiancheng Luo<sup>2</sup>, Bo Yang<sup>1,2</sup>, Xiaopeng Wang<sup>1,2</sup>, Kangping Zhong<sup>2</sup>, Lipket Chin<sup>1,2</sup>, Hong Cai<sup>1,2</sup>, Shihai Sun<sup>3</sup>, Francis Lau<sup>2</sup>, AiQun Liu<sup>1,2</sup>; <sup>1</sup>*Research Inst. for Quantum Technology, The Hong Kong Polytechnic Univ., Hong Kong;* <sup>2</sup>*Department of Electrical and Electronic Engineering, The Hong Kong Polytechnic Univ., Hong Kong;* <sup>3</sup>*School of Electronics and Communication Engineering, Sun Yat-Sen Univ., China.* We demonstrate a 1.25-GHz QKD system using a 5-GSPS FPGA driver. By implementing electrical pre-emphasis and temporal post-selection, we suppress the QBER and achieve a secure key rate of 44 kbps at 20dB loss.

## QTh3A.34

### **Silicon Photonic Chip-Based Quantum Key Distribution System With FPGA Control,**

Xinjie Zhang<sup>1,2</sup>, Hao Yu<sup>1,2</sup>, Xiaopeng Wang<sup>1,2</sup>, Wei Wang<sup>1,2</sup>, Yaxi Yan<sup>2</sup>, Kangping Zhong<sup>2</sup>, Hong Cai<sup>1,2</sup>, Shihai Sun<sup>3</sup>, Alan Pak-tao Lau<sup>2</sup>, AiQun Liu<sup>1,2</sup>; <sup>1</sup>*Research Inst. for Quantum Technology, The Hong Kong Polytechnic Univ., Hong Kong;* <sup>2</sup>*Department of Electrical and Electronic Engineering, The Hong Kong Univ. of Science and Technology, Hong Kong;* <sup>3</sup>*School of Electronics and Communication Engineering, Sun Yat-Sen Univ., China.* We demonstrate a polarization-encoded quantum key distribution system integrating a silicon photonic transmitter chip with compact FPGA control electronics, achieving a 109 kbps secure key rate over a 51.5 km optical fiber network.

## QTh3A.35

### **Work Extraction from a Quantum Battery Charged Through an Array of Coupled**

**Cavities,** Igor Beder<sup>1</sup>, Dario Ferraro<sup>2</sup>, Paulo A. Brandão<sup>1</sup>; <sup>1</sup>*Universidade Federal de Alagoas, Brazil;* <sup>2</sup>*Universita degli Studi di Genova, Italy.* We study work extraction from a cavity quantum battery remotely charged through coupled cavity arrays. We show ergotropy degradation with distance and demonstrate that engineered initial states and nonuniform couplings restore efficient energy extraction.

## QTh3A.36

### **A Fibre-Integrated SPDC Source of Polarisation-Entangled Photon Pairs at Telecom Wavelengths Using Zn:Indiffused PPLN Ridge Waveguides,**

Peter Iveson<sup>1</sup>, Paolo L. Mennea<sup>1</sup>, Goronwy Tawy<sup>1</sup>, Rex H. Bannerman<sup>1</sup>, Noe Palomar-Davidson<sup>1</sup>, Greg Blanchard-Emmerson<sup>2</sup>, Peter G. Smith<sup>1</sup>, James C. Gates<sup>1</sup>, Corin B. Gawith<sup>1,2</sup>; <sup>1</sup>*Univ. of Southampton Optoelectronics Research Centre, UK;* <sup>2</sup>*Covesion Ltd., UK.* We report a flexible source of polarisation-entangled photon pairs using commercial components in a Sagnac configuration.

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Our source definitively violates the CHSH inequality ( $S=2.69\pm 0.04$ ), demonstrating potential for use in quantum communications.

## QTh3A.37

**Rigorous Quantum Dynamics of Interacting Quasinormal Mode Resonators With Finite Retardation**, Robert Meiners Fuchs<sup>2</sup>, Juanjuan Ren<sup>1</sup>, Stephen Hughes<sup>1</sup>, Marten Richter<sup>2</sup>; <sup>1</sup>*Queen's Univ., Canada*; <sup>2</sup>*Technische Universitat Berlin, Germany*. We present a quantization scheme for quasinormal modes of multiple open resonators including finite temporal retardation. We then derive system-bath correlation functions with rigorous Maxwell-based coupling elements applicable to established quantum dynamics schemes.

## QTh3A.38

**PPLN Waveguide Upconversion Enabling Si-SPAD Detection of Fibre-Network Photons for Quantum Networking**, Sarah E. McCarthy<sup>2,1</sup>, Ruaridh Smith<sup>2</sup>, Jack W. Thomas<sup>2</sup>, Krish Pandiyan<sup>3</sup>, Jack Waller<sup>4</sup>, Luke Morland<sup>2</sup>, Tahsina Ledger<sup>3</sup>, Dmitri Permogorov<sup>4</sup>, Corin Gawith<sup>3,5</sup>, Loyd J. McKnight<sup>2,1</sup>; <sup>1</sup>*Univ. of Strathclyde, UK*; <sup>2</sup>*Fraunhofer Centre for Applied Photonics, UK*; <sup>3</sup>*Covesion Ltd., UK*; <sup>4</sup>*RedWave Labs Ltd., UK*; <sup>5</sup>*Univ. of Southampton, UK*. Optical upconversion in PPLN ridge waveguides enables silicon SPAD detection at fibre-network wavelengths. We demonstrate integrated systems combining high conversion efficiency with low effective dark counts.

## QTh3A.39

**Distinguishing Entangled and Classical Two-Photon Interactions Driven by Highly Spatially Multimode Parametric Down-Conversion**, Thomas C. Dickinson<sup>1</sup>, Alessandra Gatti<sup>2</sup>, Ottavia Jedrkiewicz<sup>2</sup>, Matteo Clerici<sup>1</sup>, Lucia Caspani<sup>1</sup>; <sup>1</sup>*Como lake Inst. of Photonics, Universita degli Studi dell'Insubria - Sede di Como, Italy*; <sup>2</sup>*Istituto di Fotonica e Nanotecnologie, Consiglio Nazionale delle Ricerche, Italy*. We propose a novel technique for experimentally removing quantum correlations in parametric down-conversion and show that, at high photon fluxes, previous methods are inadequate to distinguish entangled from non-entangled interactions in second harmonic generation.

## QTh3A.40

**An Entanglement Swapping Scheme for Generation of Bipartite Magnonic Cat States.**, URMIMALA DEWAN<sup>2</sup>, Roson Nongthombam<sup>2</sup>, Sampreet Kalita<sup>1,2</sup>, Amarendra K. Sarma<sup>2</sup>; <sup>1</sup>*physics, Univ. of Strathclyde, UK*; <sup>2</sup>*Indian Inst. of Technology Guwahati, India*. We present an entanglement-swapping scheme for spatially separated magnon–superconducting qubit hybrid systems, enabling successful generation of bipartite magnonic cat states via flux-mediated coupling and Bell-state measurement on qubits. Such schemes constitute building blocks for quantum repeaters and magnon-based quantum network architectures.

