Optica Quantum 2.0 Conference and Exhibition Session Guide

Disclaimer: this guide is limited to technical program with abstracts and author blocks as of 12 May. For updated and complete information with special events, reference the online schedule or mobile app.

Monday, 2 June

08:00 -- 10:00
Room: Imperial Ballroom
QM1A • Keynote Session I

QM1A.1 • 08:00 (Plenary)
Quantum Computing – Hype, Hope, and Fun, Christopher R. Monroe[1]; *[1]Duke Univ., USA.* Quantum computers exploit the bizarre features of quantum physics - uncertainty, entanglement, and measurement - to perform impossible tasks using conventional means. These may include the computing and optimizing over ungodly amounts of data, breaking encryption standards and simulating models of chemistry and materials.

QM1A.2 • 08:45 (Invited)
The Physics Behind Quantum Information Networks, Michael G. Raymer[1]; *[1]Univ. of Oregon, USA.* I will discuss underlying concepts and history leading to the present state of research in quantum communication and networking.

QM1A.3 • 09:15 (Invited)
Quantum Sensors for New-Physics Discoveries in the Laboratory and in Space, Marianna Safronova[1]; *[1]Univ. of Delaware, USA.* I will present an overview of new physics searches with quantum sensors, highlighting dark matter searches using atomic and nuclear clocks and exploring deployment of quantum sensors in space for fundamental physics.

10:30 -- 12:30
Room: Imperial Ballroom
QM2A • Photonic Quantum Computing

QM2A.1 • 10:30 (Invited)
ORCA Computing: Roadmap From Quantum Generative AI to Fault Tolerance, Joshua Nunn[1]; *[1]ORCA Computing, UK.* Abstract not available.

QM2A.2 • 11:00
Deterministic and Reconfigurable Graph State Generation With a Solid-State Quantum Emitter, Helio Huet[1], Prashant Ramesh[1,2], Stephen Wein[3], Nathan Coste[4,1], Paul Hilaire[3], Niccolo Somaschi[3], Martina Morassi[1], Aristide Lemaître[1], Isabelle Sagnes[1], Matthew Doty[2], Olivier Krebs[1], Loïc Lanco[1,5], Dario Fioretto[1,3], Pascale Senellart[1]; *[1]C2N, CNRS, France; [2]Univ. of Delaware, USA; [3]Quandela SAS, France; [4]School of Mathematical and Physical Sciences, Australia; [5]Université Paris Cité, CNRS, France.* We demonstrate deterministic and reconfigurable spin-multiphoton graph state generation using a semiconductor quantum dot embedded in a cavity, compatible with commercial integration for practical fault-tolerant measurement-based quantum computation.

QM2A.3 • 11:15

End-to-end Switchless Architecture for Fault-Tolerant Photonic Quantum Computing, Paul Renault[1], Patrick Yard[1], Raphael Pooser[1], Miller Eaton[1], Hussain Zaidi[1]; *[1]QC82, USA.* We propose a photonic architecture enabling the generation of GKP states from squeezed vacuum states. A 12.1dB threshold of cluster squeezing is achieved by encoding the resultant GKP states into a quantum error correction code.

QM2A.4 • 11:30

Boosted Bell-State Measurements for Photonic Quantum Computation, Nico Hauser[3], Matthias J. Bayerbach[3], Simone E. DAurelio[3], Raphael Weber[1,2], Matteo Santandrea[2], Shreya P. Kumar[2], ish Dhand[2], Stefanie Barz[3]; *[1]Inst. for Theoretical Physics & IQST, Ulm Univ., Germany; [2]QC Design GmbH, Germany; [3]Inst. for functional matter and quantum technologies, Univ. of Stuttgart, Germany.* We demonstrate a boosted linear-optical Bell-state measurement with up to 75% success probability using entangled ancillary photons. We show that this boosted Bell-state measurement significantly increases the feasibility of fusion-based quantum computation schemes

QM2A.5 • 11:45

Realization of a C-NOT Gate in a Fully Reconfigurable Time-Multiplexed Photonic Circuit, Federico Pegoraro[1], Philip Held[1], Jonas Lammers[1], Benjamin Brecht[1], Christine Silberhorn[1]; *[1]Integrated Quantum Optics, Inst. of Photonic Quantum Systems (PhoQS), Paderborn Univ., Germany.* We realize a fully reconfigurable time-multiplexed photonic circuit capable of preparing a state of two qubits and implementing a post-selected C-NOT gate on their joint state with a fidelity of (93.8 ±1.4)%.

QM2A.6 • 12:00

Fault-Tolerant Quantum Computing With Single-Species Rare-Earth Ion-Doped Crystals, Eva M. Gonzalez Ruiz[1], Hugo Jacinto[1,2], Nicolas Sangouard[1]; *[1]Institut de Physique Théorique, CEA, France; [2]Alice & Bob, France.* We propose a fault-tolerant quantum computing protocol on a single-species rare-earth-ion-doped crystal, analyzing universal (single- and two-qubit) gate performance, readout optimization, and quantum error correction thresholds. Our findings highlight Eu^{3+}:Y$_2$SiO$_5$ as the best candidate.

QM2A.7 • 12:15

Non-Adaptive Measurement-Based Quantum Computation Using a Qudit GHZ State, Jinwon Yoo[1], Stefania Sciara[1], Nicola Montaut[1], Agnes George[1], Roberto Morandotti[1]; *[1]Institut National de la Recherche Scientifique, Canada.* We demonstrate non-adaptive measurement-based quantum computation using a frequency-time-entangled three-qutrit GHZ state. The findings highlight the effectiveness of the qudit GHZ state in quantum computation and reveal the nonlocal characteristics of multipartite high-dimensional entangled systems.

10:30 -- 12:30
Room: Yorkshire A
QM2B • Quantum Cryptography

QM2B.1 • 11:00
Integrated Lithium Niobate Photonics for High-Speed Quantum Key Distribution, Zhihao Lin[1,2], Yuanfei Gao[1], Lai Zhou[1], Huihong Yuan[1], Yuntao Zhu[3], Zhongjin Lin[3], Wei Zhang[2], Yidong Huang[2], Xin-Lun Cai[3], Zhiliang Yuan[1]; *[1]Beijing Academy of Quantum Information Sciences, China; [2]Tsinghua Univ., China; [3]Sun Yat-Sen Univ., China.* We demonstrate the first chip-to-chip quantum key distribution system based on thin-film lithium niobate platform, with a quantum bit error rate of 0.53% and a secret key rate exceeding 10 Mbps over 25 km fibers.

QM2B.2 • 11:15
High-Speed Heterodyne-Based Quantum Random Number Generator on a Chip, Tommaso Bertapelle[1], Marco Avesani[1], Alberto Santamato[2], Alberto Montanaro[2,3], Marco Chiesa[4,5], Davide Rotta[4,5], Massimo Artiglia[2,3], Vito Sorianello[2], Francesco Testa[3], Gabriele De Angelis[2,3], Giampiero Contestabile[3], Giuseppe Vallone[1], Marco Romagnoli[2], Paolo Villoresi[1]; *[1]Università degli Studi di Padova, Italy; [2]Photonic Networks and Technologies Lab - CNIT, Italy; [3]Scuola Superiore Sant'Anna, Italy; [4]InPhoTec, Integrated Photonic Technologies Foundation, Italy; [5]CamGraPhIC srl, Italy.* This study presents the first on-chip source-device independent QRNG, achieving a secure generation rate over 20 Gbps. The chip is custom-designed to reduce complexity while providing practical solutions for high-performance, portable, and space-based quantum applications.

QM2B.3 • 11:30
Frequency-bin Encoding for Flexible Entanglement-Based QKD Networks, Anahita Khodadad Kashi[1], Michael Kues[1]; *[1]Inst. of Photonics, Leibniz Univ. Hannover, Germany.* We demonstrate the first-time frequency-bin-encoded entanglement-based quantum key distribution and reconfigurable distribution of frequency-based entanglement. A scalable frequency-bin-basis analyzer facilitates resource-efficiency and maintained security for key distribution among multiple users over extended geographical areas.

QM2B.4 • 11:45
Toward Fully Operational Quantum key Distribution Networks Using Polarization Entanglement, Yoann Pelet[1], Gregory Sauder[1], Sébastien Tanzilli[1], Anthony Martin[1], Olivier Alibart[1]; *[1]Instutut de physique de Nice, France.* We present the development and real-field test of a fully automated, self stabilizing QKD setup exploiting polarization entanglement, allowing to perform real-field QKD experiment for hundreds of hours, without requiring any operator.

QM2B.5 • 12:00
Quantum Key Distribution in Multimode Fiber on Metropolitan-Scale Distances, Adam Brzosko[1,2], Robert Woodward[2], Yuen San Lo[2], Mirko Pittaluga[2], Peter Smith[2], James Dynes[2], Andrew Shields[2]; *[1]Univ. of Cambridge, UK; [2]Toshiba Europe Limited, UK.* We report a proof-of-principle realization of a decoy-state BB84 QKD protocol with phase encoding over 17 km of

MMF fiber, including a discussion on its stability and implementation considerations.

QM2B.6 • 12:15
A 18km-Long Free-Space Testbed for Intermodal Quantum Key Distribution Nearby Padova, Edoardo Rossi[1], Ilektra Karakosta-Amarantidou[1], Matteo Padovan[1], Antonio Vanzo[2,1], Stefano Bonora[2], Giuseppe Vallone[1], Paolo Villoresi[1], Francesco Vedovato[1]; *[1]Universita degli Studi di Padova, Italy; [2]Inst. of Photonics and Nanotechnology, National Council of Research of Italy, Italy.* We present the testbed for intermodal Quantum Key Distribution over a free-space channel of 18 km that we are developing nearby the metropolitan area of Padova. The receiver implements adaptive optics for efficient single-mode-fiber coupling.

10:30 -- 12:30
Room: Yorkshire B
QM2C • Quantum Sensing

QM2C.1 • 10:30 (Invited)
Quantum Gravity Tests Inspired by Quantum Optics: From Single Graviton Detection to Other Near Future Experiments, Igor Pikovski[1]; *[1]Stevens Inst. of Technology, USA.* Here I will discuss how single graviton detection can be achieved, similarly to early tests of quantum theory. I will also discuss how these and other AMO experiments can provide empirical evidence of quantum gravity.

QM2C.2 • 11:00
Comparing Homodyne and Heterodyne Tomography of Non-Gaussian Quantum States of Light via Classical Fisher Information, Rhea P. Fernandes[1], Andrew J. Pizzimenti[2], Christos Gagatsos[2], Joseph M. Lukens[3,1]; *[1]Arizona State Univ., USA; [2]Univ. of Arizona, USA; [3]Purdue Univ., USA.* A major unexplored question of quantum state tomography is the relative efficiency of homodyne versus heterodyne measurements for reconstructing non-Gaussian states. We introduce a Fisher information-based formalism to answer this question, tested through simulated experiments.

QM2C.3 • 11:15
Quantum-Enhanced Multi-Parameter Sensing in a Single Mode, Christophe Valuhu[2], Matthew Stafford[3], Zixin Huang[1], Vassili Matsos[2], Maverick Millican[2], Teerawat Chalermpusitarak[2], Nicolas Menicucci[4], Joshua Combes[5], Ben Baragiola[4], Ting Rei Tan[2]; *[1]Macquarie Univ., Australia; [2]Univ. of Sydney, Australia; [3]Univ. of Bristol, UK; [4]RMIT, Australia; [5]Univ. of Melbourne, Australia.* We deterministically prepare Gottesman--Kitaev--Preskill (GKP) states in the mechanical motion of a trapped ion and demonstrate uncertainties in position and momentum below the standard quantum limit.

QM2C.4 • 11:30
Quantum-Enhanced Multi-Phase Distributed Sensing With a tSU(1,1) Interferometer, Seongjin Hong[2,1], Matthew A. Feldman[1], Claire E. Marvinney[1], Donghwa Lee[3], Changyoup Lee[4], Raphael Pooser[1], Alberto Marino[1]; *[1]Oak Ridge National Laboratory, USA; [2]Chung-Ang Univ., Korea (the Republic of); [3]Korea Inst. of Science and Technology,*

Korea (the Republic of); [4]Korea Research Inst. of Standards and Science, Korea (the Republic of). We demonstrate the detection of a linear superposition of two distributed phases with a 1.7 dB quantum noise reduction using a tSU(1,1) interferometer. We extend the system theoretically to a multi-phase distributed sensing scheme.

QM2C.5 • 11:45

Beam Tracking Beyond the Heisenberg Uncertainty Limit, Yingwen Zhang[1,2], Duncan England[2], Noah Lupu-Gladstein[1,2], Frédéric Bouchard[2], Guillaume Thekkadath[2], Philip Bustard[2], Ebrahim Karimi[1,2], Benjamin Sussman[2,1]; *[1]Univ. of Ottawa, Canada; [2]National Research Council Canada, Canada.* Determining a beam's full trajectory requires tracking both its position and momentum. However, the uncertainty product of the two parameters is bounded by the Heisenberg uncertainty limit (HUL). Here, we demonstrate a quantum beam tracking technique by leveraging position and momentum entangled photons to achieve an accuracy beyond the HUL.

QM2C.6 • 12:00

Quantum-Enhanced Multi-Phase Distributed Sensing Using Fewer Photons, Seongjin Hong[1], Dong-Hyun Kim[2], Yong-Su Kim[2], Yosep Kim[3], Seung-Woo Lee[2], Raphael Pooser[4], Kyunghwan Oh[1], Su-Yong Lee[5], Changhyoup Lee[6], Hyang-Tag Lim[2]; *[1]Yonsei Univ., Korea (the Republic of); [2]KIST, Korea (the Republic of); [3]Korea Univ., Korea (the Republic of); [4]QC82, USA; [5]ADD, Korea (the Republic of); [6]KRISS, Korea (the Republic of).* We demonstrate the measurement of a linear superposition of four distributed phases using two photons with a quantum enhanced sensitivity. We further extend the system theoretically to a multi-phase distributed quantum sensing.

QM2C.7 • 12:15

All-Fiber Microendoscopic Polarization Sensing at Single-Photon Level Aided by Deep-Learning, Martin Bielak[1], Dominik Vasinka[1], Miroslav Jezek[1]; *[1]Palacky Univ. Olomouc, Czechia.* We address the problem of precise polarization measurement in challenging conditions. To resolve this problem, we introduce a single-shot all-fiber method based on intermodal interaction aided by deep-learning, providing accuracy down to a single-photon level.

14:00 -- 16:00
Room: Imperial Ballroom
QM3A • Quantum Networking

QM3A.1 • 14:00

Entanglement-Preserving Electro-Optic Photonic Router at a Telecom Wavelength, Pengfei Wang[2], Soyoung Baek[1], Fumihiro Kaneda[2,3]; *[1]Research Inst. of Electrical Communication, Tohoku Univ., Japan; [2]Graduate School of Science, Tohoku Univ., Japan; [3]Precursory Research for Embryonic Science and Technology, Japan Science and Technology Agency, Japan.* We demonstrate a low-loss and polarization-entanglement-preserving photonic router at the telecom C-band. The router enables switching an optical path of two-photon polarization-mode N00N states while maintaining its high degree of entanglement.

QM3A.2 • 14:15
Feasibility Study of Frequency-Encoded Photonic Qubits Over a Free-Space Channel, Stephane Vinet[1], Wilson Wu[2,1], Yujie Zhang[1], Thomas Jennewein[1,2]; *[1]Univ. of Waterloo, Canada; [2]Simon Fraser Univ., Canada.* We demonstrate a novel interferometric approach to decode frequency-bins, transmitted over free-space channels, without any adaptive optics or modal filtering. Moreover, we investigate the phase stability requirements for frequency-bin encoded satellite communication.

QM3A.3 • 14:30
Exploring New Applications Using Solid-State Quantum Network, Maxim A. Sirotin[1,2], Pieter-Jan Stas[1], Yan-Cheng Wei[1], Aziza Suleymanzade[1], Gefen Baranes[1,2], Yan Qi Huan[1], Umut Yazlar[1,3], Evgenii Kniazev[1], Francisca Abdo Arias[1], Johannes Borregaard[1], Hongkun Park[4], Marko Loncar[5], Mikhail Lukin[1]; *[1]Physics Dept., Harvard Univ., USA; [2]Research Laboratory of Electronics, Massachusetts Inst. of Technology, USA; [3]Division of Materials Science & Engineering,, Boston Univ., USA; [4]Dept. of Chemistry and Chemical Biology, Harvard Univ., USA; [5]John A. Paulson School of Engineering and Applied Sciences, Harvard Univ., USA.* We experimentally explore new applications utilizing a two-node quantum network based on silicon-vacancy centers in diamond integrated in nanophotonic cavities, including distributed blind quantum computing and nonlocal quantum interferometry.

QM3A.4 • 14:45
Toward Qudit Quantum Networking With Rare-Earth Ions, Will A. Pajak[1,2], Chun-Ju Wu[1,2], Emanuel Green[1,2], Andrei Faraon[1,2]; *[1]Thomas J. Watson, Sr, Laboratory of Applied Physics, California Inst. of Technology, USA; [2]Inst. for Quantum Information and Matter, California Inst. of Technology, USA.* We demonstrate coherent control of a qudit system formed by four hyperfine levels of 171-Yb in YVO4. This is achieved using a photonic crystal resonator leveraging the birefringence of the crystal.

QM3A.5 • 15:00
Hybrid-Integrated InGaAs/InP SPAD Arrays for Quantum Communication Systems, Joseph Dolphin[1,2], Rosemary E. Scowen[1], Taofiq K. Paraiso[1], Louise Wells[1], Mark Stevenson[1], Andrew Shields[1]; *[1]Toshiba Research Europe Ltd, UK; [2]Dept. of Engineering, Univ. of Cambridge, UK.* We introduce a four-channel GHz-gated InGaAs/InP single-photon avalanche diode (SPAD) detector assembly, coupled to a glass photonic integrated circuit, and demonstrate performance and applicability to practical quantum communication systems.

QM3A.6 • 15:15
SnV Centers in Photonic Crystal Cavities as a Platform for Quantum Network Nodes, Daniel Bedialauneta Rodriguez[1], Nina Codreanu[1], Tim Turan[1], Christopher Waas[1], Hans K. Beukers[1], Matteo Pasini[2], Leonardo G. Wienhoven[1], Julia M. Brevoord[1], Ronald Hanson[1]; *[1]QuTech and Kavli Inst. of Nanoscience, Netherlands; [2]ICFO, Spain.* Diamond photonic crystal cavity parameters are measured at cryogenic temperatures. In-situ resonance frequency tuning through gas desorption allows us to probe the SnV-cavity system.

QM3A.7 • 15:30

Entanglement Distribution Over Ultra-Low-Loss Fiber With a Silicon Chip Source, Jinyi Du[1], XIngjian Zhang[1], En Teng Lim[1], George F. Chen[2], Hongwei Gao[2], Dawn T. Tan[2,3], Alexander Ling[1,4]; [1]*Centre for Quantum Technologies, Singapore;* [2]*Photonics Devices and System Group, Singapore Univ. of Technology and Design, Singapore;* [3]*Inst. of Microelectronics, Agency for Science Technology and Research (A*STAR), Singapore;* [4]*Dept. of Physics, National Univ. of Singapore, Singapore.* We develop and demonstrate a silicon chip generating 460,000 entangled photon pairs per second with 97.90(3)% fidelity. The photons were transmitted over 155 km of deployed fiber (66 dB loss) and ultra-low-loss fiber spools (0.16 dB/km), achieving extended transmission distances.

QM3A.8 • 15:45

a Quantum Network Node Based on SnV Centers in Diamond, David Hunger[1], Jeremias Resch[1], Ioannis Karapatzakis[1], Kerim Köster[1], Andras Lauko[1], Marcel Schrodin[1], Philipp Fuchs[2], Michael Kierschnick[3], Julia Heupel[4], Cyril Popov[4], Jan Meijer[3], Christoph Becher[2], Wolfgang Wernsdorfer[1]; [1]*Karlsruhe Inst. of Technology, Germany;* [2]*Universität des Saarlandes, Germany;* [3]*Univ. of Leipzig, Germany;* [4]*Univ. of Kassel, Germany.* We report spin control of a tin vacancy center in diamond and achieve a coherence time of up to 10 ms. We also control a nearby carbon nuclear spin with up to 1 s coherence. Finally, we incorporate SnV centers in a microcavity and achieve a cooperativity of 0.3, substantiating the potential of SnV centers in diamond for quantum network nodes.

14:00 -- 16:00
Room: Yorkshire A
QM3B • Quantum Optics I

QM3B.1 • 14:00

Deterministic Quantum Teleportation Using Adaptive Quantum non Demolition Measurements, Manish Chaudhary[1]; [1]*Univ. of Liège, Belgium.* We develop a teleportation scheme to prepare an unknown spin coherent state based on atomic ensembles. This is achieved by performing QND measurements. The quantum state of three atomic ensembles is evolved using a sequence of QND measurements in the spin basis z and x, followed by adaptive unitaries so that desired Bell measurement is implemented.

