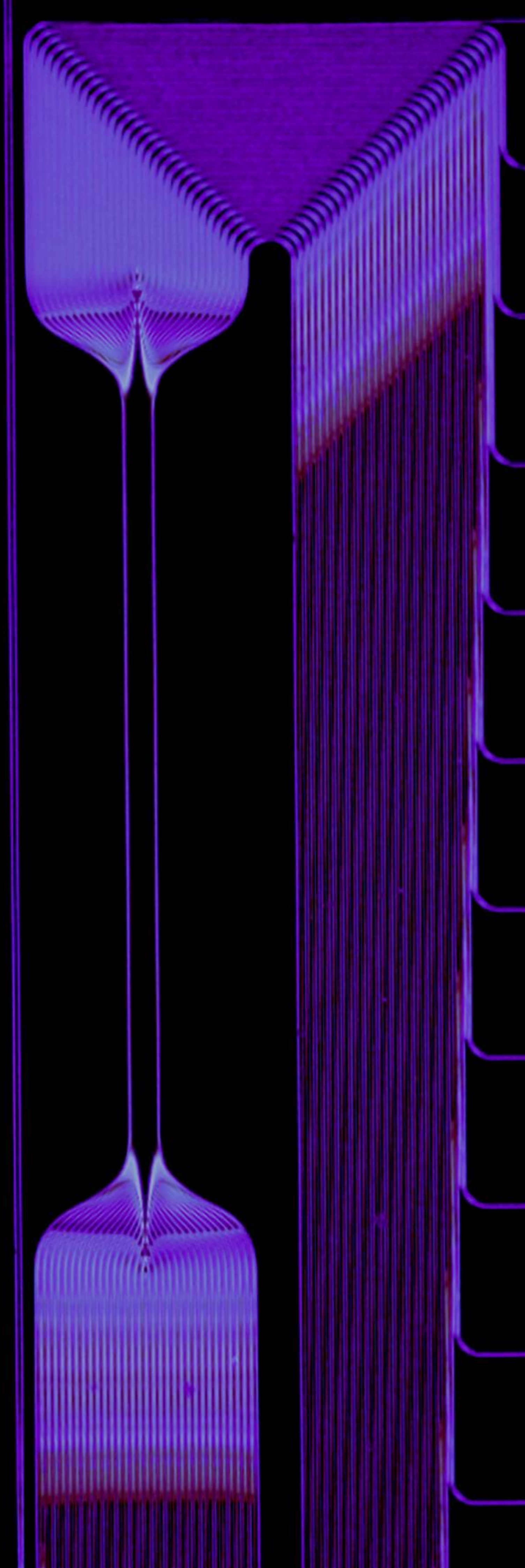
BQIT:24

Eleventh Annual Bristol Quantum Information Technologies Workshop

22-24 April 2024



QET Labs

University of BRISTOL

CONTENTS

PROGRAMME COVER IMAGE: ED DEACON (UNIVERSITY OF BRISTOL)

CODE OF CONDUCT

The BQIT team is dedicated to providing a harassment-free hybrid conference experience for everyone, regardless of gender, gender identity and expression, age, sexual orientation, disability, physical appearance, body size, race, ethnicity, religion (or lack thereof) or technology choices. We do not tolerate harassment of workshop participants in any form. Sexual language and imagery is not appropriate for any workshop platform, including talks, panels, dinners, Twitter and other online media. Workshop participants violating these rules may be sanctioned or expelled from BQIT:24 at the discretion of the workshop organisers.

WELCOME TO BQIT:24

Welcome all to BQIT:24, the eleventh edition of the Bristol Quantum Information Technologies Workshop. It is an absolute pleasure to have you all here – both in person and online – at what we know will be an exciting few days of stimulating discussions, talks and posters.