## QTh3A.41

**Intercalated Carbon Alkali Sources for Chip-Scale Atomic Devices**, William J. Doyle<sup>1</sup>, Timothy N. Nunley<sup>2</sup>, Paul D. Kunz<sup>2</sup>, Daniel Wasserman<sup>1</sup>; <sup>1</sup>*Department of Electrical and Computer Engineering, The Univ. of Texas at Austin Cockrell School of Engineering, USA*; <sup>2</sup>*Department of Physics, The Univ. of Texas at Austin College of Natural Sciences, USA*. We propose alkali-intercalated carbon as a scalable source of alkali atoms for chip-scale atomic devices. We demonstrate intercalation using two low-cost carbon material systems and subsequent out-diffusion for the filling of vapor cells.

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## QTh3A.42

### **Fiber-Integrated Quantum Frequency Conversion for Remote Quantum**

**Networks**, Zhichuan Liao<sup>1,2</sup>, Ao Shen<sup>1,4</sup>, Lai Zhou<sup>1</sup>, Nan Jiang<sup>3</sup>, Zhiliang Yuan<sup>1</sup>; <sup>1</sup>*Beijing Academy of Quantum Information Sciences, China*; <sup>2</sup>*Chinese Academy of Sciences Inst. of Physics, China*; <sup>3</sup>*School of Physics and Astronomy, Beijing Normal Univ., China*; <sup>4</sup>*National Laboratory of Solid State Microstructures and School of Physics, Collaborative Innovation Center of Advanced Microstructures, Nanjing Univ., China*. We demonstrate a fiber-integrated quantum frequency converter that downconverts 637.2 nm photons to 1588.3 nm using a PPLN waveguide, achieving 9% efficiency and 154 Hz noise, enabling simulated spin–photon fidelity > 52% after 100 km fiber.

## QTh3A.43

**Spatial Schmidt Spectrum of Entangled Two-Photon State**, Radhika Prasad<sup>1</sup>, Nilakshi Senapati<sup>1</sup>, Anand K. Jha<sup>1</sup>; <sup>1</sup>*Indian Inst. of Technology Kanpur, India*. High-dimensional entangled states in the Schmidt basis enable efficient entanglement quantification. Existing schemes measure a few modes or spatially-averaged spectrum. Our interferometric technique can measure complete spatial Schmidt spectrum with 98% fidelity and 3000 dimensionality.

## QTh3A.44

### **Quantum Infrared Imaging Using Superconducting Nanowire Single-Photon**

**Detectors**, Riccardo M. Ienco<sup>2</sup>, Daniela Salvoni<sup>1,2</sup>, Fabio Auriemma<sup>4</sup>, Mikkel Ejrnaes<sup>4</sup>, Syed Muhammad Junaid Bukhari<sup>3</sup>; <sup>1</sup>*Photon Technology Italy SRL, Italy*; <sup>2</sup>*Qunatech srl, Italy*; <sup>3</sup>*Physics, Universita degli Studi di Napoli Federico II Complesso Universitario di Monte Sant'Angelo, Italy*; <sup>4</sup>*Instituto di Superconduttori e Materiali Innovativi SPIN – Pozzuoli,, Consiglio Nazionale delle Ricerche, Italy*. We show an SNSPD-based infrared imaging system that exploits temporal photon correlations from thermal sources to enhance signal-to-noise ratio, enabling high-contrast spectral imaging under low photon flux conditions.

## QTh3A.45

Withdrawn

## QTh3A.46

**Quantum Frequency Conversion MWIR Flash Single-Photon Imaging With a Chirped Poled Lithium Niobate Crystal**, Ruaridh Smith<sup>1</sup>, Luke Morland<sup>1</sup>, Jack W. Thomas<sup>1</sup>, Sean Quinn<sup>1</sup>, Peter Schlosser<sup>1</sup>, Krish Pandiyan<sup>2</sup>, Tahsina Ledger<sup>2</sup>, Corin Gawith<sup>2,3</sup>, Richard Walker<sup>4</sup>, Robbie Thomas<sup>4</sup>, Loyd J. McKnight<sup>1,5</sup>, Vasili Savitski<sup>1</sup>; <sup>1</sup>*Fraunhofer Centre for Applied Photonics, UK*; <sup>2</sup>*Covesion Ltd., UK*; <sup>3</sup>*Univ. of Southampton Optoelectronics Research Centre, UK*; <sup>4</sup>*Photon Force Ltd., UK*; <sup>5</sup>*Inst. of Photonics, Univ. of Strathclyde, UK*. This paper proposes a next-generation single-photon upconversion imaging system for sensing in the MWIR. We demonstrate highly sensitive, wide field-of-view, flash single-photon imaging by upconverting MWIR light in a chirped poled lithium niobate crystal.

## QTh3A.47

**Cavity Parametric Homodyne: Squeezing Measurement Across a 10THz Quantum Frequency Comb**, Saar H. Levin<sup>1</sup>, Avi Pe'er<sup>1</sup>; <sup>1</sup>*Bar-Ilan Univ., Israel*. We demonstrate a simple measurement of squeezing (4.5dB) across the broadband comb of an OPO source using only incoherent detection of the output spectrum with the pump acting as the LO for the entire spectrum.

## QTh3A.48

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**Quantum-Assisted Nonlocal Optical Interferometry**, Siyuan Sun<sup>1</sup>; <sup>1</sup>*Univ. of Science and Technology of China, China*. Extending the baseline of optical interferometry is essential for astronomical observations. Here, we demonstrate quantum-assisted nonlocal optical interferometry by employing entangled states. This experiment can be generalized to outdoor configurations with longer baselines, offering a pathway toward optical very-long-baseline interferometry.

## QTh3A.49

**Towards Detecting Defects in Steel with a Diamond Magnetometer**, Sourav Chatterjee<sup>2</sup>, Pranit Terse<sup>1</sup>, Sakshi Dwivedy<sup>1</sup>, Phani Peddibhotla<sup>1</sup>; <sup>1</sup>*Physics, Indian Inst. of Science Education and Research Bhopal, India*; <sup>2</sup>*Tata Consultancy Services Limited, India*. We demonstrate a simple, sensitive and contactless method for imaging features in magnetic materials using a fibre-coupled diamond magnetometer. This approach can potentially enable non-destructive identification and precise localization of defects in steel.

## QTh3A.50

**Quantum Computational Learning of Optical States**, Spencer D. Dimitroff<sup>1,3</sup>, John Kallaugher<sup>2,4</sup>, Ashe Miller<sup>4</sup>, Mohan Sarovar<sup>3</sup>; <sup>1</sup>*The Univ. of New Mexico, USA*; <sup>2</sup>*National Univ. of Singapore, Singapore*; <sup>3</sup>*Sandia National Laboratories, USA*; <sup>4</sup>*Sandia National Laboratories, USA*. We establish sample complexity bounds on learning every parameter of Gaussian optical states to  $\epsilon$ -precision using a measurement scheme that first transduces the optical modes into qubits and then performs quantum computation on the qubits.