QM3B.2 • 14:15

Towards a Device Independent Proof of Indefinite Causal Order With a Quantum Switch, Carla M. Richter[1,2], Michael Antesberger[1,2], Huan Cao[1], Philip Walther[1,3], Lee A. Rozema[1]; [1]*Vienna Center for Quantum Science and Technology (VCQ), Univ. of Vienna, Austria;* [2]*Faculty of Physics & Vienna Doctoral School in Physics, Univ. of Vienna, Austria;* [3]*Research Network Quantum Aspects of Time (TURIS) & Christian Doppler Laboratory for Photonic Quantum Computer, Univ. of Vienna, Austria.* Building on concepts from Bell inequalities, we experimentally realize a device-independent protocol proving that the quantum switch creates an indefinite causal order. This is achieved by entangling the switch's control qubit with a ancilla photon.

QM3B.3 • 14:30

Device-Independent Quantum Position Verification, Gautam A. Kavuri[1,2], Abigail Gookin[1], Yanbao Zhang[3], Joshua Bienfang[1], Yusuf Alnawakhtha[4], Soumyadip Patra[5], Carl Miller[1], Dileep V. Reddy[1], Michael Mazurek[1,2], Carlos Abellan[6], Waldimar Amaya[6], Morgan Mitchell[7], Peter Bierhorst[5], Scott Glancy[1], Richard Mirin[1], Martin J. Stevens[1], Emanuel Knill[1], Lynden Shalm[1,2]; *[1]NIST, USA; [2]Physics, Univ. of Colorado, USA; [3]Quantum Information Science Section, Oak Ridge National Laboratory, USA; [4]Physics, Univ. of Maryland, USA; [5]Mathematics, Univ. of New Orleans, USA; [6]Quside, Spain; [7]ICFO, Spain.* We propose and implement a device-independent protocol for quantum position verification against unentangled adversaries. Our experiment achieves provable localization to a 1-dimensional region that is 40.7 +- 0.7% the size of the smallest theoretical region achievable with classical protocols.

QM3B.4 • 14:45

Experimental Device-Independent Certification of a 4-Qubit GHZ State, Nicolas Laurent-Puig[1], Laura dos Santos Martins[1], Uta Meyer[1], Eleni Diamanti[1], Damian Markham[1], Ivan Šupić[1], Simon Neves[2]; *[1]Sorbonne Université LIP6, France; [2]FEMTO-ST Insitute, Université de Franche-Comté, France.* Authentication of quantum resources is crucial for quantum protocols. We adopt Gocanin et al. protocol to experimentally certify a four-photon GHZ state in a device-independent framework, without assuming identically and independently distributed states. This certification is performed using our compact, high-fidelity entangled photon source.

QM3B.5 • 15:00

Scalable Entangled Photon Generation Using a Spin in a C-Band Quantum Dot, Petros Laccotripes[1,2], Tina Muller[2], David A. Ritchie[1], Mark Stevenson[2]; *[1]Dept. of Physics, Univ. of Cambridge, UK; [2]Quantum Information Group, Toshiba Europe, UK.* On-demand entanglement generation between stationary and propagating qubits directly in the telecom C-band is crucial for quantum networks. For the first time we demonstrate high-fidelity spin-photon entanglement, a key ingredient of multiphoton cluster-state generation protocols.

QM3B.6 • 15:15

Violating Bell's Inequality With Single-Photon Entangled States Using Self-Referential Measurements, Daniel Kun[1], Teodor Stroemberg[2], Borivoje Dakic[1], Philip Walther[1], Lee A. Rozema[1]; *[1]Universitat Wien, Austria; [2]Inst. of Science and Technology Austria, Austria.* We violate a CHSH inequality using two copies of single-photon entangled states, simultaneously verifying their entangled nature without the need for post-selection or local oscillators.

QM3B.7 • 15:30

Experimental Quantum Voting Using Photonic GHZ States, Francis J. Marcellino[1], Towsif Taher[1], Mingsong Wu[1], Tiff Brydges[1], Rob Thew[1]; *[1]Univ. of Geneva, Switzerland.* We implement a recent proposal for a quantum voting scheme (Centrone 2022, Phys. Rev. Appl. 18, 014005), based on photonic GHZ states, that guarantees anonymity for voters and does not require a trusted election authority.

QM3B.8 • 15:45

Experimentally Verifiable Criteria of non-Gaussian Coherences, Ambroise Boyer[1], Beate Asenbeck[1], Lukas Lachman[1,2], Priyanka Giri[1], Albane Lapras[1], Alban Urvoy[1], Radim Filip[2], Julien Laurat[1]; *[1]Laboratoire Kastler Brossel, France; [2]Dept. of Optics,, Palacky Univ.,, Czechia.* We introduce a hierarchical framework using absolute, relative, and qubit-specific thresholds assessing non-Gaussianity and non-classicality in local coherences. We generate high purity superpositions of 1- and 2-photons with vacuum that surpass the specified criteria.

14:00 -- 15:30
Room: Yorkshire B
QM3C • Tutorial: Spin Based QC

QM3C.1 • 14:00 (Tutorial)
Spin Qubits and Their Coupling to Photons, Guido Burkard[1]; *[1]Univ. of Konstanz, Germany.* This tutorial is an introduction to spin qubits in semiconductors. It covers the basic physics of spin qubits, state of the art, recent progress towards high-fidelity quantum operations, coupling to photons, and some remaining obstacles and challenges.

16:30 -- 18:45
Room: Imperial Ballroom
QM4A • Quantum Memories

QM4A.1 • 16:30 (Invited)
Quantum Memory with Rare-Earth Solids, Elizabeth A. Goldschmidt[1]; *[1]Univ of Illinois at Urbana-Champaign, USA.* Rare-earth atoms in solids are a promising platform for quantum memory across a range of applications. I will present recent results showing optical delays and photon manipulation in erbium-doped thin-film lithium niobate.

QM4A.2 • 17:00
Combining a Quantum Cryptographic Protocol with a Highly Efficient Cold-Atom-Based Quantum Memory, Félix Garreau de Loubresse[1], Hadriel Mamann[1], Thomas Nieddu[1], Félix Hoffet[1], Mathieu Bozzio[2], Iordannis Kerenidis[3], Eleni Diamanti[4], Alban Urvoy[1], Julien Laurat[1]; *[1]Laboratoire Kastler Brossel - SU, France; [2]Vienna Center for Quantum Science and Technology, Austria; [3]Univ. of Paris - IRIF, France; [4]LIP6, CNRS, Sorbonne Univ., France.* We report the first demonstration of a quantum cryptographic protocol incorporating a quantum memory layer. The protocol imposes strigent requirements on the memory storage-and-retrieval efficiency and on the error rate of the communication.

QM4A.3 • 17:15
Storage of Qubits in Solid-State Quantum Memory Array, Markus Teller[1], Susana Plascencia[1], Cristina Sastre Jachimska[1], Samuele Grandi[1], Hugues de Riedmatten[1,2]; *[1]ICFO, Spain; [2]ICREA, Spain.* We demonstrate the storage of path and time-bin qubits in solid-state quantum memories. Our system stores up to 250 modes with faint laser pulses and validates

performance using single photons from a nonlinear source.

QM4A.4 • 17:30
Fiber-to-Fiber Loop-Based Quantum Memory for Photonic Polarization Qubits, Sandra W. Cheng[1], Carson Evans[1], Todd Pittman`[1]; [1]*Univ. of Maryland, Baltimore County, USA.* We demonstrate a loop-based quantum memory with single-mode input and output for ultra-broadband polarization qubits. Visibility and fidelity results will be presented for heralded photons with reconfigurable storage times of 36.5 ns and 526 ns.

QM4A.5 • 17:45
Enhancing Quantum Memories With Light-Matter Interference, Ilse Maillette de Buy Wenniger[1], Paul Burdekin[1], Steven Sagona-Stophel[2], Jerzy Szuniewicz[3], Aonan Zhang[1], Sarah Thomas[1], Ian Walmsley[1]; [1]*Imperial College London, UK;* [2]*Okinawa Inst. of Science and Technology, Japan;* [3]*Faculty of Physics, Univ. of Warsaw, Poland.* We experimentally demonstrate a novel route towards efficient quantum memories, leveraging light-matter interference in alkali-based memories. Simulations show that this protocol allows for high efficiencies (> 95%) with broadband operation, while significantly reducing technical overhead.

QM4A.6 • 18:00
Advancements in Erbium-Doped Silica Fibers for Quantum Networks: Ultra-Long Population Storage and Ultra-Narrow Homogeneous Linewidths at Millikelvin Temperatures, Mahdi Bornadel[1], Farhad Rasekh[1], Nasser Gohari Kamel[1], Sara Shafiei Alavijeh[1], Erhan Saglamyurek[1,2], Faezeh Kimiaee Asadi[1], Sourabh Kumar[1], Daniel Oblak[1], Christoph Simon[1]; [1]*Univ. of Calgary, Canada;* [2]*Lawrence Berkeley National Laboratory and Dept. of Physics,, Univ. of California, USA.* We demonstrate ultra-long population storage (~ 9 hours) and ultra-narrow homogeneous linewidths (~ 8 kHz) in erbium-doped silica fibers (EDF) at ~ 7 mK using spectral hole burning and photon-echo techniques. These results establish EDF as a strong candidate for fiber-based quantum memory.

QM4A.7 • 18:15
Unlocking a New Nuclear Spin Memory Resource in $^{171}Yb:YVO_4$, Erin Liu[1], Sophie Hermans[1], Emanuel Green[1], Chun-Ju Wu[1], Andrei Ruskuc[1], Andrei Faraon[1]; [1]*California Inst. of Technology, USA.* We simulate the interactions between the ytterbium qubit and its nearest-neighbor vanadium nuclear spins in $^{171}Yb:YVO_4$. Future control techniques will extend coherence times and introduce a new memory resource for quantum networks.

QM4A.8 • 18:30
Towards Integrated Quantum Interface with Rare-Earth Ion-Doped Thin Films, Lucas Araujo Oliveira Sotero Silva[1], Diana Sung Kim[1], Maria Alejandra Arranz[1], Alexandre Tallaire[1], Philippe Goldner[1], Kamel Bencheikh[2], Alexey Tiranov[1]; [1]*CNRS Chimie ParisTech - PSL, IRCP UMR 82, France;* [2]*Centre de Nanosciences et de Nanotechnologies, CNRS, Université Paris-Saclay, France.* Quantum emitters embedded in photonic circuits are fundamental for for quantum information applications. Here, evanescent coupling between $Yb:Y_2O_3$ thin films and GaInP photonic crystals is explored to achieve high-quality factors and efficient photon collection.

16:30 -- 18:45
Room: Yorkshire A
QM4B • Instrumentation for QUIST

QM4B.1 • 16:30 (Invited)
Newly Developed Hybrid Miniaturized Quantum Light Modules for Mid-Infrared Hyperspectral Imaging and Quantum Optical Coherence Tomography Sensing, Katrin Paschke[1], Gunnar Blume[1], Nils Werner[1], Philipp Hildenstein[1], Alexander Sahm[1], David Feise[1], Felix Mauerhoff[1], Johannes Zender[1], sven Ramelow[2]; *[1]Ferdinand-Braun-Institut (FBH), Germany; [2]Nonlinear Quantum Optics, Humboldt-Universität zu Berlin, Germany.* We introduce compact quantum light modules based on entangled photon pairs, generated through interference in a nonlinear interferometer, enabling access to the mid-IR spectral range while conducting measurements in the NIR. This approach eliminates the need for mid-IR detectors or sources. The modules integrate laser diodes, micro-optical elements, and a nonlinear optical crystal into a small, efficient package, offering new opportunities for mid-IR hyperspectral imaging and quantum sensing.

QM4B.2 • 17:00
Optical Microcavities for Efficient Qubit-Photon Interfaces and Networked Quantum Computing, Ben Walker-Pearl[1], Laiyi Weng[1], Huili Hou[1], Dmitrii Ushmaev[1], Aurélien Trichet[1], Erik Williams[1], Pavel Hilšer[1], Harry Bostock[1]; *[1]Nu Quantum Ltd, UK.* Cavities enable efficient qubit-photon interfaces–a path to scale-out quantum computing cores. Here, we present the performance of our cavity-technology, its suitability to extract NIR-photons from atomic qubits and robust integration into a UHV environment.

QM4B.3 • 17:15
Ultra-Stable Open Micro-Cavity Platform for Closed-Cycle Cryostats, Michael Förg[1], Jonathan Noe[1], Ashly Jose[1], Sambit Mitra[1], Manuel Nutz[1], Kerim Köster[2,3], Andras Lauko[2,3], David Hunger[2,3], Thomas Hümmer[1]; *[1]Qlibri GmbH, Germany; [2]Physikalisches Institut, Karlsruhe Inst. of Technology (KIT), Germany; [3]Inst. for Quantum Materials and Technologies (IQMT), Karlsruhe Inst. of Technology (KIT), Germany.* We present the integration of a fully-tunable, open-access, fiber-based Fabry-Perot micro-cavity platform into the vibrational environments of different closed-cycle cryostats reaching sub-pm mechanical stability. In addition, we show the development of superconducting coils to generate fields up to 150 mT for those cryogenic cavity scenarios.

QM4B.4 • 17:30
Photonic Crystal Cavities in Lithium Niobate With Controllable Coupling, Mattias Rasmussen[1], Homa Zarebidaki[2], Hamed Sattari[2], Amir H. Ghadimi[2], Mujtaba Zahidy[1], Michael Galili[1], Dirk Englund[3], Dashiell L. Vitullo[4], Mikkel Heuck[1]; *[1]Technical Univ. of Denmark, Denmark; [2]Centre Suisse d'Electronique et de Microtechnique, Switzerland; [3]Massachusetts Inst. of Technology, USA; [4]DEVCOM Army Research Laboratory, USA.* We demonstrate photonic crystal cavities in lithium niobate with controllable cavity-waveguide coupling. The quality factor is tunable with a dynamic range > 20 and an intrinsic value of $Q_i = 2.6 \times 10^5$.

QM4B.5 • 17:45

Low Loss Fibre Bragg Grating Filters for Photon Noise Suppression, Benjamin Field[1,2], Chintan Mistry[1], Liguo Luo[3], Goran Edvell[3], Joss Bland-Hawthorn[4,5], Sergio Leon-Saval[4,5], John Bartholomew[1,6]; *[1]Center for Engineered Quantum systems, School of Physics, Univ. of Sydney, Australia; [2]Sydney Quantum Academy, Australia; [3]Advanced Fibre Bragg Grating Facility, Research and Prototype Foundry, Univ. of Sydney, Australia; [4]Sydney Astrophotonic Instrumentation Labs, School of Physics, Univ. of Sydney, Australia; [5]Sydney Inst. for Astronomy, School of Physics, Univ. of Sydney, Australia; [6]Univ. of Sydney Nano Inst., Univ. of Sydney, Australia.* We discuss the use of fibre Bragg grating filters to eliminate the noise associated with a pump signal in single photon experiments. We demonstrate devices with over (127.6±0.3) dB of attenuation and minimal insertion loss.

QM4B.6 • 18:00

Towards the Implementation of a Laser That Surpasses the Standard Quantum Limit for Coherence., Lucas A. Ostrowski[1], Howard Wiseman[1]; *[1]Centre for Quantum Dynamics, Griffith Univ., Australia.* A quantum enhancement exists for the production of coherence by a laser device. We explore recent developments relating to this fundamental result in laser physics, with an emphasis on the prospect for experimental implementation.

QM4B.7 • 18:15

Tuneable Delay-Line Based Optical Memory for Quantum Networks, Yu Guo[1], Anindya Banerji[1], Arya Chowdhury[2,3], Alexander Ling[1,2]; *[1]Centre for Quantum Technologies, National Univ. of Singapore, Singapore; [2]Dept. of Physics, National Univ. of Singapore, Singapore; [3]Thales Research and Technology, Singapore.* We demonstrate a free-space delay-line-based optical memory using nested concave mirrors, enabling a tunable storage time, and low-dispersion broadband operation at room temperature. This compact, high-efficiency design is well suited for scalable quantum networks and communication applications.

QM4B.8 • 18:30

Towards an Integrated Sensor for Optimized OCT With Undetected Photons, Franz Roeder[1], René Pollmann[1], Viktor Quiring[1], Christof Eigner[1], Benjamin Brecht[1], Christine Silberhorn[1]; *[1]Paderborn Univ., Integrated Quantum Optics, Inst. for Photonic Quantum Systems (PhoQS), Germany.* We demonstrate that nonlinear integrated interferometers based on guided-wave PDC processes benefit from implementation in the induced coherence geometry instead of the commonly used SU(1,1) geometry for quantum OCT measurements with undetected photons.

16:30 -- 18:45
Room: Yorkshire B
QM4C • Quanutm Light Sources I

QM4C.2 • 17:00
Tunable Polarization Entanglement From Spontaneous Parametric Down-Conversion in Quasi-Phase-Matched Semiconductors, Benjamin Braun[1,2], Josip Bajo[1,2], Chiara Trovatello[3,4], Giulio Cerullo[3], P. James Schuck[4], Philip Walther[1,5], Lee A. Rozema[1]; *[1]Vienna Center for Quantum Science and Technology (VCQ), Austria; [2]Vienna Doctoral School in Physics (VDSP), Austria; [3]Dipartimento di Fisica, Politecnico di Milano, Italy; [4]Dept. of Mechanical Engineering, Columbia Univ., USA; [5]Research Platform for Testing the Quantum and Gravity Interface (TURIS), Christian Doppler Laboratory for Photonic Quantum Computer, Austria.* We present an ultra-thin source of down-converted photon pairs. These semiconductor-based devices are periodically poled to enhance generation efficiencies, yielding high-fidelity, maximally-entangled, tunable polarization states, without any walk-off compensation or interferometric techniques.

QM4C.3 • 17:15
Advancing Single-Photon Emitters in Silicon Nitride, Alexander Senichev[1], Zachariah O. Martin[1], Pranshu Maan[1], Mustafa G. Ozlu[1], Joel Davidsson[2], Mark K. Svendsen[3], Kristian S. Thygesen[3], Alexei S. Lagutchev[1], Vladimir Shalaev[1], Alexandra Boltasseva[1]; *[1]Purdue Univ., USA; [2]Linköping Univ., Sweden; [3]Technical Univ. of Denmark, Denmark.* We present recent developments on single-photon emitters in silicon nitride, analyzing defect structures through material characterization and computational modeling. Additionally, we demonstrate their fabrication using a foundry-compatible deposition technique, enabling scalability for quantum photonic applications.

QM4C.4 • 17:30
Fully on-Chip Source of Hybrid Polarization and Time-Energy Entangled Photons, Zacharie M. Léger[1], Trevor J. Stirling[1], Meng Lon Iu[1], Amr S. Helmy[1]; *[1]The Edward S. Rogers Sr. Dept. of Electrical & Computer Engineering, Univ. of Toronto, Canada.* We demonstrate the first all-on-chip polarization and time-energy hybrid entangled photon source. This monolithic Bragg reflection laser source has polarization and time-energy visibilities of 95.5% and 86% respectively, with a pair rate of 5.6×10^6 pairs/s.

QM4C.5 • 17:45
Characterization of High-Purity Single Photons From Pulsed SPDC in a Monolithic Cavity, Xavier Barcons Planas[1,2], Helen M. Chrzanowski[1], Janik Wolters[2,3]; *[1]Humboldt-Universität zu Berlin, Germany; [2]German Aerospace Center, Germany; [3]Technische Universität Berlin, Germany.* Scalability in photonic quantum technologies requires the generation of pure single photons with high efficiency. We present a pulsed SPDC photon-pair source within a monolithic crystal cavity for enhanced spectral and spatial purity.

QM4C.6 • 18:00
Enhanced Room-T Single-Photon Emission in SiN With Bullseye Resonant Cavity, Artem Kryvobok[1,2], Yuheng Chen[1,2], Jae-Ik Choi[1,2], Jeffrey Simon[1,2], Benjamin Lawrie[2,3], Vahagn Mkhitaryan[1,2], Demid Sychev[1,2], Alexander Senichev[1,2], Alexander Kildishev[1,2], Alexandra

Boltasseva[1,2], Vladimir Shalaev[1,2]; *[1]Purdue Univ., USA; [2]Quantum Science Center (QSC), USA; [3]Oak Ridge National Laboratory, USA.* We present our recent work on enhancing room-temperature single-photon emitters (SPEs) in silicon nitride (SiN) in a bullseye resonant cavity. Our results demonstrate 3.5× Purcell enhancement in the SPE emission rate and emission directionality improvement.