Bristol has a rich history in quantum science and technology. In the early 20th century Paul Dirac studied engineering mathematics here before going on to carry out his seminal work in atomic quantum theory and his prediction of antimatter, earning himself a Nobel Prize. Later, Lennard-Jones worked here on the early forms of quantum chemistry, while Walter Heitler and Hans Bethe were in Bristol during the mid-20th Century working on quantum electrodynamical forces. Around the same time, Nevill Mott carried out his seminal work on the quantum foundations of the theory of metals and semiconductors, for which he was awarded a Nobel Prize. In the 1950's David Bohm moved to Bristol with his then graduate student Yakir Aharanov, whose names are now combined in every physics textbook describing the interaction of charged particles with electromagnetic fields, the famous Aharanov-Bohm effect. In the 1960's Michael Berry joined the School of Physics here in Bristol, developing the theory behind geometric phases which have become hugely important in quantum processing schemes. At the end of the 20th Century, a number of academics were recruited to Bristol in quantum information theory, starting with Sandu Popescu, followed by hires in experimental quantum optics including John Rarity and Jeremy O'Brien. This resulted in the founding of the Centre for Quantum Photonics, which later evolved into the Quantum Engineering Technology Laboratories (QET Labs) that is currently home to fifteen principal investigators and host to BQIT's past and present.

This long academic history and its culmination in quantum technology development here in Bristol is accompanied by the history we have in running BQIT. A precursor to BQIT was the Quantum Photonics Workshop, which was held in the Nanoscience and Quantum Information Building in 2009. This was so successful that we knew we had to continue to provide a platform for world-leading researchers to share their work. With the continued growth of quantum technologies globally, we took the decision to expand the remit to the many technology platforms and applications being pursued, and this eleventh edition of BQIT is no different. We have speakers discussing technology platforms ranging from Rydberg atoms and trapped ions through to molecular qubits and defects in diamond. We have talks and posters spanning the full gamut of quantum applications including communications, sensing, imaging, computing, and tests of fundamental physical phenomena. We are excited to see what new areas of overlap and ideas come from the discussions that BQIT enables.

Over the years we have worked to ensure that BQIT is as inclusive and accessible as possible, and have learnt a lot from taking BQIT virtual in 2020 and 2021, to hybrid since 2022. This year we continue that tradition and bring you a hybrid conference, allowing those that require it the ability to attend online as well as bringing others together in person. We trust that interactions between all attendees, both online and in-person, will be plentiful and fruitful, and that everyone has a thoroughly enjoyable week. We have a number of activities lined up for you all, including a drinks reception, a laser tag networking event, an equity, diversity and inclusion workshop, and dinner in Bristol Museum. We are also extremely grateful and happy to be hosting a large number of industrial sponsors for BQIT this year, and we hope you enjoy interactions with them as well.

With that, the only thing left to say is have a wonderful and productive week, and enjoy all that Bristol has to offer. We look forward to meeting you all and enjoying BQIT:24 together.