## QTh3A.51

**Quantum State Tomography Using MPPCs via Physics Informed Neural Networks**, Chandan S. Rana<sup>1</sup>, Tomis Prajapati<sup>1,2</sup>, V. Narayanan<sup>1</sup>; <sup>1</sup>*Department of Physics, Indian Inst. of Technology Jodhpur, India*; <sup>2</sup>*Department of Physics, Tata Inst. of Fundamental Research Hyderabad, India*. We experimentally reconstruct the complete POVM of a light source using MPPC by employing a physics-informed neural network applied to the measured click statistics. The method enforces physical constraints and enables characterization of nonclassical light sources and its Wigner distributions.

## QTh3A.52

**Physics-Informed Neural Networks for Modeling Optical Soliton Dynamics and Kerr-Induced Quadrature Squeezing**, Geetanshi Maheshwari<sup>2</sup>, Vishal Navani<sup>2</sup>, Gautam Das<sup>1</sup>, V. Narayanan<sup>2</sup>; <sup>1</sup>*Department of Physics, Lakehead Univ., Canada*; <sup>2</sup>*Department of Physics, Indian Inst. of Technology Jodhpur, India*. Physics-informed neural networks (PINNs) are used to solve the nonlinear Schrödinger equation (NLSE) governing optical soliton propagation in an optical fiber under the Kerr nonlinear effect. The framework accurately reproduces analytical soliton solutions while preserving physical constraints.

## QTh3A.53

**Fluorescence Lifetime Sensing With Hong-Ou-Mandel Effect Using Thermal Reference Photons**, Vytautas Zickus<sup>1,2</sup>, Evita Spalinskaite<sup>2</sup>, Euan Millar<sup>1</sup>, Povilas Jurksaitis<sup>2</sup>, Ilya Starshynov<sup>1</sup>, Zigmantas Balevicius<sup>2</sup>, Ashley Lyons<sup>1</sup>; <sup>1</sup>*School of Physics and Astronomy, Univ. of Glasgow, UK*; <sup>2</sup>*Department of Laser Technologies, Valstybinis moksliniu tyrimu institutas Fiziniu ir technologijos mokslu centras, Lithuania*. Fluorescence Lifetime with Hong-Ou-Mandel effect (FL-HOM) measures sub-picosecond fluorescence lifetimes by interfering a fluorescence and a reference photon, which can be thermal, as we demonstrate here. This enables low-cost FLHOM with a single laser source.

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## QTh3A.54

### **Surface Plasmon Resonance–Enhanced NV-Center Diamond Quantum**

**Magnetometers**, Ethan Qiao<sup>2</sup>, Xuejun Lu<sup>1</sup>; <sup>1</sup>*Univ. of Massachusetts Lowell, USA*; <sup>2</sup>*Commonwealth School, USA*. We demonstrate a surface plasmon resonance (SPR)–enhanced NV-center quantum magnetometer. This plasmon–NV coupling increases the detected signals while avoiding spin-resonance broadening. This technique enables high-precision quantum sensing with low fabrication complexity and cost.

## QTh3A.55

### **Amplification and Storage of Light in a Degenerate two-Level System in the Presence of a**

**Magnetic Field**, Raoni Moreira<sup>1</sup>, Lindaci Bento<sup>2</sup>, João C. de Aquino Carvalho<sup>1</sup>; <sup>1</sup>*Departamento de Física, Universidade Federal de Pernambuco, Brazil*; <sup>2</sup>*Centro de Ciências, Tecnologia e Saúde, Universidade Estadual da Paraíba, Brazil*. We present a model for amplification and storage of narrowband light in a closed two-level system with triple Zeeman degeneracy under a magnetic field, validated by density-matrix simulations, with applications in communication between distant nodes.

## QTh3A.56

**The QuComms Hub Optical Ground Station Testbed Facility**, Andrew Green<sup>1,2</sup>, cameron simmons<sup>1</sup>, Ross Donaldson<sup>1,2</sup>; <sup>1</sup>*Heriot-Watt Univ., UK*; <sup>2</sup>*Lumino Technologies, UK*. Following the commissioning of the Quantum Communication Hub's Optical Ground Station (HOGS) in 2025, we update on growing infrastructure and testbed capabilities of the facility site, from our optical fibre network to our drone platform.

## QTh3A.57

### **a Deployed Fiber Link for Quantum Networking in Hefei**, Xiao Liu<sup>1,2</sup>, Tian-Xiang Zhu<sup>1,2</sup>, Xiao-

Min Hu<sup>1,2</sup>, Chao Zhang<sup>1,2</sup>, Zong-Quan Zhou<sup>1,2</sup>, Chuan-Feng Li<sup>1,2</sup>, Guang-Can Guo<sup>1,2</sup>; <sup>1</sup>*Laboratory of Quantum Information, Univ. of Science and Technology of China, China*; <sup>2</sup>*Anhui Province Key Laboratory of Quantum Network, Univ. of Science and Technology of China, China*. We report a metropolitan fiber link in Hefei for quantum networking, enabling time-bin and polarization qubit transmission. Initial characterization shows low loss and stable polarization, supporting quantum memory interfaces and entanglement distribution across scalable quantum network nodes.

## QTh3A.58

### **Quantum-Correlated Light From a Cold-Atom Mirrorless Optical Parametric**

**Oscillator**, Raoni Moreira<sup>1</sup>, Gabriel d. Borba de Andrade<sup>1,2</sup>, Luciano S. Cruz<sup>3</sup>, Marcelo Martinelli<sup>2</sup>, Daniel Felinto<sup>1</sup>, José Tabosa<sup>1</sup>; <sup>1</sup>*Departamento de Física, Universidade Federal de Pernambuco, Brazil*; <sup>2</sup>*Instituto de Física, Universidade de Sao Paulo, Brazil*; <sup>3</sup>*Centro de Ciências Naturais e Humanas, Universidade Federal do ABC, Brazil*. We demonstrate four-mode quantum entanglement in a cold-atom MOPO operating below threshold. Using a novel heterodyne technique, we recover the covariance matrix, enabling applications in quantum networks and higher-order entanglement studies.