QM4C.7 • 18:15

An Efficient Walk-Off Compensation Technique for Polarization-Based Entanglement of Highly Nondegenerate Photon Pairs, Sungeun Oh[1], Thomas Jennewein[1,2]; *[1]Univ. of Waterloo, Canada; [2]Physics, Simon Fraser Univ., Canada.* We present an efficient walk-off compensation technique for constructing an optical interferometer that enables polarization-based entanglement of highly nondegenerate photon pairs, relevant for quantum networking scenarios requiring distinct wavelengths for various applications.

QM4C.8 • 18:30

Design of a High Speed Frequency Multiplexed Entangled Photon Source, Benjamin B. Szamosfalvi[1], Jarrett Nelson[1], CJ Xin[2], Leticia Magalhaes[2], Marko Loncar[2], Ryan Camacho[1]; *[1]Electrical and Computer Engineering, Brigham Young Univ., USA; [2]Electrical Engineering, Harvard Univ., USA.* We design a cavity-based frequency-multiplexed photon pair source by combining full-wave photonic simulation with a novel quantum theoretical treatment. Simulation predicts the joint spectral intensity function and pair generation rates greater than 1 GHz/mode.

Optica Quantum 2.0 Conference and Exhibition Session Guide

Disclaimer: this guide is limited to technical program with abstracts and author blocks as of 12 May. For updated and complete information with special events, reference the online schedule or mobile app.

Tuesday, 3 June

08:00 -- 10:30
Room: Imperial Ballroom
QTu1A • Keynote Session II: International Year of Quantum

QTu1A.1 • 08:00 (Plenary)
100 Years of Quantum: the Journey From Great Science to Societal Impact, Peter L. Knight[1]; [1]*Imperial College London, UK.* The United Nations proclaimed 2025 as the International Year of Quantum Science and Technology, recognizing 100 years of development of quantum mechanics. Join us in celebrating how quantum changes our world.

QTu1A.2 • 08:45 (Plenary)
Building Entanglement Distribution Networks, Alexander Ling[1]; [1]*Centre for Quantum Technologies, Singapore.* Entanglement correlations allow distributed quantum systems to be described in the same physical state, and is a resource for many of the technologies that we call Quantum 2.0. What is a practical distance over which we can distribute entanglement? In this session, I will review and discuss the physical layer of the entanglement distribution network, including both ground and space segments.

QTu1A.3 • 09:30 (Plenary)
Title to be Announced, Carmen Palacios-Berraquero[1]; [1]*nu Quantum, UK.* Abstract not available.

11:00 -- 12:30
Room: Imperial Ballroom
QTu2A • Space Quantum Communication

QTu2A.1 • 11:00 (Invited)
Space-Based QKD, Christoph Marquardt[1]; [1]*Friedrich-Alexander-Universität, Germany.* Abstract not available.

QTu2A.2 • 11:30
SEAQUE: UIUC-led Quantum Space Technology Demonstration, Liam M. Ramsey[1], Kelsey Ortiz[1], Spencer J. Johnson[3], Joanna Krynski[2], Rick Eason[1], Nigar Sultana[2], Nouralhoda Bayat[2], Qi Lim[1], Cameron Jones[1], Timur Javid[1], Evan Widloski[1], Matteo Stefanini[1], Josh Aller[4], Bradley Slezak[4], Daniel Suarez[5], Subash Sachidananda[5], Alexander Ling[5], Phil Battle[4], Thomas Jennewein[2], Michael Lembeck[1], Makan Mohageg[6], Paul Kwiat[1]; [1]*Univ. of Illinois Urbana-Champaign, USA;* [2]*Univ. of Waterloo, Canada;* [3]*NASA Jet Propulsion Laboratories, USA;* [4]*AdvR Inc., USA;* [5]*National Univ. of Singapore, Singapore;* [6]*Boeing, USA.* The UIUC-led Space Entanglement and Annealing Quantum Experiment (SEAQUE) advances work in space-based quantum networks, demonstrating operation of a waveguide-based polarization-based

entanglement source and liquid crystal tomography system aboard the ISS.

QTu2A.3 • 11:45
Demonstration of a Reconfigurable Ground to Space Quantum Networking Scheme, Stephane Vinet[1], Thomas Jennewein[1,2]; *[1]Univ. of Waterloo, Canada; [2]Simon Fraser Univ., Canada.* Satellite-based quantum communication suffers from limited availability and important link losses. We demonstrate a simple reconfigurable network architecture dynamically switching between satellite-enabled and ground-based connectivity to optimize entanglement generation rates and the network's functionality.

QTu2A.4 • 12:00
Receiving Polarization-Encoded Quantum Key Distribution Signals From the QUBE-II CubeSat, Michael Steinberger[1,2], Michael Auer[1,2], Adomas Baliuka[1,2], Moritz Birkhold[1,2], Karabee Batta[1,2], Harald Weinfurter[1,2], Lukas Knips[1,3]; *[1]Ludwig Maximilian Univ. of Munich, Germany; [2]Munich Center for Quantum Science and Technology, Germany; [3]Max Planck Inst. of Quantum Optics, Germany.* Quantum Key Distribution (QKD) in space will be integral for future quantum networks. Based upon our pathfinder mission QUBE, the QUBE-II space mission is aiming to demonstrate economic global-scale QKD with an eight-unit CubeSat.

QTu2A.5 • 12:15
Entanglement Swapping for Deployment in Low-Earth Orbit, Jennifer Ellis[1], Danny Kim[1], Sofiane Merkouche[1], Brett Yurash[1], Cameron Taggesell[1], Makan Mohageg[2], Shanying Cui[1]; *[1]HRL Laboratories, LLC, USA; [2]Boeing Company, USA.* An implementation of entanglement swapping is demonstrated on a satellite-ready payload, using low size, weight, and power components that operate over a wide ambient temperature range, and are robust to certain single-point failures.

11:00 -- 12:30
Room: Yorkshire A
QTu2B • Atomic Quantum Computing

QTu2B.1 • 11:00
Portable Room Temperature Trapped ion Quantum Computer, Robert Niffenegger[1]; *[1]Univ. of Massachusetts Amherst, USA.* We present a compact trapped ion quantum computer which uses modular laser sources and optical systems from PyOpticL (an open-source layout library) and which does not use bulk cavities (e.g. ULEs) for laser stabilization for SPAM, dramatically lowering the barrier to entry into the highest fidelity qubit modality, Zeeman trapped ion qubits.

QTu2B.2 • 11:30
Fault-Tolerant Operation and Materials Science With Neutral Atom Logical Qubits, Matt Bedalov[1], Matt Blakely[1], Peter Buttler[1], Caitlin Carnahan[1], Fred Chong[2], Woo Chang Chung[1], Dan Cole[1], Palash Goiporia[1], Pranav Gokhale[1], Bettina Heim[3], Garrett Hickman[1], Eric Jones[1], Ryan Jones[1], Pradnya Khalate[3], Jin-Sung Kim[3], Kevin Kuper[1], Martin Lichtman[1], Stephanie Lee[1], David Mason[1], Nathan Neff-Mallon[1], Thomas Noel[1], Victory Omole[1], Alexander Radnaev[1], Rich Rines[1], Mark Saffman[1], Efrat Shabtai[3], Mariesa Teo[2], Bharath Thotakura[1], Teague

Tomesh[1], Angela Tucker[1]; *[1]Infleqtion, USA; [2]Univ. of Chicago, USA; [3]Nvidia, USA.* We report fault-tolerant operation of logical qubits in a neutral atom quantum computer. We then demonstrate a materials science application based on the Anderson Impurity Model.

QTu2B.3 • 11:45
Using Bosonic Modes for Thermal State Preparation, Anton T. Than[1,2], Yasar Y. Atas[3,4], Abhijit Chakraborty[3,4], Jinglei Zhang[3,4], Matthew Diaz[1,2], Kalea Wen[5,1], Xingxin Liu[1,2], Randy Lewis[6], Alaina Green[1], Christine Muschik[3,4], Norbert Linke[7,1]; *[1]Joint Quantum Inst., USA; [2]Physics, Univ. of Maryland, College Park, USA; [3]Inst. for Quantum Computing, Canada; [4]Physics and Astronomy, Univ. of Waterloo, Canada; [5]College of William and Mary, USA; [6]Physics and Astronomy, York Univ., Canada; [7]Physics, Duke Univ., USA.* We devise a method to prepare thermal states using the bosonic modes of a trapped-ion quantum computer. We use this to perform the first quantum simulation of lattice quantum chromodynamics at finite temperature and density.

QTu2B.4 • 12:00
Sensor State Protection in Λ-Type Atomic Ensemble Quantum Memories, Tegan Loveridge[1,2], Kai Shinbrough[1,2], Virginia O. Lorenz[1,2]; *[1]Dept. of Physics, Univ. of Illinois Urbana-Champaign, USA; [2]IQUIST, Univ. of Illinois Urbana-Champaign, USA.* We simulate Λ-type quantum memory in atomic ensembles with the addition of a high-lying sensor state in the continuous dynamical decoupling regime. We find order-of-magnitudes memory lifetime enhancement and explore the dressing-field parameter space.

QTu2B.5 • 12:15
Symmetric Basis Approach for Exploring Multipartite Dynamics and Correlations in $^{87}\mathrm{Rb}$ Rydberg Atom Arrays, Juyoung Park[1], Minhyuk Kim[2], Jaewook Ahn[1]; *[1]KAIST, Korea (the Republic of); [2]Korea Univ., Korea (the Republic of).* We propose symmetric basis framework for analyzing correlations in multipartite quantum systems. Using bilayer system of 13 $^{87}\mathrm{Rb}$ atoms, we measure mutual information up to $\log_2 3$, demonstrating its effectiveness in analyzing quantum correlations.

11:00 -- 12:00
Room: Yorkshire B
QTu2C • Tutorial: Towards A Global Quantum Network

QTu2C.1 • 11:00 (Tutorial)
Quantum Networking and the Future Quantum Internet, William Munro[1]; *[1]Okinawa Inst of Science & Technology, Japan.* This tutorial examines the foundational concepts and challenges of building scalable quantum communication networks, emphasizing their distinctions from classical systems and the essential technologies needed to realize a functional quantum internet.

14:00 -- 16:00
Room: Exhibits Poster Area
QTu3A • Poster Session I

QTu3A.1
Study of Yb Plasma by Magnetic Field-Assisted LIBS, Jamil ur Rahman[1,2]; *[1]QAU, Pakistan; [2]Physics, Hazara Univ., Pakistan.* Study of Yb plasma by magnetic field-assisted laser-induced breakdown spectroscopy (LIBS).

QTu3A.2
Single-Stage Fiber Amplifiers Achieving Linewidths at the Tens-of-kHz Scale for Quantum and Semiconductor Applications, Enkeleda Balliu[2], Amanda Faltyn[1], Trevor Tumiel[1]; *[1]HUBNER Photonics, USA; [2]Cobolt AB, Sweden.* Ampheia fiber amplifiers deliver 532 nm at 5 W and 1064 nm at 50 W with low RIN. Experiments show single-stage amplifiers achieving tens-of-kHz linewidths, advancing precision applications in quantum technologies with improved stability.

QTu3A.3
Withdrawn

QTu3A.4
Nonlocal Metasurface Coupled to a Single Photon Emitter for on-Chip Applications, Amitrajit Nag[1], Girish S. Agarwal[2], Jaydeep K. Basu[1]; *[1]Indian Inst. of Science, India; [2]Physics and Astronomy, Texas A&M Univ., USA.* Single photon emitters coupled to nonlocal metasurfaces are advantageous for integrated photonics. We report on the near-field coupling of single emitters to the all-dielectric metasurface waveguide that amplifies the single photon emission and improves on-chip applications.

QTu3A.5
Advancing Quantum Applications With OAM-Dependent Phase Control in Photonic Waveguides, José V. Moura[1], Laura Santos[1], Jonathas M. Oliveira[2], José Rocha[3,4], Alcenisio J. Silva[1], Eduardo J. Fonseca[1]; *[1]Inst. of Physics, Federal Univ. of Alagoas, Brazil; [2]Campus Rio Largo, Federal Inst. of Alagoas, Brazil; [3]Dept. of Physics and Astronomy, Univ. of Exeter, UK; [4]School of Information Technology and Electrical Engineering, The Univ. of Queensland, Australia.* This paper explores how waveguides supporting orbital angular momentum (OAM) can produce an OAM-dependent phase. These insights highlight the role of structured light and waveguide design in applications using photonic chips supporting OAM.

QTu3A.6
Withdrawn

QTu3A.7
Path Towards Single Photon Detection at the mid-Infrared Wavelenghts at Room Temperature, Pierfrancesco Ulpiani[1], Daniele Palaferri[2], Lorenzo Mancini[2], Massimiliano Proietti[1], Carlo Liorni[1], Francesco Cappelli[3], Simone Borri[3], Massimiliano Dispenza[1], Paolo De Natale[3], Chiara Vecchi[2], Leonardo Daga[2]; *[1]Leonardo SpA, Italy; [2]GEM Elettronica, Italy; [3]CNR-*

INO, Italy. Single Photon Detection is an enabling technology for several quantum applications. Room-temperature solutions for mid-wave infrared does not exist, in the present work a near-single photon detection scheme at room temperature is presented.

QTu3A.8
Efficient Preparation of Molecular Ground States on Quantum Computers With Givens Rotations, Nirmal M R[1], Ankit Khandelwal[1], Manoj Nambiar[1], Sharma S. R. K. C. Yamijala[2]; [1]*Tata Consultancy Services Limited, India;* [2]*Dept. of Chemistry, Indian Inst. of Technology Madras, India.* We propose a method to build efficient quantum circuits for molecular electronic structure calculations. The approach uses quantum gates based on Givens rotations, achieving more than 60% reduction in circuit-depth while retaining highly accurate energies.

QTu3A.9
Withdrawn

QTu3A.10
A Unified Framework of Parameter-Shift Rule Based on Heisenberg Picture, Hironari Nagayoshi[1], Warit Asavanant[1,2], Ryuhoh Ide[1], Akira Furusawa[1,2]; [1]*Dept. of Applied Physics, School of Engineering, The Univ. of Tokyo, Japan;* [2]*OptQC Corp., Japan.* We propose a framework of parameter-shift rule for variational quantum algorithms that provides a unified description of previous extensions, together with unexplored use cases such as adaptive circuits, quantum state engineering, and CV-DV hybrid systems.

QTu3A.11
Post-Selection-Free 4D Quantum Fourier Transform, SRINIVASU SAPIREDDY[1], Harshawardhan Wanare[2,1]; [1]*Photonics Science and Engineering, IIT Kanpur, India;* [2]*Physics, IIT Kanpur, India.* We propose a 4D Quantum Fourier Transform using azimuthally structured anisotropic electro-optic modulators for hyper entangled single photon in the OAM-polarization basis, without any intermediate measurements, thus enabling integrable, high-speed, and high-dimensional photonic quantum operations.

QTu3A.12
Jordan-Schwinger Phase-Space Approach to Self-Induced Transparency Solitons, Mojdeh Shikhali Najafabadi[1], Joel corney[3], Luis L. Sánchez-Soto[1,4], Gerd Leuchs[1,2]; [1]*Max Planck Inst. for the sceince of, Germany;* [2]*Friedrich-Alexander-Universit\"{a}t Erlangen-N\"{u}rnberg, Germany;* [3]*School of Mathematics and Physics, Univ. of Queensland, Brisbane, Queensland 4072, Australia, Australia;* [4]*Departamento de \'Optica, Facultad de F\'{\i}sica, Universidad Complutense, 28040~Madrid, Spain, Spain.* We develop a numerical method for simulating self-induced transparency solitons in open quantum systems using the Schwinger boson representation, positive P, and truncated Wigner approximations. Benchmarking against positive P helps assessing the accuracy limits of truncated Wigner.

QTu3A.13
All-Optical Gottesman-Kitaev-Preskill Qubit Generation via Approximate Squeezed Coherent State Superposition Breeding, Andrew Pizzimenti[1], Daniel Soh[1]; [1]*Univ. of Arizona, USA.* We demonstrate that by breeding approximate squeezed coherent state superpositions,

Gottesman-Kitaev-Preskill qubits can be generated all-optically with success probabilities two orders of magnitude greater than photon number resolving measurement based methods.

QTu3A.14
Experimental Verification of Entanglement Witness of Dicke State on IBM QPU, Tomis Tomis[1], Harsh Mehta[1], V. Narayanan[1]; *[1]IIT JODHPUR, India.* An entanglement witness is necessary to characterize genuine multipartite entangled states. We theoretically derive the entanglement witness for the four-qubit Dicke state. A negative expectation value confirms genuine multipartite entanglement. Our witness was experimentally verified on IBM QPU, with and without error mitigation techniques.

QTu3A.15
Bosonic Noise Mitigation and Suppression Using Linear Optics, Yong Siah Teo[1], Saurabh U. Shringarpure[1], Sungjoo Cho[1], Hyunseok Jeong[1]; *[1]NextQuantum and Seoul National Univ., Korea (the Republic of).* Probabilistic linear-optical methods mitigate thermal and random-displacement noise in estimators of observable expectation values and suppress dephasing noise in unmeasured states (Teo *et al*., arXiv:2411.11313, 2024). Combinations address noise compositions during idling and gates.

QTu3A.16
Mid-Infrared Silicon Photonics for Selenium Quantum Defects, Yunzhao Wang[1], Shuyun Liu[1], Nicholas Yama[1], Lasse Vines[2], Jeff Young[3], Kai-Mei Fu[1,4]; *[1]Univ. of Washington, USA; [2]Univ. of Oslo, Norway; [3]Univ. of British Columbia, Canada; [4]PNNL, USA.* We develop and test a silicon photonics platform at 2.9 µdesigned for optimal coupling to selenium donors in the 500 nm device layer, and present progress toward high (> 10) cooperativity devices.

QTu3A.17
Demonstration of a Compiled Version of Shor's Algorithm Using Frequency and Time Single-Photon Qudits, Jinwon Yoo[1], Nicola Montaut[1], Matteo Piccolini[1,2], Stefania Sciara[1], Rosario Lo Franco[2], Roberto Morandotti[1]; *[1]Institut National de la Recherche Scientifique, Canada; [2]Università degli Studi di Palermo, Italy.* We present a resource-efficient compiled version of Shor's algorithm by employing frequency and time qudits within a single photon and utilizing fiber-optic devices. Our results demonstrate successful factorization of the number 15 with high fidelity.

QTu3A.18
Quantum Double Blind Zero-Knowledge Shared Authentication Based on the GHZ Game, Thomas H. Yang[1], Weiguo Yang[2]; *[1]Adura Inc, USA; [2]School of Engineering and Technology, Western Carolina Univ., USA.* We conceptualize a multi-party shared authentication system built from a triplet entangled Greenberger-Horne-Zeilinger (GHZ) state with a quantum circuit implementation and simulation in the IBM Quantum Platform.

QTu3A.19
Withdrawn

QTu3A.20
Withdrawn

QTu3A.21
Withdrawn

QTu3A.22
Quantum Autoencoder-Driven Hamiltonian Reduction for VQE Applications, Ankit Khandelwal[1], Nirmal M. R[1], M Girish Chandra[1]; *[1]Tata Consultancy Services, India.* We propose a quantum machine learning-based method to compress molecular Hamiltonians and efficiently compute ground-state energies (GSEs) using the variational quantum eigensolver (VQE), significantly reducing resource requirements.

QTu3A.23
Single-Qudit-Based Variational Quantum Eigensolver Using Orbital Angular Momentum States, Hyang-Tag Lim[1,2], Kang-Min Hu[1,2], Byungjoo Kim[3], Myung-Hyun Sohn[4], Yosep Kim[5], Yong-Su Kim[1], Seung-Woo Lee[1]; *[1]Center for Quantum Techonology, Korea Inst. of Science and Technology, Korea (the Republic of); [2]Quantum Information, Korea Univ. of Science and Technology, KIST school, Korea (the Republic of); [3]Dept. of Laser & Electron Beam Technologies, Korea Inst. of Machinery and Materials, Korea (the Republic of); [4]Dept. of Applied Physics, Kyung Hee Univ., Korea (the Republic of); [5]Dept. of Physics, Korea Univ., Korea (the Republic of).* Variational quantum eigensolver (VQE) is a promising candidate to solve eigenvalue problems. However, quantum resources increase substantially for complex problems in conventional multi-qubit VQE. We propose more resource-efficient qudit-based VQE using orbital angular momentum states.

QTu3A.24
Withdrawn

QTu3A.25
Stochastic Quasi-Gradients for Training Variational Quantum Circuits Without Backprop, Ethan N. Evans[1], Zachary P. Bradshaw[1], Matthew Cook[1], Margarite L. LaBorde[1]; *[1]Naval Surface Warfare Center Panama City, USA.* We present a quasi-first order optimization method for training variational quantum circuits based on a stochastic approximation. We demonstrate backpropagation-free optimization of VQCs in simulation by parallel sampling of arbitrary exponential distributions.