Alex Clark, on behalf of the BQIT board

VENUE & PARKING

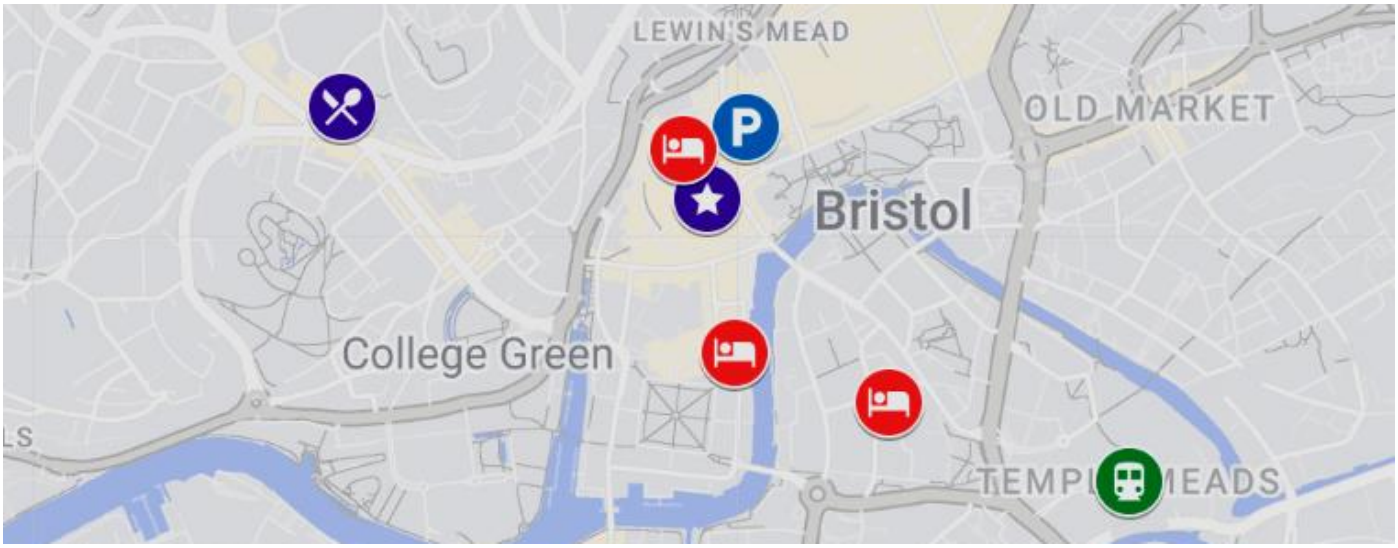
Bristol Harbour Hotel

53-55 Corn St, Bristol BS1 1HT

The in-person component of BQIT:24 will be held in the Bristol Harbour Hotel.

Parking is available at the nearby NCP with a 20% discount.

Drinks will be served at our event venue following the poster session on the first day of our workshop (Monday 22 April) at 5pm.



WORKSHOP DINNER

Bristol Museum & Art Gallery

Queens Rd, Clifton, Bristol BS8 1RL

If you have registered for this year's conference dinner, we invite you to join us at the Bristol Museum & Art Gallery following Day Two of our workshop (Tuesday 23 April). Drinks will be served at 6.30pm, with dinner at 7.15pm.

The Bristol Museum & Art Gallery can be found up the hill towards the University, a short 15/20 minute walk (or bus ride!) away.

If you have not registered for our dinner, but are interested in attending, please speak to someone at our reception desk, or email us at bqit-admin@bristol.ac.uk.

DAY ONE AGENDA
MONDAY
APRIL 22

TIME	EVENT	LENGTH
09.30	Alex Clark (University of Bristol) *Welcome and opening of the workshop*	15 min
	Session One: chaired by Sahra Ahmed Kulmiya (University of Bristol)	
09.45	Jonathan Pritchard (University of Strathclyde) *Scalable qubit arrays for quantum computation and optimisation*	25 min
10.10	F. Raphaël Lebrun-Gallagher (University of Sussex) *Scaling trapped-ion quantum computers using inter-module ion transport operations*	25 min
10.35	Selwyn Simsek (Quantinuum) *H_2 on H2: estimating the ground state energy of hydrogen with logical qubits*	25 min
11.00	Félix Bussières (IDQuantique) *Sponsor talk: Title: 28-pixel SNSPD for high-photon-number efficiency and ultrahigh detection rates*	10 min
	Session Two: chaired by Siddarth Joshi (University of Bristol)	
11.30	Urbasi Sinha (Raman Research Institute) *New explorations in free space quantum communications: Towards a world connected with quantum*	25 min
11.55	Mustafa Gündoğan (Humboldt-Universität zu Berlin) *What can you do with quantum memories in space?*	25 min
12.20	Jasminder Sidhu (University of Strathclyde) *Long-range quantum communications*	25 min
12.45	Debarshi Das (University College London) *Testing whether gravity acts as a quantum entity when measured*	15 min

Session Three: chaired by Cyril Torre (University of Bristol)

14.00	Anna Paterova (Institute of Materials Research and Engineering A*STAR) *Infrared micro-spectroscopy with visible light*	25 min
14.25	Javier Sabines Chesterking (Xanadu) - **presenting online** *Quantum measurement enables single biomarker sensitivity in flow cytometry*	25 min
14.50	Weijie Nie (University of Bristol) *Quantum-Inspired Frequency-Agile Sources for Real-World Rangefinding*	25 min
15.15	Martin Bielak (Palacký University Olomouc) - **presenting online** *All-fiber microendoscopic polarization sensing at single-photon level aided by deep-learning*	15 min

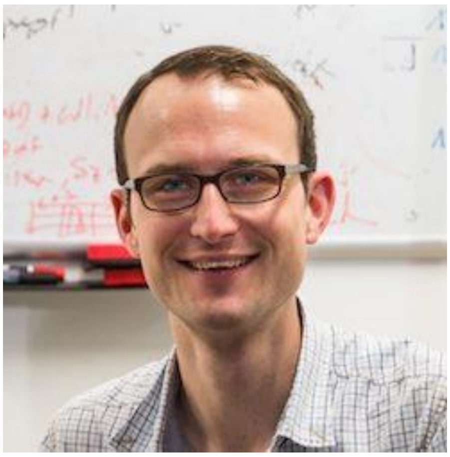
Session Four: Poster session

16.00	Poster session	60 min (continues into drinks reception)
17.00	**Drinks reception at the event venue**	

Welcome drinks at Bristol Harbour Hotel

Drinks and canapés will be served at our event venue following the poster session at 5pm.