## QTh3A.59

### **Hollow-Core Fibre Fabrication for Rubidium-Based Quantum Technologies**, Rebecca

Walters<sup>1</sup>, Georgia Booton<sup>1</sup>, Leah Murphy<sup>1</sup>, Daniel Gilks<sup>2</sup>, Peter Mosley<sup>1</sup>, Kristina Rusimova<sup>1</sup>; <sup>1</sup>*Univ. of Bath, UK*; <sup>2</sup>*BT Group Plc, UK*. We present examples of hollow-core fibre fabricated for quantum applications based on interactions between light and alkali vapours at

# Optica Quantum 2.0 Conference and Exhibition

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## QTh3A.60

**Monolithic AlGaAs Spot-Size Converter for InAs/GaAs Quantum Dots**, Tim M. Schneider<sup>1,2</sup>, Niklas Bruckmoser<sup>1,3</sup>, Nadeem Akhlaq<sup>2,3</sup>, Kevin Kiener<sup>1,3</sup>, Namita Agrawal<sup>1,3</sup>, Lasse Södergren<sup>1,3</sup>, Benjamin Lienhard<sup>1,3</sup>, Jonathan Finley<sup>2,3</sup>, Stefan Filipp<sup>1,3</sup>; <sup>1</sup>*Walther-Meißner-Institut, Germany*; <sup>2</sup>*Walter Schottky Inst., Germany*; <sup>3</sup>*Department of Physics, Technische Universität München School of Natural Sciences, Germany*. We present a monolithic AlGaAs/GaAs spot-size converter for InAs quantum dots integrating a PIN-diode stack. Simulations show > 99 % mode-conversion efficiency at 935 nm, enabling robust, low-loss direct fiber packaging for cryogenic quantum devices.

## QTh3A.61

**Two-Photon Excitation Fluorescence 3D Imaging of NV- Color Centers in Bulk Diamond Samples**, Daniel Rozsa<sup>2,1</sup>, Renata Kubacka<sup>2,1</sup>, Robert Szpocs<sup>2,1</sup>; <sup>1</sup>*R&D Ultrafast Lasers Kft., Hungary*; <sup>2</sup>*HUN-REN Wigner Fizikai Kutatóközpont, Hungary*. Linearly polarized output of a 18.9 MHz repetition rate Yb-fiber laser delivering 0.4 ps pulses at around 1030 nm is used for two-photon excitation fluorescence 3D imaging of CVD grown single-crystal diamond samples containing 4 PPM nitrogen-vacancy (NV) centers.

## QTh3A.62

**Efficient Spatial Photon Coincidence Imaging With a Time-Correlated Single-Photon Counting SPAD Camera**, Ruotong Feng<sup>1</sup>, Malo Joly<sup>1</sup>, Edoardo Charbon<sup>2</sup>, Hugo Defienne<sup>3</sup>; <sup>1</sup>*Laboratoire Kastler Brossel, France*; <sup>2</sup>*Ecole polytechnique federale de Lausanne, Switzerland*; <sup>3</sup>*Institut des NanoSciences de Paris, France*. We demonstrate spatial photon coincidence measurements using a TCSPC SPAD camera. We measure the momentum correlation width of type-I SPDC photon pairs generated in a BBO crystal in a far-field configuration.

## QTh3A.63

**Mechanical Rotation Induced Non-Local Quantum Entanglement**, Swain Ashutosh<sup>1</sup>, Marko Toroš<sup>2</sup>, Maria Chiara Braidotti<sup>1</sup>, Mauro Paternostro<sup>3,4</sup>, Miles J. Padgett<sup>1</sup>, Daniele Faccio<sup>1</sup>; <sup>1</sup>*Univ. of Glasgow School of Physics and Astronomy, UK*; <sup>2</sup>*Univerza v Ljubljani Fakulteta za matematiko in fiziko, Slovenia*; <sup>3</sup>*Universita degli Studi di Palermo Dipartimento di Fisica e Chimica Emilio Segre, Italy*; <sup>4</sup>*Centre for Theoretical Atomic, Molecular, and Optical Physics, School of Mathematics and Physics, Queen's Univ., UK*. We show that a photonic Sagnac interferometer can generate non-local quantum entanglement when subjected to mechanical rotation. The resulting states violate the Bell-CHSH inequality, highlighting non-inertial motion as a controllable resource for quantum non-locality.

## QTh3A.64

**A Compact Nonlinear Interferometer for Spectroscopy With Undetected Photons in the Mid-Infrared**, Theresa Kloß<sup>2</sup>, Helen Chrzanowski<sup>2</sup>, Sven Ramelow<sup>2,1</sup>; <sup>1</sup>*Ferdinand-Braun-Institut gGmbH, Germany*; <sup>2</sup>*Humboldt-Universität zu Berlin Mathematisch Naturwissenschaftliche Fakultät, Germany*. We demonstrate a compact nonlinear interferometer for mid-infrared spectroscopy, mitigating the impact of atmospheric H<sub>2</sub>O(g) and allowing the characterization of a chrysotile asbestos sample in the wavelength range from 2.68  $\mu\text{m}$  to 2.77  $\mu\text{m}$ .

## QTh3A.65

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**Robust Verification Method for Entangled Two-Photon Absorption Using Entanglement Area Control and Parallel Coincidence Measurement,** Yuya Takamoto<sup>1</sup>, Naru Yoneda<sup>1,2</sup>, Kanako Yoshimura<sup>1</sup>, Osamu Matoba<sup>1,2</sup>; <sup>1</sup>*Kobe Univ., Japan*; <sup>2</sup>*Center of Optical Scattering Image Science, Japan*. We propose a robust verification method for ETPA by controlling the entanglement area via objective magnification. Combined with parallel coincidence measurement, this simple approach facilitates ETPA validation without complex optical configurations.

## QTh3A.66

**Continuously-Tunable Spontaneous Parametric Down-Conversion From 5-11  $\mu\text{m}$  via Orientation Patterned Gallium Phosphide,** Fabrice von Chamier<sup>1</sup>, Helen Chrzanowski<sup>1</sup>, Emma P. Pearce<sup>1,2</sup>, Derryck T. Reid<sup>3</sup>, Peter Schunemann<sup>4</sup>, Sven Ramelow<sup>1,5</sup>; <sup>1</sup>*Institut für Physik, Humboldt-Universität zu Berlin, Germany*; <sup>2</sup>*School of Physics and Astronomy, Univ. of Glasgow, UK*; <sup>3</sup>*School of Engineering and Physical Sciences, Heriot-Watt Univ., UK*; <sup>4</sup>*BAE Systems Plc, UK*; <sup>5</sup>*Ferdinand-Braun-Institut gGmbH, Germany*. We investigate spontaneous parametric downconversion (SPDC) in a bulk orientation-patterned gallium arsenide crystal. Pumping with a 1064 nm laser, we obtain highly non-degenerate SPDC with idler wavelengths tuneable from 5-11  $\mu\text{m}$ . This work extends quantum sensing into spectral regions inaccessible to traditional nonlinear crystals.

## QTh3A.67

**Approximate Gottesman-Kitaev-Preskill State Encoding in Pulsed Optomechanical Regime,** Joy Ghosh<sup>1</sup>; <sup>1</sup>*Indian Inst. of Technology Kharagpur, India*. We propose a measurement-based protocol to prepare finite-energy Gottesman–Kitaev–Preskill states in a mechanical oscillator using pulsed optomechanical interactions. Sequential pulse, measurement, and feedforward steps realize modular quadrature measurements, enabling robust non-Gaussian bosonic codes in realistic platforms.