QTu3A.26
Withdrawn

QTu3A.27
Optimizing Higher-Order Photon Correlation Using Machine Learning for Novel Sensing Technology, Yasmin Sarhan[1], Umadini D. Ranasinghe[1], Abigail L. Stressinger[1], Guangpeng Xu[1], James Berry[1], Tim Thomay[1]; *[1]State Univ. of New York at Buffalo, USA.* A novel technique harnessing higher-order photon correlation data for sensing applications is optimized using a machine learning model. We present two applications: Higher-order photon state classification

and quantum fingerprinting for plant growth optimization.

QTu3A.28
Utilizing Quantum Fingerprints in Plant Cells to Optimize Growth Conditions, Umadini D. Ranasinghe[1], Abigail L. Stressinger[2], Guangpeng Xu[1], Yasmin Sarhan[1], James Berry[2], Tim Thomay[1]; *[1]Physics, SUNY at Buffalo, USA; [2]Biology, SUNY at Buffalo, USA.* We developed a quantum fingerprint for plants using higher order photon correlation based on quantum light emitters. Overcoming classical limitations, this approach allows us to classify leaves as healthy or unhealthy enabling optimized plant growth.

QTu3A.29
Nonlinear SU(1,1) Interferometers With an on-Chip Parametric Amplifier, Yue Li[1], Xiaotian Zhu[1], Jianmin Wang[1], E. Y. B. Pun[1], Sai Tak Chu[1], Zhe-Yu J. Ou[1]; *[1]City Univ. of Hong Kong, Hong Kong.* We report an SU(1,1) interferometers in passive and active modes, realized in a micro-ring made of high-index silica glass. Phase-dependent fringes and quantum noise reduction are observed for potential applications in on-chip precision phase sensing.

QTu3A.30
Mode-Selective low-Noise up-Conversion of Light With an all-Telecom Quantum Pulse Gate, Ankita Khanda[2,1], Laura Serino[2,1], Christof Eigner[1], Michael Stefszky[2,1], Benjamin Brecht[2,1], Christine Silberhorn[2,1]; *[1]Inst. for Photonic Quantum Systems (PhoQS), Paderborn Univ., Germany; [2]Integrated Quantum Optics, Dept. of Physics, Paderborn Univ., Germany.* Coherent time-frequency filtering is the optimal noise rejection solution for single-photon free-space telecom applications. We present a high efficiency all-telecom implementation of the quantum pulse gate operating via temporal mode-selective frequency conversion in $LiNbO_3$ waveguides.

QTu3A.31
Quantum-Optimal Frequency Estimation of Stochastic AC Fields, Anirban Dey[1], Cosmo Lupo[2], Sara Mouradian[3], Zixin Huang[1]; *[1]Macquarie Univ., Australia; [2]Politecnico di Bari, Italy; [3]Univ. of Washington, USA.* We frame the problem of frequency measurement as the estimation of a correlated dephasing quantum channel.
We determine the ultimate quantum limits in AC magnetic sensing by finding the exact upper bounds for estimating frequency and frequency differences of stochastic fields.

QTu3A.32
Two-Photon Interference and Linear Quantum Erasers: Achieving Sub-Attosecond Uncertainty in the Low Photons Regime, Fabrizio Sgobba[1,2], Francesco Maria Di Lena[1], Andrea Andrisani[1], Luigi Santamaria[1]; *[1]Centro Geodesia Spaziale, Agenzia Spaziale Italiana, Italy; [2]Istituto Nazionale di Ottica (INO), Consiglio Nazionale delle Ricerche (CNR), Italy.* Recent applications of estimation theory to Hong-Ou-Mandel interferometry led to remarkable results from precision metrology to biological samples tomography. Here is presented a temporal quantum eraser capable of sub-attosecond uncertainties. Akn.: Prin QUEXO (Quantum Exoplanets).

QTu3A.33
Quantum-Inspired Multispectral LiDAR Using Wavelength-to-Time Mapping, Autumn R. Landwehr[1], Markus Allgaier[1]; *[1]Univ. of North Dakota, USA.* Parallel range measurements using several wavelengths are resource intensive if multiple detectors are required. We explore a scheme that uses one detector and dispersive fiber spectroscopy known from quantum optics, and explore its applicability to LiDAR.

QTu3A.35
Towards Hybrid Quantum Repeaters With O-Band Quantum Dots and Alkali Vapors, Joanna Zajac[1], Andreas Pfenning[2], Tobias Huber-Loyola[2], Sven Höfling[2]; *[1]Brookhaven National Laboratory, USA; [2]Lehrstuhl für Technische Physik, Julius-Maximilians-Univ. of Würzburg, Germany.* We are going to discuss recent progress towards development of telecom QDs sources working in O-band and results on modelling of hybrid systems consisting of these QDs and Rb room temperature vapors

QTu3A.35
Efficient Broadband Antennas for a Quantum Emitter Working at Telecommunication Wavelengths, Joanna Zajac[1]; *[1]Brookhaven National Laboratory, USA.* In this contribution, we propose and model a broadband optical antenna working in O-band designed for III-V QDs. They exhibits high extraction efficiencies with small Purcell enhancement and Gaussian mode profile.

QTu3A.36
Optical Spectroscopy of $^{171}Yb^{3+}$ Ions in a Scheelite Crystal, Emanuel Green[1], Sophie Hermans[1], Erin Liu[1], Alexey Tiranov[2], Pascal Loiseau[2], Philippe Goldner[2], Andrei Faraon[1]; *[1]Caltech, USA; [2]Institut de Recherche de Chimie Paris, France.* We perform optical spectroscopy on $^{171}Yb^{3+}$ rare-earth ions doped in $CaWO_4$. We characterize the temperature dependent lifetime and the magnetic field dependence of the transitions.

QTu3A.37
Active Polarization Control Using Classical Headers in Quantum Wrapper Networks, Gamze Gul[1], James van Howe[2], Shannon G. Tan[1], Mehmet B. On[3], Roberto Proietti[4], Gregory S. Kanter[1], S. J. Ben Yoo[3], Prem Kumar[1]; *[1]Northwestern Univ., USA; [2]Augustana College, USA; [3]Univ. of California, Davis, USA; [4]Politecnico di Torino, Italy.* We demonstrate automated polarization compensation of quantum datagrams leveraging classical headers as a polarization probe, thereby advancing the functionality of quantum wrapper networking. We furthermore observe minimal performance degradation from Raman scattering noise.

16:00 -- 18:00
Room: Imperial Ballroom
QTu4A • Photonic Quantum Processing

QTu4A.1 • 16:00
CNOT Gate Operation and Bell State Generation Using Single Photons Emitted From Spatially Ordered Large Volume Quantum Dot , Qi Huang[1], Lucas Jordao[1], Swarnabha Chattaraj[1], Jiefei Zhang[1], Siyuan Lu[1], Anupam Madhukar[1]; *[1]Univ. of Southern California, USA.* High fidelity CNOT gate operation and Bell state generation is demonstrated using highly pure and indistinguishable single photons from spatially-ordered mesa-top quantum dots with controlled shape and large volume, opening pathways to quantum photonic circuits.

QTu4A.2 • 16:30
Chip-Based Photon Addition, Kristina Malinowski[1], Aswini Pattanayak[2], Amir Targholizadeh[2], Jagi Rout[2], Holland Frieling[1], Benjamin E. Koltenbah[3], Pankaj Jha[2], Harry A. Atwater[1]; *[1]Caltech, USA; [2]Syracuse Univ., USA; [3]Boeing Company, USA.* We report the design of chip-based building blocks for a photon addition module where one or more photons are coherently added via stimulated emission to a weak source light signal to enhance the signal-to-noise ratio.

QTu4A.3 • 16:45
Efficient Distillation of Indistinguishable Photons, Jason Saied[1], Jeffrey Marshall[1,3], Namit Anand[1,2], Eleanor G. Rieffel[1]; *[1]NASA Ames Research Center, USA; [2]KBR, Inc., USA; [3]USRA Research Inst. for Advanced Computer Science (RIACS), USA.* We introduce state-of-the-art protocols to distill indistinguishable photons, reducing error rates by a factor of n, using only O(n) photons. We discuss the protocols, resource requirements, and applications to fault-tolerant quantum computation.

QTu4A.4 • 17:00
Towards Cluster State Generation With Spatial Modes, Zacharie M. Léger[1], Daida Thomas[2], Saesun Kim[2], Matthew A. Feldman[1], Alberto Marino[1,2]; *[1]Oak Ridge National Laboratory, USA; [2]Homer L. Dodge Dept. of Physics and Astronomy, Univ. of Oklahoma, USA.* We leverage spatial modes to generate multipartite entangled states in a cross-coupled SU(1,1) interferometer with intensity-difference squeezing of 4.2 dB. Theoretical analysis shows that the generated state can be converted to a cluster state.

QTu4A.5 • 17:15
Image Recognition Powered by Photonic Reservoir Computation, William Munro[1], Akitada Sakurai[1], Aoi Hayashi[1], Hon Wai Lau[1], Kae Nemoto[1]; *[1]Okinawa Inst of Science & Technology, Japan.* Boson sampling has demonstrated quantum advantage yet struggled to find real world practical applications. We show these processors generate the complex dynamics necessary to power quantum reservoir computing and utilize it for various image recognition and classification tasks.

QTu4A.6 • 17:30
Silicon Photonics Variational Quantum Circuits Leveraging Integrated Entangled Photon Sources, Alessio Baldazzi[1], Matteo Sanna[2,1], Stefano Azzini[1], Lorenzo Pavesi[1]; *[1]Univ. of*

Trento, Italy; [2]Rotonium, Italy. Using four path-encoded photonic qubits, multidimensional entangled states are prepared to solve for the ground state energy of the Hydrogen molecule with 3 mHa accuracy and correctly factorize a chosen semi-prime number.

QTu4A.7 • 17:45
Complexity From Genuine non-Gaussian Entanglement: Quantum Correlations Beyond Hong-Ou-Mandel, Xiaobin Zhao[1], Pengcheng Liao[1], Quntao Zhuang[1]; *[1]Univ. of Southern California, USA.* Quantum state tomography requires exponential copies due to complex correlations. Generalizing the Hong-Ou-Mandel effect, we establish a resource theory for non-Gaussian entanglement, showing polynomial scaling for learning free states and exponential scaling for resource states.

16:00 -- 18:00
Room: Yorkshire A
QTu4B • Spin Photon Interfaces

QTu4B.1 • 16:00 (Invited)
Enabling Long-Distance Quantum Interconnect With Epitaxial Erbium Qubits and Spin-Photon Interfaces, Tian Zhong[1]; *[1]Univ. of Chicago, USA.* We demonstrate dual erbium telecom spin-photon interfaces in two lattice symmetry sites in an epitaxial thin-film. We achieve kilohertz optical dephasing rate and millisecond spin coherence times, suitable for long-distance quantum network.

QTu4B.2 • 16:30
Scalable Integration and Control of Diamond Color Centers in a Piezoelectric Photonic Platform, Genevieve Clark[1,2], Matt Saha[1], Alex Witte[1], Matthew Zimmermann[1], Kevin Palm[1,2], Andrew Leenheer[3], Gerald Gilbert[1], Matt Eichenfield[3,4], Dirk Englund[2]; *[1]MITRE Corp, USA; [2]Massachusetts Inst. of Technology, USA; [3]Sandia National Laboratory, USA; [4]Univ. of Arizona, USA.* We demonstrate optical and strain control of diamond color centers in a fully integrated and packaged photonic chip, as well as strategies for scaling beyond single-chip systems.

QTu4B.3 • 16:45
Coherent Acoustic Control of Tin-Vacancy Spins in a Nanophotonic Quantum Node, David A. Golter[1], Genevieve Clark[1,2], Kevin Palm[1,2], Andrew Greenspon[1,2], William Yzaguirre[1], Andrew Leenheer[3], Matt Eichenfield[4,3], Gerald Gilbert[1], Dirk Englund[2]; *[1]MITRE Corp, USA; [2]Massachusetts Inst. of Technology, USA; [3]Sandia National Laboratories, USA; [4]Univ. of Arizona, USA.* We demonstrate high-fidelity acoustic spin control of diamond tin-vacancy qubits in an integrated nanophotonic device, along with magnetic field optimized spin-phonon coupling and single-shot spin readout.

QTu4B.4 • 17:00
Hole *g*-Factor Anisotropy Impacts Spin-Photon Entanglement in InGaAs Quantum Dots, Prashant Ramesh[1,2], Emilio Annoni[3], Nico Margaria[3], Dario Fioretto[1,3], Anton Pishchagin[3], Martina Morassi[1], Aristide Lemaître[1], Matthew Doty[2], Pascale Senellart[1], Loïc Lanco[1,4], Nadia

Belabas[1], Stephen Wein[3], Olivier Krebs[1]; *[1]C2N-CNRS, France; [2]Univ. of Delaware, USA; [3]Quandela, France; [4]Université Paris Cité, France.* We probe the origin of hole *g*-factor anisotropy in InGaAs QDs, using photoluminescence measurements to construct a spin Hamiltonian model, then use this model to simulate the impact of the anisotropy on spin-photon entanglement generation.

QTu4B.5 • 17:15
Cavity-Assisted Single-Shot T Center Spin Readout, Yu En Wong[1], Qiyang Huang[1], Adam Johnston[1], Songtao Chen[1]; *[1]Rice Univ., USA.* We present a theoretical framework describing strategies for single-shot electron spin readout for a cavity-coupled single T center. By solving Lindblad master equation, we investigate the optimal readout fidelity utilizing spin-dependent fluorescence and cavity reflection.

QTu4B.6 • 17:30
Ferroelectric Effect in Thin-Film Strontium Titanate, Kamal Brahim[1,2], Andries Boelens[1,3], Anja Ulrich[1,4], Nina Zdravkovic[1,5], Michiel Debaets[1,4], Conglin Sun[1,6], Yishu Huang[1,4], Sandeep Saseendran[1], Kasper Van Gasse[7], Bart Kuyken[7], Kristiaan De Greve[1,2], Clement Merkling[1,3], Christian Haffner[1]; *[1]InterUniv. Microelectronics Centre (imec), Belgium; [2]Dept. of Electrical Engineering (ESAT), KU Leuven, Belgium; [3]Dept. of Materials Engineering (MTM), KU Leuven, Belgium; [4]Dept. of Information Technology (INTEC), Ghent Univ., Belgium; [5]School of Electrical Engineering, Univ. of Belgrade, Serbia; [6]Dept. of Physics and Astronomy, KU Leuven, Belgium; [7]Ghent Univ., Belgium.* We show that thin-film strontium titanate can exhibit a high gigahertz permittivity and ferroelectricity at cryogenic temperatures. The symmetry breaking due to ferroelectricity results in a Pockels coefficient that surpasses that of lithium.

QTu4B.7 • 17:45
Large-Range Optical Resonant Frequency Tuning and Stabilization of Diamond Tin-Vacancy Centers, Julia M. Brevoord[1], Leonardo G. Wienhoven[1], Nina Codreanu[1], Tetsuro Ishiguro[1,2], Elvis van Leeuwen[1], Mariagrazia Iuliano[1], Lorenzo DeSantis[1], Christopher Waas[1], Hans K. Beukers[1], Tim Turan[1], Carlos Errando-Herranz[1], Kenichi Kawaguchi[2], Ronald Hanson[1]; *[1]Technical Univ. of Delft, Netherlands; [2]Quantum Laboratory, Fujitsu Limited, Japan.* We demonstrate large-range tuning of the optical transition of Tin-Vacancies (SnV) in diamond using electro-mechanical-induced strain, realizing >40 GHz tuning. We employ real-time feedback on the strain environment to stabilize the resonant frequency.

16:00 -- 18:15
Room: Yorkshire B
QTu4C • Quantum Imaging

QTu4C.1 • 16:00 (Invited)
Quantum Enhancement for Stimulated Raman Scattering Microscopy, Yasuyuki Ozeki[1]; [1]*Univ. of Tokyo, Japan.* Abstract not available.

QTu4C.2 • 16:30
Hyperspectral mid-IR Quantum Imaging for Label-Free Classification, Marlon Placke[1], Chiara Lindner[2], Felix Mann[1], Inna Kviatkovsky[1], Helen M. Chrzanowski[1], Frank Kühnemann[2,3], Sven Ramelow[1]; [1]*Humboldt Universität zu Berlin, Germany;* [2]*Fraunhofer-Institut für Physikalische Messtechnik IPM, Germany;* [3]*Physikalisches Institut, Universität Freiburg, Germany.* Nonlinear interferometry based on correlated photons (SPDC) allows mid-infrared measurements with silicon-based low-noise detection. Combining quantum imaging techniques and Fourier-transform analysis, we demonstrate mid-IR hyperspectral imaging for label-free classification of bio-tissue and microplastics samples.

QTu4C.3 • 16:45
Light-Field Microscope Using Entangled Photons, Yingwen Zhang[1,2], Duncan England[2], Antony Orth[2], Ebrahim Karimi[1,2], Benjamin Sussman[2,1]; [1]*Univ. of Ottawa, Canada;* [2]*National Research Council Canada, Canada.* We demonstrate a quantum light-field microscope (LFM) that utilizes position-momentum entangled photons to simultaneously capture both their position and momentum information. We demonstrate 3D microscopy that has a resolving power of 5µm while maintaining a depth of field of 500µm, approximately 3 times of the best classical LFM designs.

QTu4C.4 • 17:00
Spin Squeezing in Electron Microscopy, Shiran Even-Haim[1], Ethan Nussinson[1], Roni Ben-Maimon[2], Alexey Gorlach[1], Ron Ruimy[1], Ephraim Shahmoon[2], Osip Schwartz[2], Ido Kaminer[1]; [1]*Technion, Israel;* [2]*Weizmann, Israel.* We propose the concept of spin squeezing for electron interferometry, which offers a robust pathway toward quantum metrology in electron microscopy, promising to overcome the signal-to-noise ratio limit imposed by the electron-induced sample damage.

QTu4C.5 • 17:15
Quantum Ghost Imaging of Remote Targets With a SPAD Camera, Massimiliano Proietti[1], Alessia Suprano[1], Francesco Poggiali[1], Ugo Zanforlin[1], Chiara Michelini[1], Carsten Pitsch[2], Dominik Walter[2], Benjamin Guery[2], Henri Haka[3], Federica A. Villa[3], Alberto Tosi[3], Massimiliano Dispenza[1]; [1]*Leonardo SpA, Italy;* [2]*IOSB, Fraunhofer, Germany;* [3]*Polimi, Italy.* Quantum Ghost Imaging exploits entangled photons to image a target. Standard approaches require to know the target's distance a priori, making it unpractical. We exploit a novel SPAD camera, to surpass such limitation.

QTu4C.6 • 17:30

Quantum Ghost Imaging for Live Bioimaging, Duncan P. Ryan[1], Kati Seitz[1], Demosthenes Morales[1], Paul Mos[2], Yang Lin[2], Claudio Bruschini[2], Edoardo Charbon[2], James Werner[1]; [1]*Center for Integrated Nanotechnologies, Los Alamos National Laboratory, USA;* [2]*Advanced Quantum Architecture Laboratory, Ecole polytechnique federale de Lausanne, Switzerland.* We demonstrate quantum ghost imaging in two important applications for bioimaging: (1) as a method to visualize low transparency plants and (2) to obtain live imaging with 1 Hz frame rates.

QTu4C.7 • 17:45

Noise-Immune Quantum Imaging with Undetected Photons, Chandler R. Tarrant[1], Mayukh Lahiri[1]; [1]*Oklahoma State Univ., USA.* We present a quantum imaging technique that (1) can acquire phase images when standard interferometry-based imaging techniques fail due to uncontrollable, random phase fluctuations, and (2) does not require detecting the photons probing the object.

Optica Quantum 2.0 Conference and Exhibition Session Guide

Disclaimer: this guide is limited to technical program with abstracts and author blocks as of 12 May. For updated and complete information with special events, reference the online schedule or mobile app.

Wednesday, 4 June

08:00 -- 10:30
Room: Imperial Ballroom
QW1A • Keynote Session III: Jeff Kimble Memorial Session

QW1A.1 • 08:00 (Invited)
The Night We Squeezed Light, Ling-An Wu[1]; *[1]Inst. of Physics, Chinese Academy of Sciences, China.* A brief account will be given of the night that Jeff Kimble's lab first observed squeezed light from an optical parametric oscillator, which later became a major source for the generation of nonclassical light.

QW1A.2 • 08:30 (Invited)
Macroscopic Objects in a Quantum Regime: a Journey Launched With Jeff Kimble, Eugene S. Polzik[1]; *[1]Kobenhavns Universitet, Denmark.* Starting from probing atomic ensembles with nonclassical light at Kimble's lab in 1990s, this research field produced quantum entanglement and teleportation of macroscopic objects and sensing of fields and forces beyond standard quantum limits.