DAY ONE ABSTRACTS



Jonathan Pritchard

University of Strathclyde

Scalable qubit arrays for quantum computation and optimisation

Neutral atoms have emerged as a powerful and scalable platform for quantum computing, offering the ability to generate large numbers of identical and high quality qubits in reconfigurable arrays. By coupling atoms to highly excited Rydberg states with strong, long-range dipole -dipole interactions it is possible to perform high-fidelity two and multi-qubit gate operations, or to natively implement classical graph optimisation problems, highlighting the versatility for performing both analogue and digital quantum computing.

In this talk we will present work at Strathclyde focused on developing large-scale system for quantum computing and optimisation, including demonstration of high fidelity single qubit gate operations on up to 225 qubits with errors below the threshold for fault tolerance using a non-destructive readout technique, as well as initial results from performing weighted graph optimisation using programmable local light-shifts across the atom array. This provides a route to embedding a wider class of problems including quadratic unconstrained binary optimisation (QuBO) and integer factorisation.

F. Raphaël Lebrun-Gallagher

University of Sussex

Scaling trapped-ion quantum computers using inter-module ion transport operations

Trapped ions are among the most mature quantum computing hardware platforms. However, to deliver on some of the most disruptive quantum computing applications, trapped ion quantum computers must operate in the fault-tolerant regime. This imparts a large physical qubit overhead for quantum error correction with hundreds of thousands or millions of qubits being required. A main problem is therefore to develop techniques capable of supporting operation with such large qubit numbers.

Here, I will discuss how a significant barrier to scaling up trapped ion quantum computers is removed by executing quantum gates using voltages applied to a microchip together with microwave fields. By using arrays of microfabricated electrodes many qubits can be housed onto a single microchip and quantum algorithms can be executed via a sequence of quantum gates and ion transport operations. To go beyond the number of qubits afforded within a single microchip and reach the qubit numbers required for fault-tolerant utility-scale quantum computation, microchip modules can be connected via electric fields. We present the experimental demonstration of this inter-module link by transporting ions at a rate of 2424 s^{-1} and measure no impact on the phase coherence of the qubit.

Selwyn Simsek

Quantinuum

H_2 on H2: estimating the ground state energy of hydrogen with logical qubits

Quantum chemistry is one of the most promising applications of a quantum computer. In order to solve chemistry problems of reasonable size on a quantum computer, quantum error correction must be employed so that the results of the large computations are not destroyed by accumulated errors before they are completed. Quantum error correction, while effective, requires many additional qubits and needs to be executed on a powerful quantum computer with low error rates. In this talk, I will present work concerning the first (to our knowledge) solution of a useful quantum chemistry problem using error-corrected logical qubits on any quantum computer. We propose the computation of the ground state energy of a diatomic hydrogen molecule on the Quantinuum H2-1 quantum computer with logical qubits encoded using the seven qubit Steane code. I will discuss the quantum error correction techniques that make this possible and present some preliminary results.

Félix Bussières

IDQuantique

Sponsor talk: Title: 28-pixel SNSPD for high-photon-number efficiency and ultrahigh detection rates

Superconducting nanowire single-photon detectors (SNSPDs), with their unmatched overall set of performance, are now a fundamental tool to develop and build optical quantum technologies. To extend their enabling potential for quantum communication and quantum computing systems, IDQ developed a new generation of detectors that achieve extremely high detection rates (up to 250 Mcps with a single detector, and up to 1 Gcps with a few detectors) combined with high-performance photon-number resolution (with state-of-art few-photon efficiencies). Interestingly, the design of the detectors allows them to keep a very low jitter even at high detection rates, a feature that is generally necessary to increase the rate quantum communication protocols. I will also introduce our new rackmountable SNSPD cryostat, designed for highly integrated quantum-optical systems.