## QTh3A.68

**Unveiling Hierarchical Invariants in Multiphoton Linear Optics,** Baichuan Yang<sup>1</sup>, Hao Zhan<sup>1</sup>, Minghao Mi<sup>1</sup>, Aonan Zhang<sup>2,3</sup>, Liang Xu<sup>1</sup>, Lijian Zhang<sup>1</sup>; <sup>1</sup>*National Laboratory of Solid State Microstructures, Nanjing Univ., China*; <sup>2</sup>*Clarendon Laboratory, Univ. of Oxford, UK*; <sup>3</sup>*Blackett Laboratory, Imperial College London, UK*. We unveil invariant subspaces partitioning the multiphoton operator space, enforcing hierarchical conserved properties of multiphoton states under linear-optical unitaries. We experimentally verify their conservation and use them to bound state transformation errors and metrological sensitivity.

## QTh3A.69

Withdrawn

## QTh3A.70

**Optical Cat State Approximation in a Nonlinear Interferometer-Like Photon-Subtraction Setup,** Johanna Conrad<sup>2,1</sup>, Fabian Steinlechner<sup>2,1</sup>, René Sondenheimer<sup>3,1</sup>; <sup>1</sup>*Fraunhofer IOF, Germany*; <sup>2</sup>*Inst. of Applied Physics, Friedrich-Schiller-Universität Jena, Germany*; <sup>3</sup>*Inst. of Condensed Matter Theory and Optics, Friedrich-Schiller-Universität Jena, Germany*. Schrödinger cat states are valuable non-Gaussian resources, but their preparation via photon subtraction scales poorly with their size. We propose a nonlinear interferometer-like scheme that enables higher-fidelity cat-state approximations with improved success

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## QTh3A.71

**Quantum Computing - Molecular Simulations**, Srinivasa R. Gundu<sup>1</sup>; <sup>1</sup>*MallaReddy Univ., India*. The study presents a quantum computing framework to simulate photosynthesis, modeling light absorption, exciton dynamics, charge transfer, and reaction mechanisms by integrating quantum chemistry and molecular dynamics, achieving accurate and biologically relevant energy flow predictions.

**16:00 -- 18:00**

**Room: Alsh 1**

## QTh4A • Quantum Imaging and Spectroscopy

*Presider: Irina Novikova; College of William & Mary, USA*

### QTh4A.1 • 16:00

**Time-Resolved Spectrometer for Visible-to-Near-Infrared Biphoton**, Ozora Iso<sup>1,2</sup>, Koya Onoda<sup>1</sup>, Nicola J. Fairbairn<sup>1</sup>, Masahiro Yabuno<sup>3</sup>, Hiroataka Terai<sup>3</sup>, Shigehito Miki<sup>3</sup>, Ryosuke Shimizu<sup>1,4</sup>; <sup>1</sup>*Department of Engineering Science, Graduate School of Informatics and Engineering, Denki Tsushin Daigaku, Japan*; <sup>2</sup>*School of Chemistry, Univ. of Glasgow, UK*; <sup>3</sup>*Joho Tsushin Kenkyu Kiko Mirai ICT Kenkyujo, Japan*; <sup>4</sup>*Inst. for Advanced Science, Denki Tsushin Daigaku, Japan*. We present a time-resolved biphoton spectrometer to measure the biphoton spectrum of visible-to-near-infrared photon pairs. The measured spectrum shows a clear contrast with 150 ps segmentation and spectral anticorrelation.

### QTh4A.2 • 16:15

**Sensing with Undetected mid-Infrared Photons for non-Destructive Testing**, Paul Gattinger<sup>2</sup>, Markus Branstetter<sup>2</sup>, Andreas Schell<sup>1</sup>, Ivan Zorin<sup>2</sup>; <sup>1</sup>*Johannes Kepler Universitat Linz, Austria*; <sup>2</sup>*Research Center for Non Destructive Testing GmbH, Austria*. Sensing with undetected photons provides an alternative in optical metrology, specifically in infrared (IR) spectroscopy, imaging, and optical coherence tomography (OCT). We demonstrate and discuss practical aspects of these techniques for practical non-destructive testing (NDT).

### QTh4A.3 • 16:30

**Quantum Imaging of Self-Emitting Infrared Objects With Undetected Photons Through Thermal Background**, Asteria Chen<sup>1</sup>, Anne Bai<sup>1</sup>, Xun Yu<sup>1</sup>, Nathan G. Gemmell<sup>1</sup>, Caiyi Liu<sup>1</sup>, Vladimir Kornienko<sup>1</sup>, Chris Phillips<sup>1</sup>, Rupert Oulton<sup>1</sup>; <sup>1</sup>*Imperial College London, UK*. Quantum imaging with undetected photons is experimentally shown to suppress thermal infrared background noise. We successfully imaged a heated filament on a silicon camera, despite strong self-emission that saturates an InGaAs infrared camera.

### QTh4A.4 • 16:45

**New Opportunities in Quantum Optical Coherence Tomography Imaging Using Fourier-Domain Detection**, Sylwia Kolenderska<sup>1,2</sup>, Crislane de Brito<sup>1</sup>, Piotr Kolenderski<sup>1</sup>; <sup>1</sup>*Uniwersytet Mikolaja Kopernika w Toruniu, Poland*; <sup>2</sup>*Univ. of Canterbury, New Zealand*. Quantum Optical Coherence Tomography improves axial resolution and cancels even-order dispersion, but is hindered by long acquisitions, artefacts and residual dispersion effects. We demonstrate Fourier-domain detection enabling to robustly overcome these obstacles.

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## QTh4A.5 • 17:00

### **Development of Time-Resolved Fluorescence Spectroscopy Using Heralded Emission**

**Spectroscopy for Organic Light-Emitting Materials**, Nicola J. Fairbairn<sup>1</sup>, Koya Onoda<sup>1</sup>, Ozora Iso<sup>1,2</sup>, Masahiro Yabuno<sup>3</sup>, Hiroataka Terai<sup>3</sup>, Shigehito Miki<sup>3</sup>, Yuji Kagotani<sup>4</sup>, Motoyasu Adachi<sup>4</sup>, Gordon J. Hedley<sup>2</sup>, Ryosuke Shimizu<sup>1,5</sup>; <sup>1</sup>*Department of Engineering Science, Denki Tsushin Daigaku Joho Rikogakuiki Daigakuin Joho Rikogaku Kenkyuka, Japan*; <sup>2</sup>*School of Chemistry, Univ. of Glasgow, UK*; <sup>3</sup>*Joho Tsushin Kenkyu Kiko Mirai ICT Kenkyujo, Japan*; <sup>4</sup>*Inst. for Quantum Life Science, Kokuritsu Kenkyu Kaihatsu Hojin Ryoshi Kagaku Gijutsu Kenkyu Kaihatsu Kiko, Japan*; <sup>5</sup>*Inst. for Advanced Science, Denki Tsushin Daigaku, Japan*.

We demonstrate a novel quantum spectroscopy technique that overcomes conventional fluorescence limitations using heralded frequency-entangled photon pairs for ultra-low-intensity lifetime measurements, achieving background suppression and non-destructive characterisation of bulk organic emitters over short integration times.