QW1A.3 • 09:00 (Invited)
Nonclassical Light – Getting More Out of a Single Atom, Andrew Scott Parkins[1,2]; *[1]Dodd-Walls Centre for Photonic and Quantum Technologies, New Zealand; [2]Dept. of Physics, Univ. of Auckland, New Zealand.* I describe novel proposals for the generation of a variety of different, topical forms of nonclassical light in the emission of a single atom, each taking some inspiration from pioneering work of Jeff Kimble.

QW1A.4 • 09:30 (Invited)
Title to be Announced, Hood D. Jonathan[1]; *[1]Purdue Univ., USA.* Abstract not available.

QW1A.5 • 10:00 (Invited)
Title to be Announced, Gerhard Rempe[1]; *[1]Max-Planck-Institut für Quantenoptik, Germany.* Abstract not available.

11:00 -- 13:00
Room: Imperial Ballroom
QW2A • Quantum & AI

QW2A.1 • 11:00 (Invited)
Title to be Announced, Vladimir Manucharyan[1]; *[1]École Polytechnique Fédérale de Lausanne, Switzerland.* Abstract not available.

QW2A.2 • 11:30
A Quantum Computing Benchmark Based on Circuit Features, Xingxin Liu[1], Timothy Proctor[2], Alaina Green[1], Norbert Linke[4,3]; *[1]Univ. of Maryland College Park, USA; [2]Quantum Performance Laboratory, Sandia National Laboratories, USA; [3]Physics, Duke Univ., USA; [4]The National Quantum Laboratory (QLab), Univ. of Maryland, USA.* We propose a quantum computing benchmarking protocol based on multiple circuit features, demonstrated on IBM and IonQ systems, which outperforms traditional volumetric benchmarking by more accurately predicting hardware performance.

QW2A.3 • 11:45
A Unified Quantum Modeling Approach for Superconducting Parametric Amplifiers, Yongjie Yuan[1], Özüm E. Asirim[1], Michael Haider[1], Christian Jirauschek[1]; *[1]Technical Univ. of Munich, Germany.* We present a unified theoretical framework for the modeling of superconducting quantum amplifiers. This enables a systematic evaluation of the amplifier performance across various architectures, offering a versatile design and optimization tool for quantum-limited amplifiers.

QW2A.4 • 12:00
Toward Implementation of Quantum-Secure Multiparty Deep Learning, Kfir Sulimany[1], Sivan Trajtenberg-Mills[1], Ryan Hamerly[1,2], Dirk Englund[1]; *[1]MIT, USA; [2]Physics \& Informatics Laboratories, NTT Research, USA.* Quantum-secure depp learning guarantees data security during distributed machine learning computations. We propose an architecture employing spectral filtering and homodyne detection for scalable, secure, cloud-based deep learning in optical networks.

QW2A.5 • 12:15
Quantum Advantage in Phase Unitary Learning With a Continuous-Variable Quantum Compiler, Matthew A. Feldman[1,2], Tyler Volkoff[3], Zoe Holmes[4], Seongjin Hong[2], Claire Marvinney[1,2], Raphael Pooser[1,2], Andrew Sornborger[5,2], Alberto Marino[1,2]; *[1]Quantum Information Science Section, Oak Ridge National Laboratory, USA; [2]Quantum Science Center, Oak Ridge National Laboratory, USA; [3]Theoretical Division, Los Alamos National Laboratory,, USA; [4]Laboratory of Quantum Information and Computation, Ecole Polytechnique Federale de Lausanne, Switzerland; [5]Information Sciences, Los Alamos National Laboratory, USA.* We demonstrate a continuous-variable quantum compiler with 3.6-fold faster convergence and 5.4-fold enhanced precision for optical phase unitary learning, highlighting the advantages of squeezing in learning the dynamics of quantum systems.

11:00 -- 13:00
Room: Yorkshire A
QW2B • Quantum Optics II

QW2B.1 • 11:00 (Invited)
Using Photons to Find Needles in a Haystack and Test Reality, Andrew G. White[1]; [1]*Univ. of Queensland, Australia.* We implement a range of experiments—from foundations through to algorithms—using programmable photonic-integrated-circuits driven by a semiconductor quantum-dot single-photon source. A deterministic version of Grover's algorithm is considerably more robust against device imperfections than the original.

QW2B.2 • 11:30
Fourier State Tomography of Quantum Light, Mohammed Alqedra[1], Pierre Brosseau[2], Anton Vetlugin[2], Cesare Soci[2], Val Zwiller[1]; [1]*KTH Royal Inst. of Technology, Sweden;* [2]*Nanyang technological Univ., Singapore.* We present the first experimental demonstration of Fourier state tomography of photonic polarization states. We measure entangled pairs from a quantum dot, achieving results comparable to projective tomography with fewer components, verifying the authenticity and scalability of Fourier tomography for characterizing quantum state.

QW2B.3 • 11:45
Completely Characterizing Multimode Nonlinear-Optical Quantum Processes, Geunhee Gwak[1], Chan Roh[1], Young-Do Yoon[1], M.S. Kim[2], Young-Sik Ra[1]; [1]*KAIST, Korea (the Republic of);* [2]*Imperial College London, UK.* We experimentally characterize multimode nonlinear-optical quantum processes by obtaining the complete information. This full information allows us to factorize the multimode processes, leading to the identification of eigenquadratures and the associated amplification and noise properties.

QW2B.4 • 12:00
Direct Polarization-Entangled Photon Pair Generation Using Domain-Engineered Nonlinear Crystal, Anatoly Shukhin[1], Inbar Hurvitz[2], Leonid Vidro[1], Ady Arie[2], Hagai Eisenberg[1]; [1]*HUJI, Israel;* [2]*Tel-Aviv Univ., Israel.* We propose and demonstrate a method for creating high-quality polarization-entangled photon pairs by designing the photons' Joint spectral amplitude, utilizing a domain-engineered nonlinear crystal and SPDC, with an extremely simple single-filter setup, without requiring post-selection.

QW2B.5 • 12:15
Zero-Added-Loss Multiplexing with Phase-Matched Spectral Islands, Clark Embleton[1], Michael G. Raymer[1], Brian J. Smith[1], Franco N. Wong[2], Jeffrey H. Shapiro[2]; [1]*Univ. of Oregon, USA;* [2]*Massachusetts Inst. of Technology, USA.* Zero-added-loss multiplexing (ZALM) was proposed [Phys. Rev. Appl. **19**, 054209 (2023)] for high-rate, high-purity entanglement distribution in quantum networks. We show that ZALM enables quasi-deterministic, polarization-entangled photon-pair production with phase-matched spectral islands.

11:00 -- 12:30
Room: Yorkshire B
QW2C • Tutorial: Optical Quantum Computing

QW2C.1 • 11:00 (Tutorial)
Optical Quantum Computing, Olivier Pfister[1]; *[1]Univ. of Virginia, USA.* Abstarct not available.

14:00 -- 16:00
Room: Exhibits Poster Area
QW3A • Poster Session II

QW3A.1
Ternary Quantum Eraser Encryption Protocol, Yahya M. Khabrani[1], Ahmed Halawani[2], Abdulaziz Al Mogeeth[4], Zhenghong Li[3], Mohammad Al-Amri[2]; *[1]Dept. of Physics, Imam Muhammad ibn Saud Islamic Univ., Saudi Arabia; [2]Inst. of Quantum Technologies and Advanced Computing, KACST, Saudi Arabia; [3]Inst. for Quantum Science and Technology and Dept. of Physics, Shanghai Univ., China; [4]Dept. of Physics,College of Science, King Khalid Univ.,P.O.9004, Saudi Arabia.* We demonstrate a high-dimensional quantum cryptography protocol based on quantum erasers and ternary state encoding. The system achieves 56% eavesdropping limitation with 0.3 bits/photon efficiency through controlled polarization manipulation.

QW3A.2
Efficient Finite Temperature Atomic Comb Quantum Memory, Raymond Ooi[1], Shreyes Subramaniam[1]; *[1]Universiti Malaya, Malaysia.* Raman scheme atomic gas at room temperature is promising for practical quantum memory. Hybrid procedure solves the Heisenberg-Langevin and propagation equations. Atomic frequency comb with controlled laser store and retrieve quantum signal with unity efficiency.

QW3A.3
Security of Twin Field Differential Phase Shift QKD Against Intercept and Announce Attack, Nilesh Sharma[1], Anil Prabhakar[1]; *[1]Indian Inst. of Technology, Madras, India.* We analyze an intercept and announce attack on the TF-DPS QKD protocol. The secure key rate against the proposed attack is derived for two different settings of Eve's apparatus and compared with the expected one.

QW3A.4
A Novel and Agile Trusted Relay Scheme for Long Distance QKD Networks, Vaibhav P. Singh[1,2], Ashutosh K. Singh[1,3], Anil Prabhakar[1,3]; *[1]Dept. of Electrical Engineering, Indian Inst. of Technology Madras, India; [2]Quantum Technology Group, Centre for Development of Advanced Computing, India; [3]Center for Quantum Information, Communication and Computing, Indian Inst. of Technology Madras, India.* A novel trusted relay scheme is presented for long-distance QKD, focusing on reduced hardware and computational requirements, scalability, execution time, etc. The scheme works under a centralized control architecture like QKD-SDN controllers.

QW3A.5

Enhanced Discrete Variable Quantum Key Distribution Using Pulse Amplitude Modulation with Four Levels, Amir Yazdanpour[1], Shiva Kumar[1], Nahid Sharifi[1], Yeganeh Nasr[1]; *[1]McMaster Univ., Canada.* This paper presents a discrete variable QKD protocol employing four-level pulse amplitude modulation. The scheme optimizes key generation rate, bit error rate, and security through modulation depth and threshold optimization, demonstrating practical robustness in real-world quantum communication scenarios.

QW3A.6

Toward Memory-Assisted Hong-Ou-Mandel Interference Between Two Independent Cavity-Enhanced Photon Pair Sources, Edoardo Buonocore[1], Eden Figueroa[1,2], Sonali Gera[1]; *[1]Stony Brook Univ., USA; [2]Instrumentation Dept., Brookhaven National Laboratory, USA.* We report our progress toward demonstrating memory-assisted Hong-Ou-Mandel interference between independent cavity-enhanced entangled photon pair sources at room temperature as a stepping stone toward a type II quantum repeater.

QW3A.7

Partially Coherent Entangled Qubits for Applications in Secure Communication and Imaging, Bhaskar Kanseri[1], Preeti Sharma[1], Sakshi Rao[1]; *[1]Indian Inst. of Technology Delhi, India.* Partially coherent entangled qubits containing multimode nature are an excellent choice for free-space quantum communication and imaging. We experimentally realize and characterize such qubits demonstrating simultaneously their partial spatial coherence and quantum entanglement features.

QW3A.8

Fiber Entanglement Distribution, and Quantum-Classical Coexistence in C Band, Bhaskar Kanseri[1], Nishant K. Pathak[1], Abhay S. Dulta[1]; *[1]Indian Inst. of Technology Delhi, India.* We experimentally demonstrate polarization-entangled photon distribution over 50km telecom fiber, achieving robust Bell violation and secure QKD with copropagation of classical data at C-band, enabling cost-effective quantum networks using existing telecom infrastructure.

QW3A.9

Quantum Teleportation of Coherent States of Structured Light, Tanita T. Permaul[1], Arijit Dutta[1], Filippus S. Roux[1], Thomas Konrad[1,2]; *[1]Univ. of KwaZulu-Natal, South Africa; [2]National Inst. of Theoretical and Computational Sciences (NITheCS), South Africa.* We present a quantum teleportation scheme that transfers both the spatial mode and the number-of-photons state of light. This is realised by simultaneous teleportation of pixel modes, shown at the example of coherent state inputs.

QW3A.10

Fabry-Perot Stabilization with the Pound-Drever-Hall Technique for Enhancing Nonclassical Correlations of Light Scattered by Two-Level Atoms, Alexandre Almeida[1], Guillermo Palacios[1], Gabriel C. Borges[1], Daniel Felinto Pires Barbosa[1]; *[1]UFPE, Brazil.* We demonstrate a method of stabilizing a Fabry-Perot Cavity using the Pound-Drever-Hall technique with an acousto-optical modulator, intending to filter the biphotons generated via spontaneous four-wave mixing in an ensemble of cold two-level atoms.

QW3A.11

Reconfigurable 3D-MUB OAM Superposition State Preparation for Real-Time QKD Using a Structured Electro-Optic Modulator, Srinivasu Sapireddy[1], Harshawardhan Wanare[2,1]; [1]*Photonics Science and Engineering, IIT Kanpur, India;* [2]*Physics, IIT Kanpur, India.* We present an azimuthally structured electro-optic modulator as an integrable, active waveguide, that generates 3D-MUB OAM superposition states for real-time secure quantum key distribution, significantly enhancing the key distributing rates.

QW3A.12

Exceptional Points in Open Quantum Systems, Emroz Khan[1]; [1]*The City Univ. of New York, USA.* We demonstrate how distinct quantum measurement bases evolve through interaction with the environment and can non-unitarily connect with each other at exceptional point degeneracies, leading to a non-Hermitian gate operation that does not require rotation.

QW3A.13

Magnesium Fluoride Microdisk Resonators for Frequency-Dependent Squeezing via Einstein–Podolsky–Rosen Entanglement, Zijun Shu[1], Haodong Xu[1], Nianqin Li[1], Yang Shen[1], Bo Ji[1], Guangqiang He[1]; [1]*Shanghai Jiao Tong Univ., China.* We demonstrate a platform for generating bipartite entangled quantum frequency combs using magnesium fluoride microdisk resonators with high Q factors. The system supports 14 continuous-variable quantum modes, with the frequency-dependent squeezing state being finely adjustable through the coupling rate.

QW3A.14

Optimization of Quantum-Repeater Networks Using Stochastic Automatic Differentiation, Guus Avis[1], Stefan Krastanov[1]; [1]*UMass Amherst, USA.* Quantum-network simulations are discretely random, making it difficult to extract derivatives. We solve this using a recent machine-learning technique called stochastic automatic differentiation and showcase it by optimizing the placement of quantum repeaters and more.

QW3A.15

Robust Polarization-Entangled Photons: a Fully Motorized Solution for Quantum Technologies, Rana Sebak[1,2], Rodrigo Gomez[1], Sara Montano Gamarra[3,4], Julio Tafur[4], Erik Beckert[1], Fabian Steinlechner[1,2]; [1]*Fraunhofer IOF, Germany;* [2]*Friedrich Schiller Univ., Germany;* [3]*Technische Universität Ilmenau, Germany;* [4]*Pontificia Universidad Católica del Perú, Av. Universitaria, Peru.* We are developing a polarization-entangled photon source employing FPGA-based automation for robust alignment and stability. Features include motorized geometrical alignment, temperature control, and polarization correction, ensuring resilience in harsh environments for scalable quantum communication technologies.

QW3A.16

Quantum Money Using Differential Phase Encoding, Ashutosh K. Singh[1,3], Nilesh Sharma[1,3], Vaibhav P. Singh[1,3], Anil Prabhakar[1,3], Sridhar Tayur[2]; [1]*Dept. of Electrical Engineering, Indian Inst. of Technology Madras, India;* [2]*Quantum Technologies Group, Tepper School of Business, Carnegie Mellon Univ., USA;* [3]*Center for Quantum Information, Communication and Computing, Indian Inst. of Technology Madras, India.* A Quantum Money scheme is presented with preliminary experimental results. We show a three-party system with the Bank as the trustworthy node using differential phase encoding on weak coherent source to realise the transaction.

QW3A.17
Heralded Entanglement Source Analysis for Cascaded Parametric Down-Conversion, Yousef Chahine[1], Evan J. Katz[1], Adam J. Fallon[1], John D. Lekki[1]; *[1]NASA, USA.* We present several techniques for high-rate entanglement generation through heralded, multiplexed parametric down-conversion (PDC), generalizing previous cascaded PDC and zero-added-loss multiplexing (ZALM) schemes. Closed form expressions for the heralding rate and fidelity extend previous analyses.

QW3A.18
In-Grown Diamond Color Centers with Narrow Inhomogeneous Spectral Distributions, Zachary Zitzewitz[1,2], Eric Bersin[2], David Starling[2], Ben Dixon[2]; *[1]Dept. of Physics, Yale Univ., USA; [2]Lincoln Laboratory, Massachusetts Inst. of Technology, USA.* We characterize silicon vacancies in a bulk diamond sample grown at MIT Lincoln Laboratory. The measured narrow, inhomogeneous spectral distribution indicates that they will be useful for implementing scalable quantum networks.

QW3A.19
A Polarization Preserving, Low Loss Optical Switch for High Dimensional Time Bin QKD, Michael Antesberger[1], Shoichi Murakami[2], Philip Walther[1], Lee A. Rozema[1]; *[1]Universitat Wien, Austria; [2]Osaka Univ., Japan.* We present an ultra-low-loss optical switch designed to enable the deterministic generation and measurement of time-bin qudit states for high dimensional quantum key distribution. Moreover, our optical switch preserves the single photons’ polarization state.

QW3A.20
Quantum Network with MHz Entanglement Distribution and GHz Reconfigurability, Jiapeng Zhao[1], Yang Xu[2], Hassan Shapourian[1], Xiyuan Lu[3], Eneet Kaur[1], Michael Kilzer[1], Ramana Kompella[1], Robert Boyd[2,4], Reza Nejabati[1]; *[1]Cisco, USA; [2]The Inst. of Optics, Univ. of Rochester, USA; [3]Joint Quantum Inst., Univ. of Maryland/NIST, USA; [4]Dept. of Physics and Astronomy, Univ. of Rochester, USA.* A quantum network architecture is proposed with 4.6 MHz entanglement distribution rate based on reconfigurable quantum interfaces. Our architecture provides a tangible solution to overcome several major limitations in quantum data center.

QW3A.21
High-Efficiency Free-Space Coupling from Diamond Microdisks for Scalable Spin-Photon Interfaces., Siavash Mirzaei Ghormish[1], Ryan Camacho[1], Jeddy Bennet[1]; *[1]Brigham Young Univ., USA.* We present a dual-layer grating perturbation design integrated with a microdisk resonator. This design achieves vertical emissions with 95\% Gaussian far-field overlap and 97\% collection efficiency at the numerical aperture of 0.7. Using a dipole approximation method, we optimize the design for scalable quantum networks.

QW3A.22

Spin Control of Highly Strained Silicon Vacancy Centers in Nanodiamonds, Marco Klotz[1], Andreas Tangemann[1], Alexander Kubanek[1,2]; *[1]Universität Ulm, Germany; [2]Center for Integrated Quantum Science and Technology, Germany.* Silicon vacancy centers (SiV) in diamond have emerged as a promising quantum technologies platform. We use highly strained SiV to characterize and control its optical dipole, electron and closeby nuclear spins at liquid helium temperature.

QW3A.23
Ultra-High Strained Silicon Vacancy Centers in Nanodiamonds, Andreas Tangemann[1], Marco Klotz[1], Alexander Kubanek[1,2]; *[1]Univ. Ulm, Germany; [2]Ulm Univ., Center for Integrated Quantum Science and Technology (IQst), Germany.* Silicon-Vacancy Centers (SiV) in diamond promise optical access to spin qubits within a scalable solid state host. We investigate properties of ultra-high strained SiVs in nanodiamonds at liquid Helium tepmeratures.

QW3A.24
Simulating Fiber Polarization Effects in Quantum Networks With BIFROST, Patrick R. Banner[1], Steven Rolston[1], Joseph W. Britton[2]; *[1]Univ. of Maryland at College Park, USA; [2]CCDC Army Research Lab, USA.* We present BIFROST, an open-source Python-based tool for simulating polarization effects in long optical fibers from first principles. We demonstrate its capabilities by simulating the fidelity of wavelength-division multiplexing compensation schemes in quantum networks.

QW3A.25
Boosted Quantum Teleportation, Simone E. DAurelio[1,2], Matthias J. Bayerbach[1,2], Stefanie Barz[1,2]; *[1]Stuttgart Universität - FMQ, Germany; [2]Center for Integrated Quantum Science and Technology (IQST), Germany.* Photonic quantum teleportation success probability is limited by the efficiency of the Bell-state measurement. We present an implementation of it featuring an enhanced success probability (57.9%) and average fidelity above the classical 2/3 limit.

QW3A.26
Improving Quantum Interference Visibility Between Independent Photon Sources, Hsin Pin Lo[1], Kai Asaoka[1], Hiroki Takesue[1]; *[1]NTT Basic Research Laboratories, Japan.* We compared two methods to improve the quantum interference between independent sources: decreasing the pump pulse width or interference filter bandwidth. We found both improved visibilities but with a larger coincidence rate with the former.

QW3A.27
Practical Free-Space QKD Under Night- and Day-Time Over a 0.5 km Metropolitan Link, Argiris Ntnaos[1], Aristeidis Stathis[1], Panagiotis Kourelias[1], Evridiki Kyriazi[1], Panagiotis Toumasis[1], Nikolaos K. Lyras[2], Hercules Avramopoulos[1], Giannis Giannoulis[1]; *[1]NTUA, Greece; [2]Optoelectronics Section, ESA, Netherlands.* A practical Free-Space polarization-encoded QKD system with Low-Cost Optical Terminals is presented, operating over a 0.5 km urban link, achieving <6% QBER and SKRs up to 1.3 kbps in nighttime and daytime conditions.

QW3A.28

Resource-Efficient Encoder for Arbitrary Time-bin State Generation, Matías R. Bolaños Wagner[1], Kannan Vijayadharan[1], Giuseppe Vallone[1], Paolo Villoresi[1], Costantino Agnesi[1]; [1]*Universita degli Studi di Padova, Italy.* We present a fully controllable time-bin quantum state encoder, which is easily scalable to arbitrary dimensions and time-bin widths. The encoder presents high stability and low QBER, even at high speeds of operation.

QW3A.29
Enhanced Simultaneous Quantum-Classical Communications Under Composable Security, Nicholas Zaunders[1], Ziqing Wang[2], Ryan Aguinaldo[3], Robert Malaney[2], Timothy C. Ralph[1]; [1]*Centre for Quantum Computation and Communication Technology, School of Mathematics and Physics, Univ. of Queensland, Australia;* [2]*School of Electrical Engineering and Telecommunications, Univ. of New South Wales, Australia;* [3]*Northrop Grumman Corporation, USA.* SQCC CV-QKD protocols are ideal for use in free-space-optical platforms where resources are limited. We revise SQCC security under composability, provide an improved channel coupling model and demonstrate superior performance for a given classical quality-of-service.

QW3A.30
Entanglement Distribution During Earth-Satellite Atmospheric Conditions, Randy J. Lafler[1], Mark Eickhoff[2], Scott Newey[2], Yamil Nieves Gonzalez[2], Kurt Stoltenberg[2], Frank Camacho[3], Denis Oesch[3], Robert Lanning[1]; [1]*AFRL/RD, USA;* [2]*The Boeing Company, USA;* [3]*Leidos, USA.* Polarization entanglement is distributed across a 1-mile, freespace channel tuned to emulate low-Earth orbit Earth-satellite links. We verify that the entanglement is minimally affected by these atmospheric conditions with a full quantum state tomography.

QW3A.31
Homodyne-Based CV QRNG Receiver Module for the SPOQC Mission, Vinod Nagaraja Rao[1,2], Killian Murphy[2], Emma Tien Hwai Medlock[1], Timothy Spiller[1,2], Rupesh Kumar[1,2]; [1]*School of Physics, Engineering and Technology, Univ. of York, UK;* [2]*Quantum Communications Hub, Univ. of York, UK.* We demonstrate vacuum noise based QRNG for SPOQC CubeSat mission by the Quantum Communication Hub, UK. We have successfully tested and extracted 2.998 bit per 12-bit ADC output of quantum random numbers from 9.99*10^5 amount of raw data.

QW3A.32
Rubust and Bright Polarization-Entanglement Generation Based on Type II Noncritical Phase Matching Technique, ilhwan I. kim[1,2], Yosep Kim[3], Yong-Su Kim[1,4], Kwang Jo Lee[2], Hyang-Tag Lim[1,4]; [1]*Center for Quantum Technology, Korea Inst. of Science and Technology, Korea (the Republic of);* [2]*Dept. of Applied Physics, Kyung Hee Univ., Korea (the Republic of);* [3]*Dept. of Physics, Korea Univ., Korea (the Republic of);* [4]*Division of Quantum Information, Korea Inst. of Science and Technology School, Korea Univ. of Science and Technology, Korea (the Republic of).* We theoretically and experimentally demonstrated the generation of robust and bright polarization-entangled photon pairs via a spontaneous parametric downconversion process in a bulk KTP crystal, using frequency-degenerate collinear type II noncritical phase matching technique.

QW3A.33

Erbium Dopants in Nanophotonic Silicon Devices for Photonic Quantum Technologies, Andreas Gritsch[1,2], Alexander Ulanowski[1,2], Jakob Pforr[1,2], Johannes Früh[1,2], Stephan Rinner[1,2], Florian Burger[1,2], Jonas Schmitt[1,2], Adrian Holzäpfel[1,2], Kilian Sandholzer[1,2], Andreas Reiserer[1,2]; [1]*Technical Univ. of Munich, Germany;* [2]*Max-Planck-Inst. of Quantum Optics, Germany.* We implemented coherent rotation and single-shot readout of single erbium spins in nanophotonic silicon resonators. Further measurements allow determining the spin Hamiltonian and investigating the spectral diffusion and optical coherence of these emitters.

QW3A.34

Quantum key Distribution With Gaussian Unconventional Photonic Blockade, Evgeny Moiseev[1], Kai Wang[1]; [1]*McGill Univ., Canada.* We propose to use a special coherent squeezed state for quantum key distribution (QKD), where the interference between squeezing and displacement completely suppresses the two-photon component. We show an increased key generation rate in prepare and measure QKD protocol.

QW3A.35

Automated Distribution of Polarization Entangled Photons Using Deployed New York City Fibers and Beyond, Alexander N. Craddock[1], Anne Lazenby[1], Gabriel Bello Portmann[1], Rourke Sekelsky[1], Mael Flament[1], Tyler Cowan[2], Javad Shabani[2], Matheus Sena[3], Mehdi Namazi[1]; [1]*Qunnect Inc., USA;* [2]*NYU, USA;* [3]*Deutsche Telekom AG, Germany.* We showcase the distribution of entanglement in various use cases in deployed fiber testbeds. Our work demonstrates the practical high rate, high fidelity entanglement distribution is presently achievable.

QW3A.36

Quantum Conference Key Agreement Using a Photonic Integrated Circuit Green Machine, Benjamin J. Fisher[1], Tyler R. Stowell[1], Joseph G. Richardson[2], Dzianis Saladukha[3], Matthew Hall[3], Robert Bernson[3], Ian Frank[4], Saikat Guha[2], Peter O'Brien[3], Ryan Camacho[1]; [1]*Brigham Young Univ. Electrical Engi, USA;* [2]*Univ. of Maryland, USA;* [3]*Tyndall National Inst., Ireland;* [4]*Sonos Inc, USA.* Quantum Conference Key Agreement (QCKA) allows a group of users to establish a shared secret key. We describe the experimental characterization of a "Green Machine" photonic integrated circuit (PIC) and its simulated performance in QCKA.

16:00 -- 18:00
Room: Imperial Ballroom
QW4A • Quantum Repeater and Testbeds

QW4A.1 • 16:00 (Invited)

Towards an Elementary Quantum Network of Trapped Ions Across Deployed Fiber in the Berkeley Area, Erhan Saglamyrek[1,2]; [1]*Dept. of Physics, Univ. of California Berkeley, USA;* [2]*ESnet Division, Lawrence Berkeley National Lab, USA.* Trapped ions are leading platforms for networked quantum computing and quantum repeaters. We present our efforts towards building a quantum network test-bed with these systems between Univ. of California, Berkeley and Lawrence Berkeley National Lab.

QW4A.2 • 16:30
On-Demand and Long-Lived Solid-State Quantum Memories for Multiplexed Quantum Network Links, Jonathan Hänni[1], Alberto E. Rodríguez-Moldes[1], Félicien Appas[1], Soeren Wengerowksy[1], Dario Lago-Rivera[3], Markus Teller[1], Samuele Grandi[1], Hugues de Riedmatten[1,2]; *[1]ICFO -Institut de Ciencies Fotoniques, Spain; [2]ICREA – Institucio Catalana de Recerca i Estudis Avançats, Spain; [3]TOPTICA Photonics AG, Germany.* In this talk, we demonstrate storage of heralded single photons in a dynamically decoupled spin-wave quantum memory for up to 180 microseconds and on-demand telecom-heralded entanglement of two memories with up to 15 temporal modes.

QW4A.3 • 16:45
Towards Quantum Repeater Nodes With Weakly-Coupled Nuclear Spins in Diamond, Yan Qi Huan[1], Aziza Suleymanzade[1], Pieter-Jan Stas[1], Yan-Cheng Wei[1], Erik Knall[2], Francisca Abdo Arias[1], Evgenii Kniazev[1], Bart Machielse[3], Umut Yazlar[1,4], Gefen Baranes[1,5], Maxim Sirotin[1,5], Can Knaut[1], Hongkun Park[1,6], Marko Loncar[2], Mikhail Lukin[1]; *[1]Dept. of Physics, Harvard Univ., USA; [2]John A. Paulson School of Engineering and Applied Sciences, Harvard Univ., USA; [3]Lightsynq Technologies Inc., USA; [4]Division of Materials Science & Engineering, Boston Univ., USA; [5]Dept. of Physics and Research Laboratory of Electronics, Massachusetts Inst. of Technology, USA; [6]Dept. of Chemistry and Chemical Biology, Harvard Univ., USA.* We demonstrate control of weakly-coupled ^{13}C nuclear spins coupled to silicon-vacancy (SiV) centers in diamond nanophotonic cavities and generate spin-photon entanglement with our two-qubit network node leading to potential applications as a quantum repeater platform.

QW4A.4 • 17:00
Towards Entanglement Distribution in a Suburban Quantum Network, Pooja Malik[1,2], Tommy Block[1,2], Maya Bueki[3,2], Florian L. Fertig[1,2], Yiru Zhou[1,2], Tobias Frank[3,2], Marvin Scholz[3,2], Gianvito Chiarella[3,2], Pau Farrera[3,2], Gerhard Rempe[3,2], Harald Weinfurter[1,2]; *[1]Ludwig-Maximilians-Univ. Munich, Germany; [2]Munich Center for Quantum Science and Technology (MCQST), Cyprus; [3]Max-Planck Inst. for Quantum Optics, Germany.* We demonstrate first steps toward atom-atom entanglement over 24 km of deployed fiber by distributing entanglement between a Rb-87 atom and a photon using quantum frequency conversion from 780 nm to low-loss telecom S-band.

QW4A.5 • 17:15
Room-Temperature Quantum Memory for Quantum Repeaters, Yang Wang[1], Mehdi Namazi[1]; *[1]Qunnect Inc., USA.* We report a key milestone in quantum repeater: entanglement between a telecom photon and a quantum memory. In addition, we report high memory efficiency (50%) that significantly improves the rate.

QW4A.6 • 17:30
Towards Entanglement Swapping Over 250 km of Deployed Fiber, Chase Wallace[1], Tsering Lodhen[1], Leonardo Castillo-Veneros[1], Anthony Del Valle[1], Dounan Du[1], Samuel Woronick[2], Dimitrios Katramatos[2], Julian Martinez[2], Sonali Gera[1], Eden Figueroa[1,2]; *[1]Stony Brook Univ., USA; [2]Instrumentation, Brookhaven National Laboratory, USA.* We report our progress towards performing entanglement swapping using deployed fiber in a five-node 259 km network testbed connecting Long Island and New York City.

QW4A.7 • 17:45
Towards Entanglement Swapping Over 30 km in a Three-Node Metropolitan Quantum Network in New York City., Niccolò Bigagli[1], Alexander N. Craddock[1], Tyler Cowan[2], Javad Shabani[2], Mehdi Namazi[1]; *[1]Qunnect Inc., USA; [2]Center for Quantum Information, Dept. of Physics, New York Univ., USA.* We report on our work towards entanglement swapping in a three-node quantum network between lower Manhattan and Brooklyn using bichromatic rubidium-based entanglement sources.

16:00 -- 18:00
Room: Yorkshire A
QW4B • New Frontiers in QUIST

QW4B.1 • 16:00 (Invited)
Quantum Data Center Fabric: a Vision for the Future of Quantum Computing and Networking, Reza Nejabati[1]; *[1]Cisco systems, USA.* Cisco's vision is to build a Network Fabric for a Quantum Data Center (QDC). This talk outlines new architectural frameworks and technological solutions that deliver practical, scalable quantum computing through cutting-edge quantum network interconnect innovations.

QW4B.2 • 16:30
Impact of Interconnected Architectures on Near-Term Quantum Algorithms, Eric A. Bersin[1], Benjamin Rempfer[1], Ben Dixon[1], David Starling[1], Cyrus Hirjibehedin[1], Scott Hamilton[1]; *[1]MIT Lincoln Laboratory, USA.* Scaling quantum computers requires interconnected processors; however, the interconnected architecture's effect on computing performance is not well quantified. We assess the impact of architectures on algorithm performance and identify performance benefits relative to interconnect-free architectures.

QW4B.3 • 16:45
Effective Density Matrices in Entangled Photon Detection, Taman Truong[1], Christian Arenz[1], Joseph M. Lukens[2,1]; *[1]Arizona State Univ., USA; [2]Purdue Univ., USA.* We develop a practical, mathematical model for the effective two-photon density matrix produced by a parametric source of entangled photon pairs under two and four photon-number-resolving and threshold detectors.

QW4B.4 • 17:00
Proposal for Directly Observing Kirkwood-Dirac Quasiprobability Distributions, Shuming Cheng[1], Lijun Liu[2]; *[1]Tongji Univ., China; [2]Shanxi Normal Univ., China.* The Kirkwood-Dirac (KD) quasiprobability distribution has generated great interest as prominent indicators of non-classical features in quantum information and computation. In this work, we propose an experimental-friendly protocol, which is able to observe all possible KD distributions.

QW4B.5 • 17:15
Variational Quantum Simulation Using Non-Gaussian Continuous-Variable Systems, Federico Centrone[2], Paolo Stornati[2], Antonio Acín[2], Ulysse Chabaud[1], Alexandre

Dauphin[2], Valentina Parigi[1]; *[1]Sorbonne Université, France; [2]ICFO, Spain.* We propose a novel framework for quantum simulation using non-Gaussian continuous-variable systems via a photonic variational quantum eigensolver. Under realistic experimental constraints, we simulate the ground states of a many-body system, showcasing the advantages of our model with respect to discrete variable formulations.

QW4B.6 • 17:30
Gauge Transformations for Measurement-Based Quantum Compiling, Sebastiano Corli[1], Enrico Prati[1,2]; *[1]Università degli Studi di Milano, Italy; [2]Istituto Nazionale di Fotonica e Nanotecnologie, Consiglio Nazionale delle Ricerche, Italy.* We introduce a direct method for measurement-based quantum compiling, converting any unitary circuit to a class of graph states. A set of graphical rules and a system of equations implement the process.

QW4B.7 • 17:45
Superradiance of Multilevel Atoms for Base-Independent Multiphoton Entanglement, Amir Sivan[1,2], Meir Orenstein[1,2]; *[1]Andrew and Erna Viterbi Dept. of Electrical & Computer Engineering, Technion - Israel Inst. of Technology, Israel; [2]Helen Diller Quantum Center, Technion - Israel Inst. of Technology, Israel.* Superradiant ensembles of multilevel atoms produce entangled multiphoton states. Base-independent entanglement emerges from partially degenerate four-level atom ensembles, with atomic structure and initial excitation determining both the photonic states and their entanglement.

16:00 -- 17:45
Room: Yorkshire B
JW4C • Tutorial and Presentation: Astrometry

JW4C.1 • 16:00 (Tutorial)
Astrometry, Paul W. Stankus[1]; *[1]Brookhaven National Laboratory, USA.* Abstract not available.

JW4C.2 • 17:30
Optimal Entanglement-Assisted Telescopy, Yujie Zhang[1,2], Thomas Jennewein[1,3]; *[1]Inst. for quantum computing, Univ. of Waterloo, Canada; [2]Physics and Astronomy Dept., Univ. of Waterloo, Canada; [3]Dept. of physics, Simon Fraser Univ., Canada.* We present a framework combining quantum metrology and superselection rules to systematically evaluate entanglement-assisted telescopy. This approach defines fundamental limits, enables comparison of different protocols, and identify novel protocols for quantum-enhanced telescopy.

Thursday, 5 June

08:00 -- 10:00
Room: Imperial Ballroom
QTh1A • Keynote Session IV

QTh1A.1 • 08:00 (Plenary)
Chip-Scale Quantum Many-Body Systems with Semiconductor Color Centers in Integrated Photonics, Jelena Vuckovic[1]; *[1]Stanford Univ., USA.* Optically interfaced spin qubits based on diamond and silicon carbide color centers are considered promising candidates for scalable quantum networks and sensors. However, they can also be used to build chip-scale quantum many-body systems with tunable all-to-all interactions between qubits enabled by photonics - useful for quantum simulation and possibly computing.

QTh1A.2 • 08:45 (Invited)
Scalable Quantum Processing in Silicon, Jason Petta[1]; *[1]Univ. of California Los Angeles, USA.* Abstract not avaialble.

QTh1A.3 • 09:15 (Invited)
Multiplexing Cavity-Atom Arrays for Quantum Networks and Science, Adam Shaw[1]; *[1]Stanford Univ., USA.* I will introduce our in-development experimental platform hybridizing neutral atom arrays with an array of macroscopic optical cavities in order to realize new applications across the gamut of quantum information science.

10:30 -- 12:30
Room: Imperial Ballroom
QTh2A • Single Photon Detectors

QTh2A.1 • 10:30 (Invited)
Recent Advances in Superconducting Nanowire Single Photon Detectors, Ioana Craiciu[1], Jasen Zion[2], Emanuel Knehr[1], Andrew Mueller[3], Isabel Harrysson Rodrigues[1], Bruce Bumble[1], Andrew Beyer[1], Lautaro Narvaez[3], Maria Spiropulu[3], Boris Korzh[4], Jason Allmaras[1], Emma E. Wollman[1], Matthew Shaw[1]; *[1]Jet Propulsion Laboratory, USA; [2]Dept. of Applied Physics and Materials Science, California Inst. of Technology, USA; [3]Dept. of Physics, California Inst. of Technology, USA; [4]Group of Applied Physics, Univ. of Geneva, Switzerland.* SNSPDs initially emerged as high-performing, single-pixel photon detectors for quantum experiments. Recently, advances in SNSPD technology driven by a variety of applications have opened up new possibilities for quantum imaging and high-speed quantum communication.

QTh2A.2 • 11:00
High-Temperature Superconducting Nanowire Detectors: Enabling Ultrafast Optical Response Above 77 K, Ankit Kumar[1], Dmitry Panna[1], Shlomi Bouscher[1], Avi Koriat[1], Yuval

Nitzav[2], Gabriel Natale[3], Vincent Plisson[3], Kenneth Burch[3], Ronen Jacovi[1], Amit Kanigel[2], Alex Hayat[1]; *[1]Dept. of Electrical Engineering, Technion, Israel; [2]Dept. of Physics, Technion, Israel; [3]Dept. of Physics, Boston College, USA.* We developed high-temperature superconductors (HTS) nanowire fabrication technique enabling superconducting nanowire single photon detection (SNSPD) above liquid nitrogen temperatures, significantly reducing system complexity and cost while improving energy efficiency, portability, and compactness of the detectors.

QTh2A.3 • 11:30

Opportunities and Challenges for Photon-Number Resolution with SNSPDs, Lorenzo Stasi[1,2], Towsif Taher[2], Giovanni V. Resta[1], Rob Thew[2], Hugo Zbinden[2], Félix Bussières[1]; *[1]ID QUANTIQUE, Switzerland; [2]Univ. of Geneva, Switzerland.* We present performance and practical criteria to evaluate different approaches for photon-number resolving (PNR) detection for quantum communication and computing. We present a novel parallel SNSPD that performs well on all the criteria.

QTh2A.4 • 11:45

Cryogenic Thermal Conductivity Measurement of MoSi Films for Single Photon Detectors, Jacopo Piantanida Chiesa[1], Shuhul Mujoo[2], Tom Q. Post[1], Michiel J. de Dood[1]; *[1]Huygens-Kamerlingh Onnes Laboratory, Leiden Univ., Netherlands; [2]Thomas J. Watson Sr. Laboratory of Applied Physics, Caltech, USA.* We measure the thermal conductivity of amorphous MoSi superconducting films using the 3-omega method at cryogenic temperatures. Limitations on hotspot dynamics and thermal reset times in Superconducting Nanowire Single Photon Detectors will be discussed.

QTh2A.5 • 12:00

Faster, Smarter, Bigger – Extending SNSPDs Functionalities Through Multipixel Design, Mario Castaneda[2], Marco Caputo[1], Federica Facchin[1], Eitan Oksenberg[1], Ronan Gourgues[1]; *[2]Single Quantum, Netherlands.* We present advances in multipixel SNSPD approaches, covering linear, planar and interleaved detector arrays. We describe their applications, ranging from classical and quantum communication to quantum computing, imaging and particle detection.