## QTh4A.6 • 17:15

### **Single-Photon Cameras With High Spatio-Temporal Resolution for Quantum**

**Imaging**, Tommaso Milanese<sup>1</sup>, Edoardo Charbon<sup>1</sup>; <sup>1</sup>*École Polytechnique Fédérale de Lausanne, Switzerland*. To push the limits of quantum imaging, nowadays SPAD sensors still lack certain key metrics. In this paper we analyse these limitations, review single-photon imagers architectures for quantum imaging applications, and propose solutions to address them.

## QTh4A.7 • 17:30

### **PDMS Transferred BSCCO Flakes as Platform for on Chip High $T_c$ Superconducting**

**Coherent Terahertz Detector**, Yongyu Zou<sup>1</sup>, Haonan He<sup>1</sup>, Mingqi Zhang<sup>1</sup>, Maryam Allamki<sup>1</sup>, Martin Weides<sup>1</sup>, Muhammad Imran<sup>1</sup>, Takanari Kashiwagi<sup>2</sup>, Kaveh Delfanazari<sup>1</sup>; <sup>1</sup>*Univ. of Glasgow, UK*; <sup>2</sup>*Tsukuba Daigaku, Japan*. We present a complete platform encompassing material transfer, fabrication, simulation, and initial characterisation of PDMS transferred BSCCO thin flakes integrated with spiral antennas, establishing a scalable high  $T_c$  superconducting on chip detector architecture for next generation terahertz sensing, communication, and computing technologies.

## QTh4A.8 • 17:45

### **A Fast and Complete Characterization Method of the Polarization Response in Fractal**

**SNSPDs**, Yago Herrera Moreno de Acevedo<sup>1</sup>, Federica Facchin<sup>1</sup>, Mario Castaneda<sup>1</sup>; <sup>1</sup>*Single Quantum B.V., Netherlands*. We present a fast and complete method to characterize SNSPDs' polarization response, enabling high-resolution evaluations of next generation designs. Applying it to polarization-insensitive fractal SNSPDs, we demonstrate uniform efficiency with strong saturation, low timing jitter and low dark-count rates.

**16:00 -- 18:00**

**Room: Alsh 2**

## **QTh4B • Quantum Sensors and Metrology**

*Presider: Emma Pearce; Univ. of Glasgow, UK and Emma Pearce; Univ. of Glasgow, UK*

## QTh4B.1 • 16:00

### **Squeezing Enhanced Sagnac Sensing Based on SU(1,1) Quantum Interference**

Michal Natan<sup>1</sup>, Saar H. Levin<sup>1</sup>, Avi Pe'er<sup>1</sup>; <sup>1</sup>*Bar Ilan Univ., Israel*. We propose a simple and robust

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squeezing-enhanced Sagnac interferometer using an in-loop OPA to generate counter-propagating squeezing in the spirit of  $SU(1,1)$  interference, enabling rotation sensitivity beyond the shot-noise limit via direct or parametric-homodyne detection.

## QTh4B.2 • 16:15

**The GFROG Experiment: a Giant Fiber Ring Optical Gyroscope for Testing General Relativity With Two-Photon Entanglement**, Raffaele Silvestri<sup>1</sup>; <sup>1</sup>*Universitat Wien, Austria*. We propose a giant fiber Sagnac interferometer probed with two-photon entanglement to target the general-relativistic frame-dragging contribution to Earth's rotation rate at femtorad/s precision. We outline the design, construct a physical model, and simulate the experiment.

## QTh4B.3 • 16:30

**Time and Frequency Resolved Spectroscopy With Entangled Photons**, Ashley Lyons<sup>1</sup>, Raul Alvarez-Mendoza<sup>2</sup>, Lorenzo Uboldi<sup>2</sup>, Richard Lane<sup>1</sup>, Richard J. Cogdell<sup>1</sup>, Giulio Cerullo<sup>2</sup>, Daniele Faccio<sup>1</sup>; <sup>1</sup>*Univ. of Glasgow, UK*; <sup>2</sup>*Politecnico di Milano, Italy*. We show time resolved spectroscopy at low photon fluxes that mimic natural environments within practical measurement times. We illustrate the approach by studying the fluorescent response of light harvesting molecules from purple bacteria.

## QTh4B.4 • 16:45

**Quantum Sensing of Birefringence With a Hyper-Entangled  $SU(1,1)$  Interferometer**, Samata Gokhale<sup>1</sup>, Netanel P. Yaish<sup>1</sup>, Michal Natan<sup>1</sup>, Saar H. Levin<sup>1</sup>, Yogesh Dandekar<sup>1</sup>, Avi Pe'er<sup>1</sup>; <sup>1</sup>*Bar Ilan Univ., Israel*. We demonstrate quantum interferometric sensing of birefringence beyond the shot-noise limit using a hyper-entangled  $SU(1,1)$  interferometer. The scheme employs hyper-squeezed, polarization-entangled light and predicts considerable sensitivity enhancement under realistic conditions of gain and internal loss.

## QTh4B.5 • 17:00

**Quantum Metrology Under Coarse-Grained Measurement**, Byeong-Yoon Go<sup>1</sup>, Geunhee Gwak<sup>1</sup>, Young-Do Yoon<sup>1</sup>, Sungho Lee<sup>3</sup>, Nicolas Treps<sup>2</sup>, Jiyong Park<sup>4</sup>, Young-Sik Ra<sup>1</sup>; <sup>1</sup>*Korea Advanced Inst. of Science and Technology, Korea (the Republic of)*; <sup>2</sup>*Laboratoire Kastler Brossel, France*; <sup>3</sup>*Korea Astronomy and Space Science Inst., Korea (the Republic of)*; <sup>4</sup>*Hanbat National Univ., Korea (the Republic of)*. We experimentally investigate how coarse-grained measurement, which arises from finite detector resolution, degrades precision in quantum metrology. Despite this limitation, we demonstrate that quantum-enhanced phase estimation remains achievable even under extreme coarse-graining.

## QTh4B.6 • 17:15

**Towards a Chip-Scale Atomic Magnetometer Using Fiber-Coupled Laser-Written Cesium Vapor Cell**, Yasin Taheri Mazinani<sup>3</sup>, Hugo Jorge da Nóbrega<sup>2</sup>, Prajal Chettri<sup>1</sup>, Roberto Osellame<sup>2</sup>, Giacomo Corrielli<sup>2</sup>, Vito Giovanni Lucivero<sup>3,4</sup>; <sup>1</sup>*Politecnico di Bari, Italy*; <sup>2</sup>*Istituto di Fotonica e Nanotecnologie Consiglio Nazionale delle Ricerche, Italy*; <sup>3</sup>*Universita degli Studi di Bari Aldo Moro, Italy*; <sup>4</sup>*QSENSATO Srl, Italy*. We present a functional prototype of a fiber-coupled laser-written Cs vapor cell (FC-LWVC) for compact, high-sensitivity, optical magnetometry applications, demonstrating the feasibility of integrating micro-optical components into all-glass vapor cells.