10:30 -- 12:30
Room: Yorkshire A
QTh2B • Waveguide Quantum Optics

QTh2B.1 • 10:30 (Invited)

Thin-Film Lithium Niobate Quantum Photonics, Neil Sinclair[1]; *[1]Harvard Univ., USA.* Thin-film lithium niobate is being explored for several applications in photonics including quantum optics and information science. We discuss recent work on generating and manipulating quantum light using this platform.

QTh2B.2 • 11:00

Quantum Interference Between Photons From two Waveguide-Integrated tin-Vacancy Centers, Alexander Moritz Stramma[1], Christopher Waas[1], Hans K. Beukers[1], Timo Dolné[1], Nina Codreanu[1], Niv Bharos[1], Julia M. Brevoord[1], Tim Turan[1], Pepijn Habing[1], Ronald Hanson[1]; *[1]QuTech and Kavli Inst. of Nanoscience, Delft Univ. of Technology, Netherlands.* Quantum networks are based on shared remote entanglement between local nodes by exchanging indistinguishable photons. We show Two-Photon Quantum Interference between tin-vacancy centers in diamond-waveguides and report on the progress towards remote entanglement generation.

QTh2B.3 • 11:15
WaveguideQED.jl: Simulating Interacting Stationary- and Propagating Quantum Systems., Matias Bundgaard-Nielsen[1,2], Francisco David Eliú Ruiz Mina[1], Dirk Englund[3], Mikkel Heuck[1,2], Stefan Krastanov[4]; *[1]Dept. of Electrical and Photonics Engineering, Technical Univ. of Denmark, Denmark; [2]NanoPhoton-Center for Nanophotonics, Technical Univ. of Denmark, Denmark; [3]Dept. of Electrical Engineering and Computer Science, Massachusetts Inst. of Technology, USA; [4]Manning College of Information and Computer Sciences, Univ. of Massachusetts Amherst, USA.* We present WaveguideQED.jl, a numerical tool for simulating non-Markovian waveguide quantum electrodynamics. We demonstrate its broad applicability, e.g., simulating a localized quantum system with delayed feedback from coupling to a waveguide.

QTh2B.4 • 11:30
Quantum Optics Realized in Synthetic Dimensions of a Single Waveguide, Amir Sivan[1,2], Amit Kam[2,3], Stav Lotan[1,2], Lior Gal[1], Guy Bartal[1,2], Meir Orenstein[1,2]; *[1]Andrew and Erna Viterbi Dept. of Electrical & Computer Engineering, Technion - Israel Inst. of Technology, Israel; [2]Helen Diller Quantum Center, Technion - Israel Inst. of Technology, Israel; [3]Physics Dept., Technion - Israel Inst. of Technology, Israel.* We generate advanced quantum circuits by manipulating mode structure and intermodal interactions within a single waveguide. By altering the waveguide lateral dimensions, we produce photonic states (e.g., NOON), and implement interferometers and quantum topological elements.

QTh2B.5 • 11:45
Lossless Spectral-Temporal Mode Shaping for Efficient Two-Photon Interference, Jerzy Szuniewicz[1], Jan Krzyzanowski[1], Ksawery Mielczarek[1], Michal Chrzanowski[1], Filip Sosnicki[2], Michal Karpinski[1]; *[1]Faculty of Physics, Univ. of Warsaw, Poland; [2]Integrated Quantum Optics, Inst. for Photonic Quantum Systems (PhoQS), Paderborn Univ., Germany.* We demonstrate a phase-only photonic interface enabling arbitrary spectral-temporal mode conversion. By using this method for mismatched photon spectra we achieve 63% two-photon interference visibility with sevenfold improved transmission compared to filtering, enabling efficient quantum information transfer.

QTh2B.6 • 12:00
Exciton Manipulation via Dielectric Environment Engineering in 2D Materials, Raziel Itzhak[1], Nathan Suleymanov[1], Alex Hayat[1], Ilya Goykhman[2]; *[1]Technion, Israel; [2]The Hebrew Univ. of Jerusalem, Israel.* The dielectric environment and substrate defects strongly affect the photoluminescence (PL) spectra of 2D semiconducting monolayers. Using substrate engineering and exciton manipulation, our study demonstrates different PL modulation schemes

in 2D TMDs.

QTh2B.7 • 12:15

Quantum Theory of Loss-Induced Transparency in Coupled Waveguides, Igor B. Ribeiro[1], Paulo A. Brandão[1]; [1]*Instituto de Física, Universidade Federal de Alagoas, Brazil.* Increasing loss in one waveguide can counterintuitively enhance light transmission. Using the Heisenberg-Langevin formalism, we show that this loss-induced transparency effect extends to single-photon states, for both separable and entangled cases.

10:30 -- 12:30
Room: Yorkshire B
QTh2C • Quantum Enhanced Spectrocopy

QTh2C.1 • 10:30 (Invited)

Error-Corrected Quantum Sensing With Rydberg Atoms, Michal Parniak[1]; [1]*Univ. of Warsaw, Poland.* Abstract not available.

QTh2C.2 • 11:00

Multi-Frequency Resolved Hanbury Brown-Twiss Correlations, Paul W. Stankus[1]; [1]*Brookhaven National Laboratory, USA.* Hanbury Brown-Twiss correlations are a quantum effect, allowing astronomical interferometry over arbitrary baselines. We demonstrate resolving HBT measurements at multiple frequencies simultaneously with a fast single-photon detector array, promising greatly enhanced sensitivliy.

QTh2C.3 • 11:15

Using Kerr Squeezing to Enhance Stimulated Raman Scattering, Nikolay Kalinin[1], Kilian Scheffter[1,2], Seungwon Moon[1], Hanieh Fattahi[1,2], Hannah Gallop[3], Mehdi Alizadeh[3], Adrian F. Pegoraro[4], Peter Rose[3], Mitchel Morrison[3], Lora Ramunno[3], Albert Stolow[3], Luis L. Sánchez-Soto[1,5], Alexey V. Andrianov[6], Gerd Leuchs[1,2]; [1]*Max Planck Inst. for the Science of Light, Germany;* [2]*Physik Dept., Friedrich-Alexander-Universität Erlangen-Nürnberg, Germany;* [3]*Dept. of Physics, Univ. of Ottawa, Canada;* [4]*Metrology Research Centre, National Research Council Canada, Canada;* [5]*Departamento de Óptica, Facultad de Física, Universidad Complutense, Spain;* [6]*Nonlinear Dynamics and Optics Division, Inst. of Applied Physics of the Russian Academy of Sciences, Russian Federation.* We report the first quantum enhancement of stimulated Raman scattering using Kerr squeezed light generated by a standard telecom fiber. Applications in biology will benefit from this stable and robust squeezing of intense laser pulses.

QTh2C.4 • 11:30

Mid-Infrared Quantum Spectroscopy in a Dispersion-Engineered Integrated SU(1,1) Interferometer, Abira Gnanavel[1], Franz Roeder[1], René Pollmann[1], Benjamin Brecht[1], Christine Silberhorn[1]; [1]*Paderborn Univ., Integrated Quantum Optics, Inst. for Photonic Quantum Systems (PhoQS), Germany.* We present mid-infrared spectroscopy with undetected photons in an SU(1,1) interferometer based on a second-order dispersion-engineered, ultra-broadband, non-degenerate integrated parametric down-conversion source.

QTh2C.5 • 11:45

Quantum-Enhanced THz Time-Domain Spectroscopy, Dionysis Adamou[1], Lennart Hirsch[1], Taylor Shields[1], Seungjin Yoon[1], Adetunmise C. Dada[2], Jonathan R. Weaver[1], Daniele Faccio[2], Marco Peccianti[3], Lucia Caspani[4,5], Matteo Clerici[1,5]; [1]*James Watt School of Engineering, Univ. of Glasgow, UK;* [2]*School of Physics and Astronomy, Univ. of Glasgow, UK;* [3]*Emergent Photonics Research Centre, Dept. of Physic, Loughborough Univ., UK;* [4]*Inst. of Photonics, Dept. of Physics, Univ. of Strathclyde, UK;* [5]*Como Lake Inst. of Photonics, Dipartimento di Scienza e Alta Tecnologia, Università degli Studi dell'Insubria, Italy.* We investigate the possibility of improving time-domain spectroscopy of Terahertz radiation using quantum states of light. We experimentally demonstrate that using quantum-correlated pulsed twin beams as the probe field significantly enhances the detection sensitivity.

QTh2C.6 • 12:00

Comparing Classical and Entangled Second Harmonic Generation Beyond the Photon Pairs Regime, Thomas Dickinson[1,2], Ivi Afxenti[3], Giedre Astrauskaite[4], Lennart Hirsch[3], Samuel Nerenberg[4], Ottavia Jedrkiewicz[2,5], Daniele Faccio[4], Caroline Müllenbroich[4], Alessandra Gatti[5], Matteo Clerici[2,3], Lucia Caspani[1,2]; [1]*Inst. of Photonics, Dept. of Physics, Univ. of Strathclyde, UK;* [2]*Como Lake Inst. of Photonics, Dipartimento di Scienza e Alta Tecnologia, Università dell'Insubria, Italy;* [3]*James Watt School of Engineering, Univ. of Glasgow, UK;* [4]*School of Physics and Astronomy, Univ. of Glasgow, UK;* [5]*Istituto di Fotonica e Nanotecnologie, CNR, Italy.* We report an enhancement in the efficiency of Second Harmonic Generation pumped by entangled photons compared to the classical case, up to driving intensities almost 10 times larger than the classical bound considered so far.

QTh2C.7 • 12:15

TOWARDS an INTEGRATED ENTANGLED PHOTONS SOURCE for MID-INFRARED GHOST SPECTROSCOPY, Mathis Cohen[1], Romain Dalidet[1], Anthony Martin[1], Sébastien Tanzilli[1], Laurent Labonté[1]; [1]*Institut de Physique de Nice, Université Côte d'Azur, CNRS, France.* We are developing integrated source-emitting photon pairs in the MIR and IR ranges. This source is the core component of a spectroscopic technique based on non-linear interferometry, which we have successfully demonstrated.

14:00 -- 16:00
Room: Exhibits Poster Area
QTh3A • Poster Session III

QTh3A.1

Fast Time-Gated Superconducting Nanowire Single-Photon Detectors, Antonio Guardiani[1], Katyayani Seal[1], Lieuwe Locht[1], Andreas Fognini[1]; [1]*Single Quantum B.V., Netherlands.* Time-gated SNSPDs achieve sub-nanosecond switching, improving sensitivity and filtering strong light pulses. We demonstrate resilience to 1550 nm pulses with 100,000 photons, overcoming saturation challenges and advancing applications in dynamic single-photon detection.

QTh3A.2

Photoluminescence Spectra of Point Defects in Hexagonal Boron Nitride: ab-Initio Analysis, Kerem Anar[1], Berna Akgenc Hanedar[1,2], Mehmet Cengiz Onbasli[1]; *[1]Koç Universitesi, Turkey; [2]Dept. of Physics, Kirklareli Univ., Turkey.* We identified the equilibrium structures, phonon density of states, photoluminescence spectra and zero phonon lines of n-/p-doped hBN monolayers using density functional theory. These monolayers are promising for quantum emitter and 2D photonic passivation applications.

QTh3A.3
Withdrawn

QTh3A.4
Ultrawide Tunable Coupling of Single Quantum Emitter to an Optical Nanofiber Cavity: Effect of Diameter, SUBRAT SAHU[1], RAJAN JHA[1]; *[1]IIT BHUBANESWAR, India.* We propose an optical nanofiber cavity to enhance spontaneous emission of a single quantum emitter over a broad wavelength range, and tunability in resonance wavelength ~60 nm is achieved by varying diameter range ~150 nm.

QTh3A.5
Stark Control of Plexcitonic States in Incoherent Quantum Systems, Hira Asif[1,2], Ramazan Sahin[1,2]; *[1]Akdeniz Univ. Antalya Turkey, Turkey; [2]Turkish National Observatory (TUG), Turkey.* We demonstrate coherent control of plexcitonic states in coupled quantum system via the optical Stark effect. This enables Stark-induced transparency in off-resonant quantum systems, tunable Rabi splitting and on/off switching of photoluminescence in the visible regime.

QTh3A.6
SiN Chip-Based Photon-Pair Source Connecting NIR Solid-State Memory With Telecom O-Band for Quantum Networking, Vijay Vijay[1], Joyee Ghosh[1], Vivek Venkataraman[2,1]; *[1]Dept. of Physics, Indian Inst. of Technology Delhi, India; [2]Dept. of Electrical Engineering, Indian Inst. of Technology Delhi, India.* We propose a CMOS-compatible photon-pair source based on SiN offering simultaneous high spectral-purity (≥99.9%) and polarization-entanglement (concurrence upto 0.99), with the signal photon at 794-nm for addressing Tm-based quantum memory and the idler at~1283-nm (telecom O-band).

QTh3A.7
Withdrawn

QTh3A.8
Simultaneous Generation of Quantum Frequency Combs Across Distinct Modal Families in a Single Silicon Nitride Whispering Gallery Mode Resonator, Bo Ji[1], Nianqin Li[1], Guangqiang He[1]; *[1]Shanghai Jiao Tong Univ., China.* This study demonstrates simultaneous generation of multiple optical quantum frequency combs using a single on-chip silicon nitride whispering gallery mode resonator across distinct modal families, enabling higher-density entanglement integration using monochromatic pump light.

QTh3A.9

Toward Entanglement of Two Single-Mode Squeezed States for Quantum Sensing, Kristina A. Meier[1], Robert Hill[1], Katarzyna Krzyzanowska[1], Tyler Volkoff[1], Raymond Newell[1], Nicholas Dallmann[1]; [1]*Los Alamos National Laboratory, USA.* We present progress toward creating and entangling states of squeezed light for a simulated-atmosphere tabletop quantum illumination experiment. The purpose of this experiment is to explore theoretical studies previously done by our team.

QTh3A.10
Optical Characterization of Rare Earth Doped CeO2 Thin Films, Kusal M. Abeywickrama[1], Pralay Paul[1], Melissa A. Artola[1], Sreehari Purayil[1], Sumit Gaswami[1], Dhiman biswas[1], Casey Kerr[1], Thirumalai Venkatesan[1], Alisa Javadi[1]; [1]*Univ. of Oklahoma, USA.* This study investigates Tm^{3+}- doped CeO_2 thin films grown on YSZ substrates for solid-state quantum memory applications. Optical characterization reveals distinct near-infrared and visible emissions, highlighting CeO_2's potential as a stable host material for quantum technologies.

QTh3A.11
Generation of Hyperentangled State in Nanophotonic Lithium Niobate Waveguides, Yanghe Chen[1], Bo Ji[1], Guangqiang He[1]; [1]*Shanghai Jiao Tong Univ., China.* We generated a two-mode hyperentangled state using a nanophotonic lithium niobate waveguide, achieving high-quality polarization, energy-time, and quadrature amplitude-phase entanglement. Our scheme could stand as an efficient approach to facilitate high-capacity quantum communication.

QTh3A.12
Withdrawn

QTh3A.13
Cryogenically Characterizing Designer *Nanodiamonds for Scalable Quantum Photonics,* *Vivekanand Tiwari[1], Zhaojin Liu[1,2], Hao-Cheng Weng[1], Krishna C Balram[1], John G. Rarity[1], Soumen Mandal[3], Oliver A. Williams[3], Gavin W. Morley[4], Joe A. Smith[1]; [1]Quantum Engineering Technology Labs, H. H. Wills Physics Laboratory and Dept. of Electrical and Electronic Engineering, Univ. of Bristol, UK; [2]Quantum Engineering Centre for Doctoral Training, Centre for Nanoscience and Quantum Information, Univ. of Bristol, UK; [3]School of Physics and Astronomy, Cardiff Univ., UK; [4]Dept. of Physics, Univ. of Warwick, UK.* We optically characterize NV centers in isotopically purified nanodiamonds at cryogenic temperature using a designed metallic device. By developing comparative studies, we can benchmark sets of photonic structures to tailor and improve their quantum
photonic interface.

QTh3A.14
AlGaAs-Based Entangled Photon Sources With High Degree of Polarization Entanglement Without External Filtering, *Vivienne Leidel[1], Thorsten Passow[1], Quankui Yang[1], Robert Keil[1], Silvia Guidicatti[1], Marina Preschle[1], Elke Diwo-Emmer[1], Patrick Waltereit[1], Marko Haertelt[1]; [1]Fraunhofer IAF, Germany.* We realized an AlGaAs-based entangled photon source with reduced effective refractive index difference of TE and TM polarized modes and investigated the entanglement fidelity with and without external filtering.

QTh3A.15
A Cost-Effective and Plug-and-Play Entangled Biphoton Source for Quantum Networks, *Rong Xue[1], Christopher J. Chunnilall[1]; [1]National Physical Laboratory, UK*. A cost-effective, plug-and-play, fiber-based quantum entanglement source based on a single periodically poled lithium niobate (PPLN) waveguide with a reflection scheme was developed, generating energy-time or time-bin entangled photon pairs in the telecom C-band.

QTh3A.16
Cryogenic Metasurface-Integrated Single-Photon Detectors, *Amir Targholizadeh[1], Pankaj Jha[1]; [1]Syracuse Univ., USA.* We present the design of an all-dielectric cryogenic metasurface integrated with superconducting nanowires for single-photon detection. This hybrid device can potentially address and overcome several fundamental limitations, including polarization sensitivity and maximum count rates.

QTh3A.17
High Countrate Photon Detection With Minimal Jitter Degradation in SNSPDs, *Antonio Guardiani[1], Katyayani Seal[1]; [1]Single Quantum B.V., Netherlands.* We prove SNSPD operation at high countrate with minimal jitter degradation with an optimized constant fraction discriminator. This device is useful in high-rate QKD and highest datarate laser communication at the single photon limit.

QTh3A.18
Stable Modelocked Pumping Sources for Entangled Photon States in All-Photonic Quantum Networks, *Cody Mart[1], Nicholas Nardelli[1], Tara Fortier[1]; [1]NIST, USA.* An intracavity second harmonic generation stable modelocked oscillator based on an Er/Yb phosphate glass 1550 nm laser is tested for efficient pumping of a spontaneous parametric downconversion crystal at 775 nm to produce telecom single-photon states.

QTh3A.19
Monte-Carlo-Markov-Chain Detector Tomography Applied to a NbTiN Nanobridge, *Frederik B. Baalbergen[1], Iman E. Zadeh[2], Martin P. van Exter[1], Michiel J. de Dood[1]; [1]Universiteit Leiden, Netherlands; [2]Dept. of Imaging Physics (ImPhys), Netherlands.* We determine the quantum efficiency of a Superconducting Nanobridge Single Photon Detector using novel Monte-Carlo-Markov-Chain detector tomography to explore the detection mechanism. The efficiency is limited to 56\% by the detector geometry.

QTh3A.20
Photon Statistics of Time Dependent Electronic Excitation of Spin Injected Quantum Dots, *Chiran Wijesundara[1], Jeffrey Carvalho[1], Yuan Lu[2], Tim Thomay[1]; [1]Univ. at Buffalo, USA; [2]Institut Jean Lamour, CNRS, Université de Lorraine, France.* Shaping the electrical excitation pulse of spin injected quantum dots reveals a correlation between the time dynamics of higher-order photon emission and the pulse shape. This opens new pathways for integrated quantum light sources.

QTh3A.21
Withdrawn

QTh3A.22
A Photon-Pair Source Compatible to Quantum Memories, *Leon Meßner[1], Mathilde Kakuschke[1], Henning Mollenhauer[2], Helen M. Chrzanowski[3], Janik Wolters[2,4]; [1]Advanced Quantum Light Sources, Germany; [2]Institut für optische Sensorsysteme, Deutsches Zentrum für Luft- und Raumfahrt, Germany; [3]Institut für Physik, Humbold-Universität zu Berlin, Germany; [4]Institut für Optik und Atomare Physik, Technische Universität Berlin, Germany.* We present a compact and tunable photon-pair source based on cavity enhanced parametric down-conversion. With its quantum memory compatible frequency and bandwidth, this source can form a building block for quantum network nodes.

QTh3A.23
Spectrally Multiplexed Photon Pair Source Using a Programmable Optical Filter, *Cody C. Payne[1], Markus Allgaier[1]; [1]Univ. of North Dakota, USA.* The rates of photon pairs achievable with single-mode parametric downconversion are inherently limited. Spectral multiplexing using a programmable filter on the pump spectrum can produce more pairs across a palatable multi-mode structure.

QTh3A.24
SWIR Two-Photon Imaging Using an Array of Superconducting Nanowire Single Photon Detectors, *Katyayani Seal[1]; [1]Single Quantum, Netherlands.* We engineered a free-space coupled SNSPD array for in vivo imaging of mouse brain vasculature using two-photon excitation, with both excitation and emission occurring in the short-wave infrared (SWIR) range for enhanced imaging capabilities.

QTh3A.25
Temporal Compression of Sequential Photons, *Brittany C. Conner[1], Ashish Samantaray[1], Colin Lualdi[1], Nathan Arnold[1], Paul Kwiat[1]; [1]Univ. of Illinois Urbana-Champaign, USA.* We discuss temporal compression of sequentially emitted single photons enabled by a low loss multi-pass reflection cavity.

QTh3A.26
Quantum Double Slit Experiment with Reversible Detection of Photons, *Vipin C. Devrari[1], Mandip Singh[1]; [1]IISER Mohali, India*. Observation of two photon double-slit interference, even when a photon of Einstein-Podolsky-Rosen entangled photon pair is detected on a screen before the other photon passes through the double-slit.

QTh3A.27
Information and Backaction in Optomechanical Scattering Measurements, *Youssef Tawfik[1], Thomas Purdy[1]; [1]Univ. of Pittsburgh, USA. We investigate free-space light scattering measurements of the motion of a silicon nitride membrane optomechanical system. By tracking how information is radiated and detected, we build an understanding of how to optimize quantum measurement efficiency and how to evade measurement backaction.*

QTh3A.28
Withdrawn

QTh3A.29

Quantum Phased Array Antennas, *Samantha I. Davis[1], Volkan Gurses[1], Raju Valivarthi[1], Neil Sinclair[2], Ali Hajimiri[1], Maria Spiropulu[1]; [1]California Inst. of Technology, USA; [2]Harvard Univ., USA.* We develop the theory of quantum phased arrays (QPAs), a generalization of electromagnetic phased arrays to quantized electromagnetic fields. We derive key QPA functionalities of beamforming, beamsteering, and spatial selectivity for free-space-interfaced quantum technologies.

QTh3A.30

Quantum Interference of Single Photons With Distinguishable Paths*, Yunxiao Zhang[2], Liang Cui[2], Xueshi Guo[2], Wen Zhao[2], Xuan Tang[1], Xiaoying Li[2], Zhe-Yu J. Ou[1]; [1]City Univ. of Hong Kong, Hong Kong; [2]Tianjin Univ., China*. We report a single-photon interference experiment where the interfering paths are in orthogonal polarization and temporal modes. This is achieved through amplitude measurement by homodyne detection so that interference occurs in photo-current after measurement.

QTh3A.31

Quantum-Enhanced Dark Matter Detection With in-Cavity Control: Mitigating the Rayleigh Curse, *Haowei Shi[1], Anthony J. Brady[1], Wojciech Górecki[2], Lorenzo Maccone[3], Roberto Di Candia[4], Quntao Zhuang[1]; [1]Univ. of Southern California, USA; [2]INFN Sezione di Pavia, Italy; [3]Università degli Studi di Pavia, Italy; [4]Aalto Univ., Finland.* Quantum noise detection, such as dark matter detection in microwave cavities, is limited by the Rayleigh curse. We propose in-situ transient control to mitigate such Rayleigh limit. The protocol is compatible with axion detection scenario.

QTh3A.32

Distributed Quantum Sensing With Waveguide-Coupled Quantum Emitters, *Isack A. Padilla[1], Prajit Dhara[1,2], Annyun Das[1], Kanu Sinha[1], Saikat Guha[2,1]; [1]Wyant College of Optical Sciences, Univ. of Arizona, USA; [2]Dept. of Electrical and Computer Engineering, Univ. of Maryland, USA.* We propose field gradient sensing assisted by waveguide-coupled two-level atoms, utilizing non-Markovian dynamics from macroscopic emitter separation and waveguide-mediated 'memory' effect. Our system attains steady-state quantum Fisher information for optimal separation and detuning, showing advantage in sensing atomic detuning and field gradient.

QTh3A.33

Characterization of Strain Parameters in a Diamond Nanophotonic Structure, *Ayan Majumder[2], Anuj Bathla[2,3], Vivek K Shukla[1], Padmnabh Rai[1], Kasturi Saha[2]; [1]School of Physical Sciences, UM-DAE Centre for Excellence in Basic Sciences, Univ. of Mumbai, India; [2]Dept. of Electrical Engineering, Indian Inst. of Technology Bombay, India; [3]Center for Research in Nano Technology and Science, Indian Inst. of Technology Bombay, India*. We observe an asymmetric splitting in a zero field optically detected magnetic resonance (ODMR) spectrum of negatively charged nitrogen-vacancy (NV) centers in a diamond nanophotonic structure and present a theoretical model to explain the origin of the strain parameters in the nanophotonic structure.

QTh3A.34

Luminescence Thermometry Using Erbium Dopants in Nanophotonic Silicon Waveguides, *Kilian Sandholzer[1,2], Stephan Rinner[1,2], Andreas Gritsch[1,2], Justus Edelmann[1,2], Andreas Reiserer[1,2]; [1]Technical Univ. of Munich, Germany; [2]Max-Planck-Inst. of Quantum Optics, Germany.* Spatially resolved temperature measurements in nanophotonic structures provide insights into local heat distributions that may impede the performance of embedded spin qubits. Here, we facilitate such measurements using luminescence thermometry between cryogenic and room temperature.

QTh3A.35

Disaggregating Current Layers From Magnetic Maps for Quantum Diamond Microscopy, *Saurabh Sahu[1], Prabhat Anand[1], Kriti Kumar[1], A Anil Kumar[1], Pavan K Reddy[1], Anuj Bathla[2], Kasturi Saha[2], M Girish Chandra[1]; [1]TCS Research, India; [2]Indian Inst. of Technology Bombay, India.* We propose a weighted-sparsity based optimization method for 3-D current density reconstruction from 2-D simulated magnetic field maps in quantum diamond microscopy.

QTh3A.36

A Cryogenic Optical Cavity for Trapped Yb+ Quantum Networking, *Wance Wang[1], Andrew Laugharn[1], Wenqi Zhu[2], Amit Agrawal[2], Joseph W. Britton[1,3]; [1]Dept. of Physics, Univ. of Maryland, College Park, USA; [2]Physical Measurement Laboratory, National Inst. of Standards and Technology, USA; [3]Army Research Lab, USA*. We demonstrate a cryogenic fiber-coupled optical cavity at telecom wavelengths. Cavity alignment and high finesse are preserved from room temperature to 6K. We interact trapped Yb+ with cavity modes for quantum networking.

QTh3A.37 •

Can ZnO Transform Cavity-QED?, *Wance Wang[3], Dhruv Fomra[1,2], Amit Agrawal[2], Henri J. Lezec[2], Joseph W. Britton[3,4]; [1]Dept. of Chemistry and Biochemistry, Univ. of Maryland, College Park, USA; [2]Physical Measurement Laboratory, National Inst. of Standards and Technology, USA; [3]Dept. of Physics, Univ. of Maryland, College Park, USA; [4]Army Research Lab, USA.* We grow ZnO thin films and measure their optical absorption by ring-down spectroscopy. At 1650nm we observe a 22,000 finesse in a Fabry-Pérot optical cavity incorporating one 30nm ZnO-coated layer with 10 mΩ●cm surface resistivity.

16:00 -- 18:00
Room: Imperial Ballroom
QTh4A • Atomic Interfaces

QTh4A.1 • 16:00

Generation of Cavity-Coupled Atomic Tweezer Array for Quantum Network*, Matthias Seubert[1], Lukas Hartung[1], Stephan Welte[3], Emanuele Distante[2,1], Gerhard Rempe[1]; [1]Max Planck Inst. for Quantum Optics, Spain; [2]Dipartimento di Fisica e Astronomia, Univeirsitá degli Studi di Firenze, Italy; [3]5. Physikalisches Institut, Universität Stuttgart, Germany.* We show a combination of tweezers and optical lattices for realizing a single-atom array coupled to an optical cavity. Together with single-site addressing, this allows the highly efficient generation of single photons entangled with the atomic state.

QTh4A.2 • 16:30

Full Photon Temporal Waveform Control From Singly Trapped Ions, *Carl Thomas[1], Rebecca Munk[1], Boris Blinov[1]; [1]Univ. of Washington, USA.* We present a novel technique to produce photons with arbitrary temporal waveforms via spontaneous emission by control of an atomic excitation. We demonstrate this technique in a trapped ion system with 0.996 process fidelity.

QTh4A.3 • 16:45

Entanglement Swapping With Two Co-Trapped 40Ca+ Ions for Quantum Repeater Application, *Pascal Baumgart[1], Max Bergerhoff[1], Jonas Meiers[1], Jürgen Eschner[1]; [1]Universität des Saarlandes, Germany.* We demonstrate Hong-Ou-Mandel interference of 854-nm photons emitted by and entangled with two co-trapped 40Ca+ ions, excited by nanosecond 393-nm laser pulses. We present evidence for atom-atom entanglement following a photonic Bell state measurement.

QTh4A.4 • 17:00

Towards Telecommunication-Band Quantum Networking for Atom Arrays, *Andrei Ruskuc[1], Matthew Bilotta[1], Eirini Mandopoulou[1], Brandon Grinkemeyer[1], Danilo Shchepanovich[1], Sophie Ding[2], Offek Tziperman[1], Michel Tao[1], Marko Loncar[2], Kiyoul Yang[2], Vladan Vuletic[3], Mikhail Lukin[1]; [1]Dept. of Physics, Harvard Univ., USA; [2]John A. Paulson School of Engineering and Applied Sciences, Harvard Univ., USA; [3]Dept. of Physics, Massachusetts Inst. of Technology, USA.* We present progress towards telecommunication-band quantum networking with ^{87}Rb using $5P_{3/2}$ to $4D_{5/2}$ transitions. We show correlated emission of 1530nm and 780nm photons, and fabrication of doubly-resonant Fabry-Perot microcavities for efficient photonic coupling.

QTh4A.5 • 17:15

On-Demand Interface Between a Room-Temperature Atomic Vapor Memory and Single Photons From a Semiconductor Quantum dot, *Benjamin Maaß[1,2], Avijit Barua[2], Norman Ewald[1,3], Elizabeth Robertson[1], Kartik Gaur[2], Suk In Park[4], Sven Rodt[2], Jin-Dong Song[4], Stephan Reitzenstein[2], Janik Wolters[1,2]; [1]German Aerospace Center, Germany; [2]Technische Universität Berlin, Germany; [3]Physikalisch-Technische Bundesanstalt, Germany; [4]Korean Inst. of Science and Technology, Korea (the Republic of).* We demonstrate on-demand storage and retrieval of quantum dot single photons in a room-temperature atomic vapor memory with variable storage times. This heterogeneous interface promises applications in buffering and conditioning of quantum information in networks.

QTh4A.6 • 17:30

Mitigation of Longitudinal Electric Field Components in a Standing-Wave Optical Dipole Trap, *Florian L. Fertig[1,2], Chengfeng Xu[1,2], Pooja Malik[1,2], Yiru Zhou[1,2], Harald Weinfurter[1,2]; [1]LMU Munich, Germany; [2]Munich Center for Quantum Science and Technology (MCQST), Germany.* We demonstrate a standing-wave optical dipole trap for single neutral atoms, suppressing effective magnetic field-induced dephasing. This architecture enhances coherence times, scalability, and also offers a pathway to improved quantum networking and multiplexing capabilities.

QTh4A.7 • 17:45

Coupling Slow-Mode Nanophotonics and Cold Atoms : a Versatile Waveguide QED Platform, *Anaïs Chochon[1], Adrien Bouscal[1], Sukanya Mahapatra[1,2], Idriss Douss[1], Valère Sautel[2], Malik Kemiche[2,3], Nikos Fayard[4,5], Jérémy Berroir[1], Tridib Ray[1], Jean-Jacques Greffet[4], Fabrice Raineri[2,6], Ariel Levenson[2], Kamel Bencheikh[2], Christophe Sauvan[4], Alban Urvoy[1], Julien Laurat[1]; [1]Laboratoire Kastler Brossel, Sorbonne Université, CNRS, ENS-PSL, Collège de France, France; [2]Centre de Nanosciences et de Nanotechnologies, CNRS, Université Paris-Saclay, France; [3]IMEP-LAHC, Univ. Grenoble Alpes, Univ. Savoie Mont Blanc, CNRS, Grenoble INP, France; [4]Laboratoire Charles Fabry, Université Paris-Saclay, IOGS, CNRS, France; [5]Université Paris-Saclay, CNRS, Ecole Normale Supérieure Paris-Saclay, CentraleSupélec, LuMIn, France; [6]Université Côte d'Azur, Institut de Physique de Nice, CNRS-UMR 7010, France.* Interfacing cold atoms with nanoscopic dielectric devices offers exciting opportunities for quantum technologies. We focus on enhancing light-matter coupling via slow-mode nanophotonic crystals while addressing challenges in design, nanofabrication, and precise atom delivery near surfaces.

16:00 -- 18:00
Room: Yorkshire A
QTh4B • Quantum Light Sources II

QTh4B.1 • 16:00

A Coherent and Efficient One-Dimensional Atom, *Alisa Javadi[1], N. Tomm[2], N. Antoniadis[2], M. Janovitch[2], R. Schott[3], S. Valentin[3], A. Wieck[3], A. Ludwig[3], P. Potts[2], R.J. Warburton[2]; [1]Univ. of Oklahoma, USA; [2]Univ. of Basel, Switzerland; [3]Univ. of Bochum, Germany.* We achieve 99.2% extinction in cavity transmission using a quantum dot, enabling optical nonlinearities at the two-photon limit. We observe a g2(0) = 587 for transmitted photons, the strongest reported to date.

QTh4B.2 • 16:15

Cavity Quantum Electrodynamics with a Tunable Spin-Inverted Ensemble, *Tian Xie[1], Riku Fukumori[1], jiahui li[1], Andrei Faraon[1]; [1]Caltech, USA. Cavity quantum electrodynamics sits at the heart of quantum information science.* With rare-earth ion ensembles coupling to on-chip resonators, we demonstrate collectively-induced transparency in the spin domain and microwave periodic superradiant emissions.

QTh4B.3 • 16:30

Cryogenic Feedforward of a Photonic Quantum State, *Niklas Lamberty[1,2], Frederik Thiele[1,2], Thomas Hummel[1], Nina A. Lange[1,2], Lorenzo M. Procopio[1,2], Aishi Barua[1,2], Sebastian Lengeling[3], Viktor Quiring[1], Christof Eigner[1], Christine Silberhorn[3], Tim J. Bartley[1,2]; [1]Inst. for Photonic Quantum Systems (PhoQS), Paderborn Univ., Germany; [2]Dept. of Physics, Paderborn Univ., Germany; [3]Integrated Quantum Optics Group, Inst. for Photonic Quantum Systems (PhoQS), Paderborn Univ., Germany.* We perform a feedforward operation at cryogenic temperatures using a multipixel SNSPD, electronic logic and cryogenic lithium niobate modulator. By operating all components in the same cryostat we achieve a latency of (23 ± 3) ns.

QTh4B.4 • 16:45
Coherent Spectral Shift of Single Photons From a Quantum dot, *Sanjay Kapoor[1], Aleksander Rodek[1], Michal Mikolajczyk[1], Jerzy Szuniewicz[1], Filip Sosnicki[1], Tomasz Kazimierczuk[1], Piotr Kossacki[1], Michal Karpinski[1]; [1]Faculty of Physics, Univ. of Warsaw, Poland.* We demonstrate tunable frequency shifting of photons emitted from a quantum dot source using electro-optic phase modulation while preserving the purity and indistinguishability of the source.

QTh4B.5 • 17:00
Generation and Detection of two-Dimensional Quantum States with High Integration and Scalability, *Ze-Kun Jiang[1], Li Wang[1]; [1]Shanghai Jiao Tong Univ., China.* A scheme for generation of two-dimensional correlated biphoton states within integrated photonic systems and direct detection of such states facilated by novel detectors is proposed, which significantly enhances flexibility and scalability compared to conventional methods.

QTh4B.6 • 17:15
High Dimensional Spin-Orbital Entangled States of Single Photons, *S Kumar[1], Yinhui Kan[1], Xujing Liu[1], Liudmilla F. Kulikova[2], Valery A. Davydov[2], Viatcheslav N. Agafonov[3], Sergey I. Bozhevolnyi[1]; [1]Univ. of Southern Denmark (SDU), Denmark; [2]Russian Academy of Sciences, Russian Federation; [3]Université de Tours, France. We demonstrate generation of vectorial spin-orbital photon states in high-dimensional Hilbert spaces, mapping the generated states on hybrid-order Bloch spheres.* We realize these states experimentally with high fidelity utilizing solid-state single-photon sources.

QTh4B.7 • 17:30
New Approaches to Multi-Photon Quantum Interference and Entanglement, *Shreya Kumar[1,2], Alex E. Jones[3], Matthias J. Bayerbach[1,2], Simone E. DAurelio[1,2], Nico Hauser[1,2], Stefanie Barz[1,2]; [1]Inst. for Functional Matter and Quantum Technologies, Universität Stuttgart, Germany; [2]Center for Integrated Quantum Science and Technology (IQST), Univ. of Stuttgart, Stuttgart, Germany, Germany; [3]Quantum Engineering Technology Labs, Univ. of Bristol, UK.* We study three-photon quantum interference and entanglement using beam splitters, revealing scattering statistics influenced by distinguishability, mixedness, and symmetry. Furthermore, genuine tripartite-entangled states are generated, achieving up to (87.3±1.1)% fidelity, with implications for photonic quantum technologies.

QTh4B.8 • 17:45
Electrically Contacted Bullseye Resonators for Telecom Quantum Light Sources, *Andrea Barbiero[1], Ginny Shooter[1], Joanna Skiba-Szymanska[1], Tina Muller[1], Iwan Davies[2], Benjamin Ramsay[3], David Ellis[3], Andrew Shields[1], Mark Stevenson[1]; [1]Toshiba Europe Ltd, UK; [2]IQE Europe Ltd, UK; [3]Cavendish Laboratory, Univ. of Cambridge, UK. Quantum dots (QDs) in bullseye resonators can produce single photons with high purity and efficiency.* We present the experimental characterization of telecom QD single-photon sources based on a bullseye design compatible with electric field control.

16:00 -- 18:15
Room: Yorkshire B
QTh4C • Quantum Frequency Conversion

QTh4C.1 • 16:30
Collective Dynamics of a Nitrogen-Vacancy Center Ensemble in Diamond Coupled to a Microwave Mode at Room Temperature, *Himanshu Kumar[1], Rahul Gupta[1], Himadri S. Dhar[1], Kasturi Saha[1]; [1]Indian Inst. of Technology Bombay, India.* We perform spectroscopic study of an ensemble of nitrogen-vacancy (NV) centers in diamond coupled to a high-Q factor microwave cavity and model their behavior using quantum Langevin equations. Our setup highlights the strong possibility of exploring promising quantum protocols in NV center based cavity QED system at room temperature.

QTh4C.2 • 16:45
Bidirectional Two-Stage Quantum Frequency Conversion for SnV-Resonant Photons to the Telecom C-Band, *David Lindler[1], Tobias Bauer[1], Marlon Schäfer[1], Christoph Becher[1]; [1]AG Becher, Universität des Saarlandes, Germany.* We present a bidirectional quantum frequency conversion scheme for photons resonant with SnV-centers in diamond to the telecom C-band, based on two-stage difference frequency generation in PPLN waveguides.

QTh4C.3 • 17:00
Towards Optical Networking of Superconducting Quantum Nodes: Characterization of Two-Mode Squeezed States and an Opto-Electro-Mechanical Quantum Transducer, *Siva Pradyumna Tekuru[1,2]; [1]National Inst. of Standards and Technology, USA; [2]Dept. of Physics, Univ. of Colorado Boulder, USA.* Non-degenerate, bright, two-mode squeezed states of 2.6 dB were generated for injection into a quantum transducer cavity. We employed a series of Gaussian states to quantify the information capacity from optical to microwave domains.

QTh4C.4 • 17:15
Overcoming the Fundamental Limit of Quantum Transduction via Intraband Entanglement, *Haowei Shi[1], Quntao Zhuang[1]; [1]Univ. of Southern California, USA.* We propose to noiselessly boost the efficiency of conventional quantum transducers by consuming intraband entanglement. For example, by concatenating microwave-microwave two-mode squeezing operations with the transducer, the protocol amplifies optical-to-microwave transduction efficiency without added noise.

QTh4C.5 • 17:30
Withdrawn

QTh4C.6 • 17:45
Flexible Interband Frequency Conversion in Photonic Crystal Microresonators, *Jordan R. Stone[1], Yi Sun[1], Xiyuan Lu[1], Kartik Srinivasan[1]; [1]National Inst of Standards & Technology, USA.* We demonstrate interband frequency conversion between 795 nm and 950 nm in photonic

crystal microresonators. Our scheme expands the design space for frequency converters spanning the visible and near-infrared, including telecom wavelengths.