## QTh4B.7 • 17:30

**Certifying High-Dimensional Entanglement Using Multi-Outcome Fourier Measurements**, Philipp Oleynik<sup>1</sup>, Kiki Dekkers<sup>1</sup>, Nicola D'Alessandro<sup>2</sup>,

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Armin Tavakoli<sup>2</sup>, Aurora Maccarone<sup>1</sup>, Jonathan Leach<sup>1</sup>; <sup>1</sup>*Heriot Watt Univ., UK*; <sup>2</sup>*Lunds Universitet, Sweden*. We introduce a high-dimensional entanglement witness that only requires measurements in the Fourier domain of the computational basis. Our experimental scheme supports multi outcome measurements, and we verify 11-dimensional entanglement for angle/orbital angular momentum modes

## QTh4B.8 • 17:45

**Quantum Sensing and Quantum Error Correction—Two Sides of the Same Coin**, Zhuoran Bao<sup>1</sup>, Daniel F. James<sup>1</sup>; <sup>1</sup>*Univ. of Toronto, Canada*. Statistical distance quantifies the distortion of a state caused by a unitary evolution, thereby connecting quantum sensing and error correction. Such an approach might bring insights into sensor-state designs that are robust to unwanted noise.

16:00 -- 18:00

Room: Carron

## QTh4C • Photonic Quantum Computing

*Presider: Charles Möhl; IBM Research Europe - Zurich, Switzerland*

### QTh4C.1 • 16:00 (Invited)

**Deterministic Spin-Photon Entanglement Sources for Scalable Photonic Quantum Computing**, Peter Lodahl<sup>1</sup>; <sup>1</sup>*Sparrow Quantum, Denmark*. Abstract not available.

### QTh4C.2 • 16:30

**Resource Efficient Universal Photonic Processor Based on Time-Multiplexed Hybrid Architecture**, Jonas Lammers<sup>3,1</sup>, Laura Ares<sup>3,2</sup>, Federico Pegoraro<sup>3,1</sup>, Philip Held<sup>3,1</sup>, Benjamin Brecht<sup>3,1</sup>, Jan Sperling<sup>3,2</sup>, Christine Silberhorn<sup>3,1</sup>; <sup>1</sup>*Integrated Quantum Optics, Inst. for Photonic Quantum Systems (PhoQS), Germany*; <sup>2</sup>*Theoretical Quantum Science, Inst. for Photonic Quantum Systems (PhoQS), Germany*; <sup>3</sup>*Universitat Paderborn, Germany*. We present a new protocol capable of implementing arbitrary linear transformations using discrete-time quantum walks. Its experimental implementation based on time-multiplexing demonstrates high quality unitaries of up to 30 modes.

### QTh4C.3 • 16:45

**A Silicon Integrated Quantum Frequency Processor**, Sara Congia<sup>1,2</sup>, Leopold Viroth<sup>3</sup>, Antonio Fincato<sup>3</sup>, Frederic Boeuf<sup>3</sup>, Matteo Galli<sup>1</sup>, Daniele Bajoni<sup>2</sup>, Massimo Borghi<sup>1</sup>; <sup>1</sup>*Dipartimento di Fisica "Alessandro Volta", Universita di Pavia, Italy*; <sup>2</sup>*Dipartimento di Ingegneria Industriale e dell'Informazione, Universita di Pavia, Italy*; <sup>3</sup>*STMicroelectronics, France*. We report the first fully integrated silicon quantum frequency processor, unifying on-chip photon-pair generation, programmable frequency mixing, and spectral control, demonstrating tunable frequency beamsplitters with success probability exceeding 94% and coherent manipulation of high-dimensional entangled states.

### QTh4C.4 • 17:00

**Silicon-Carbide-on-Insulator as a Monolithic, CMOS-Compatible Quantum Photonic Integrated Circuit Platform**, Homa Zarebidaki<sup>1</sup>, Mattia Orvietani<sup>1</sup>, Alberto Dellatorre<sup>1</sup>, Florian Dubois<sup>1</sup>, Jacopo Leo<sup>1</sup>, Micol Previde Massara<sup>1</sup>, Guido Spinola Durante<sup>1</sup>, Dara Bayat<sup>1</sup>, Dorian Herle<sup>1</sup>, Olivier Dubochet<sup>1</sup>, Sylvain Nicolay<sup>1</sup>; <sup>1</sup>*Centre Suisse d'Electronique et de Micro, Switzerland*. We present Silicon-Carbide-on-Insulator (SiCOI) as a monolithic, CMOS-

# Optica Quantum 2.0 Conference and Exhibition

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## QTh4C.5 • 17:15

**Entangled Photon-Pair Generation and Control With Thin-Film Lithium Niobate**, Robert J. Chapman<sup>1</sup>, Andreas Maeder<sup>1</sup>, Alessandra Sabatti<sup>1</sup>, Giovanni Finco<sup>1</sup>, Jost Kellner<sup>1</sup>, Rachel Grange<sup>1</sup>; <sup>1</sup>*Optical Nanomaterial Group, Eidgenössische Technische Hochschule Zurich, Switzerland*. We present a thin-film lithium niobate quantum photonic circuit for the generation, manipulation and tomography of path-encoded Bell states. Using spontaneous parametric down-conversion and programmable interferometers, we achieve high brightness and high-fidelity entanglement.

## QTh4C.6 • 17:30

**A Recirculating Quantum Photonic Network for Efficient Quantum Information Processing**, Emil Grovn<sup>1,3</sup>, Matias Bundgaard-Nielsen<sup>1,3</sup>, Jesper Mørk<sup>1,3</sup>, Dirk Englund<sup>2</sup>, Mikkel Heuck<sup>1,3</sup>; <sup>1</sup>*Department of Electrical and Photonics Engineering, Danmarks Tekniske Universitet, Denmark*; <sup>2</sup>*Department of Electrical Engineering and Computer Science, Massachusetts Inst. of Technology, USA*; <sup>3</sup>*NanoPhoton - Center for Nanophotonics, Danmarks Tekniske Universitet, Denmark*. We present a recirculating quantum photonic network architecture that enables significant improvements in time and resource efficiency of quantum information processing compared to state-of-the-art proposals based on, e.g., neural network architectures.

## QTh4C.7 • 17:45

**Below-Threshold Error Reduction in Single Photons Through Photon Distillation**, Jelmer Renema<sup>1,2</sup>, Frank Somhorst<sup>2</sup>, Jason Saied<sup>3</sup>, Narsim Kannan<sup>1</sup>, Ben Kassenberg<sup>1</sup>, Jeff Marshall<sup>3</sup>, Pavel Stremoukhov<sup>1</sup>, Anastasiia Lukianenko<sup>1</sup>, Pim Venderbosch<sup>1</sup>, Trevor Demille<sup>1</sup>, Andrew Roos<sup>1</sup>, Nathan Walk<sup>4</sup>, Jens Eisert<sup>4</sup>, Eleanor Rieffel<sup>3</sup>, Devin Smith<sup>1</sup>; <sup>1</sup>*QuiX Quantum B.V., Netherlands*; <sup>2</sup>*Universiteit Twente, Netherlands*; <sup>3</sup>*NASA, USA*; <sup>4</sup>*Freie Universität Berlin, Germany*. We demonstrate sub-threshold error reduction of distinguishability errors in a photonic system, compatible with fault-tolerant universal quantum computation, using photon distillation. Our error reduction persists under experimental errors, making it immediately applicable to quantum computers.

**16:00 -- 18:00**

**Room: Lomond Auditorium**

**QTh4D • Quantum Technology for Quantum Networks**

*Presider: Charles Möhl; IBM Research Europe - Zurich, Switzerland*

## QTh4D.1 • 16:00

**Frequency-bin Entanglement for Adaptable Quantum Key Distribution Networks**, Anahita Khodadad Kashi<sup>1,2</sup>, Michael Kues<sup>1,2</sup>; <sup>1</sup>*Leibniz Universität Hannover, Germany*; <sup>2</sup>*Leibniz Universität Hannover Exzellenzcluster PhoenixD, Germany*. We demonstrate frequency-bin encoding for entanglement-based QKD with reconfigurable transmission of frequency-bin entanglement and a scalable basis analyzer based on electro-optic phase modulation and frequency-to-time mapping, enabling efficient resource utilization in long-distance, multi-user quantum networks.

## QTh4D.2 • 16:15

# Optica Quantum 2.0 Conference and Exhibition

**Disclaimer:** this guide is limited to technical program with abstracts and author blocks as of 02 June. For updated and complete information with special events, reference the online schedule or mobile app

## **Fiber in-Line Single Photon Sources for Quantum Random Number**

**Generation,** Muhammed S. Kodakkaden<sup>1</sup>; <sup>1</sup>*Hamad Bin Khalifa Univ., Qatar*. We present a quantum random number generator (QRNG) using single photons from a quantum dot coupled to an optical nanofiber. The QRNG exploits the inherent randomness of single photon paths into the fiber's two counter propagating guided modes. The system generates NIST certified random bits without any need for post-processing.

### **QTh4D.3 • 16:30**

**Design of Polarization Maintaining Hollow Core Fiber for Quantum Communication,** Dan T. Nguyen<sup>1</sup>, Nikolay Kaliteevskiy<sup>2</sup>, Ilia Nikulin<sup>1</sup>, Petr Sterlingov<sup>2</sup>, Michal Mlejnek<sup>1</sup>, Aramais Zakharian<sup>1</sup>, John Downie<sup>1</sup>; <sup>1</sup>*Science and Technology Division, Corning Incorporated, USA*; <sup>2</sup>*Corning ASA Finland, Corning Incorporated, Finland*. We propose new hollow core fiber (HCF) designs that are *truly single mode* and polarization maintaining. Modeling of quantum key distribution (QKD) systems with such HCFs demonstrates significant potential of HCFs in quantum communication.

### **QTh4D.4 • 16:45**

**Integrated Laser-Written Heterodyne Receiver for Quantum Communications,** Andrea Peri<sup>1</sup>, Giulio Gualandi<sup>2,3</sup>, Tommaso Bertapelle<sup>1</sup>, Mattia Sabatini<sup>1</sup>, Giacomo Corrielli<sup>3</sup>, Yoann Piétri<sup>1</sup>, Davide G. Marangon<sup>1,4</sup>, Giuseppe Vallone<sup>1,4</sup>, Paolo Villorosi<sup>1,4</sup>, Roberto Osellame<sup>3</sup>, Marco Avesani<sup>1,4</sup>; <sup>1</sup>*Dipartimento di Ingegneria dell'Informazione, Università degli Studi di Padova, Italy*; <sup>2</sup>*Dipartimento di Fisica, Politecnico di Milano, Italy*; <sup>3</sup>*Istituto di Fotonica e Nanotecnologie Consiglio Nazionale delle Ricerche, Italy*; <sup>4</sup>*Padua Quantum Technologies Research Center, Università degli Studi di Padova, Italy*. We introduce a Femtosecond-Laser-written Photonic Integrated Circuit realizing low-loss, polarization-insensitive quantum coherent detection. High stability and CMRR  $\geq 73$  dB enabled the implementation of a high-performance CV-QKD system and a record 42.74 Gbps QRNG.

### **QTh4D.5 • 17:00**

**High-Resolution and High-Throughput Multichannel Time Tagging for Scalable Photonic Quantum Experiments,** Max Tillmann<sup>1</sup>, Michael Wahl<sup>1</sup>, Tino Röhlicke<sup>1</sup>, Nicolai Adelhoefer<sup>1</sup>, Torsten Langer<sup>1</sup>, Andreas Lehr<sup>1</sup>; <sup>1</sup>*PicoQuant GmbH, Germany*. A multichannel time-tagging architecture with picosecond resolution optimized for high throughput is demonstrated in combination with an integrated SNSPD array, providing a scalable timing backbone for quantum communication and photonic quantum computing experiments.

### **QTh4D.6 • 17:15**

**35 Gbps Source-Device-Independent InP Monolithically Integrated QRNG,** Peter S. Kincaid<sup>1</sup>, Lorenzo De Marinis<sup>1</sup>, Francesco Testa<sup>1</sup>, Nicola Andriolli<sup>2</sup>, Giampiero Contestabile<sup>1</sup>; <sup>1</sup>*Scuola Superiore Sant'Anna, Italy*; <sup>2</sup>*Università degli Studi di Pisa, Italy*. A source-device-independent QRNG based on a vacuum state heterodyne measurement was realized with an InP photonic integrated circuit, packaged inside a single module with no optical I/O. A generation rate of 35 Gbps was achieved.

### **QTh4D.7 • 17:30**

**Wavefront Shaping and Point Spread Function Engineering in Quantum Microscopy With Undetected Light,** Stefan Krause<sup>2</sup>, Jonas Vasikonis<sup>1</sup>, Lars Büttner<sup>2</sup>, Markus Gräfe<sup>1</sup>, Jürgen Czarske<sup>2</sup>; <sup>1</sup>*Technische Universität Darmstadt, Germany*; <sup>2</sup>*Technische Universität Dresden, Germany*. We demonstrate wavefront shaping with spatial light modulators (SLM) to enhance

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the performance of quantum microscopy with undetected light. Thereby, we achieve correction of internal aberrations of the optical systems and reveal 3D information.

## **QTh4D.8 • 17:45**

**A Deployable, High-Efficiency Fiber Microcavity Platform for Scalable Quantum Interfaces**, Thomas Huemmer<sup>1</sup>, Usman Adil<sup>1</sup>, Sambit Mitra<sup>1</sup>, Jonathan Noe<sup>1</sup>, Ashly Jose<sup>1</sup>, Manuel Nutz<sup>1</sup>, Michael Foerg<sup>1</sup>; <sup>1</sup>*Qlibri GmbH, Germany*. Fiber-based Fabry-Perot cavities provide compact interfaces for strong light–matter interaction. We present an open-access fiber–fiber cavity platform with passive ferrule guidance and active micro-positioning, enabling stable, tunable cavities with high mode matching, sub-picometer length stability, and suitability for UHV-compatible cavity QED.