Urbasi Sinha

Raman Research Institute

New explorations in free space quantum communications: Towards a world connected with quantum

In India, our Quantum Information and Computing lab at RRI Bangalore is working on a mega project called Quantum Experiments with Satellite Technology (QuEST) in collaboration with the Indian Space Research Organization. This is India's first satellite based Quantum Key Distribution (QKD) project which aims to develop indigenous technologies for satellite based QKD towards a quantum secure future for India. Here, we will report on several milestones in free space quantum communications, achieved by the QuEST project. The first involves the development of a novel, indigenous QKD simulation toolkit qkdSim, as well as the establishment of a prepare and measure based QKD experiment. The simulation results match well with experiment; a representative key rate and the quantum bit error rate from experiment is 51±0.5 kbit/sec and 4.79% ±0.01% respectively, wherein the simulation yields 52.83±0.36 kbit/sec and 4.79%±0.01%, respectively. With this, we establish a prepare and measure based QKD protocol in the lab with an indigenous novel simulation toolkit, both very important milestones towards our quest for satellite based QKD in India. We will then discuss our demonstration of free space entanglement based quantum communication between two buildings at RRI through an atmospheric channel, the first such demonstration in India, first performed in February 2021. Next we will discuss our recent work on passive feedback based polarisation scrambling mitigation, a crucial requirement for long haul quantum communications. One of the major challenges in long distance quantum communications is the polarization degree of freedom of single-photons getting affected while transmission through optical fibres, or atmospheric turbulence. Conventionally, an active feedback-based mechanism is employed to achieve real-time polarization tracking. In this work, we propose an alternative, less resource intensive, passive feedback based approach. As a proof-of-principle demonstration, we implement an in-lab BBM92 protocol to exemplify the performance of our technique. We have also followed this up by showing the efficacy of this method across our free space quantum communications link. We will end with our broad vision for the future in terms of a global quantum communication network.

Mustafa Gündoğan

Humboldt-Universität zu Berlin

What can you do with quantum memories in space?

Quantum memories (QMs) are central to many tasks in quantum information science, from long-distance communication to computing. As a result, there has been tremendous progress in the development of these devices in recent years. At the same time, atomic and quantum physics experiments have made a leap into orbit: for example, Bose-Einstein condensates (BEC) can now be routinely generated in orbit, while space-based sources of entangled photons have enabled quantum communication over long distances that would otherwise be impossible with optical fibres.

In this talk I will present our recent efforts at the intersection of these fields: how atomic quantum memories can be used in space, and how operating these devices in space would have advantages over their land-based counterparts. In this context, we have shown that satellites equipped with QMs would enable truly global quantum networking and experiments to explore the interface between quantum mechanics and gravity. We have also shown that the microgravity environment could increase the performance of BEC quantum memories by several orders of magnitude.

Jasminder Sidhu

University of Strathclyde

Long-range quantum communications

The space domain provides long lines of sight and low losses of free-space optical transmission. For quantum technologies, these properties provide an ideal platform to expand the range of quantum networks and distributed applications. Space quantum technologies is therefore a topic of increasing importance to develop long-range secure communications, enhanced sensing and imaging, and networked quantum computing. However, using satellites for networked quantum information protocols is beset with challenges. Namely, the quantum channel between a satellite and an optical ground station can only be established and maintained for a limited time window and has a highly dynamic loss due to atmospheric turbulence and attenuation. This talk will detail advances that account for these challenges in satellite-based quantum key distribution and model real-world engineering constraints for upcoming satellite missions. It will summarise with an overview on how satellite-based networks can support near-term distributed quantum technologies.

Debarshi Das

University College London

Testing whether gravity acts as a quantum entity when measured

A defining signature of classical systems is their in principle measurability without disturbance: a feature manifestly violated by quantum systems. We show that this can be used to test the non-classicality of the gravitational field generated by a source in quantum superposition. To this end, we describe a multi-interferometer experimental setup that can, in principle, reveal the non-classicality of a superposition-sourced gravitational field by showing that it is necessarily disturbed by a measurement of gravity. While one interferometer sources the field, the others are used to measure the gravitational field created by the superposition. The resulting measurement induced quantum update of the state (disturbance) is evidenced through spin measurement statistics. This test, when added to the recently proposed entanglement-witness based tests, enlarge the domain of quantum mechanical postulates being tested for gravity. Moreover, the proposed test yields a signature of quantum measurement induced disturbance for any rate of decoherence, and is device independent.

Anna Paterova

*Institute of Materials Research and Engineering A*STAR*

Infrared micro-spectroscopy with visible light

Infrared spectro-microscopy is a powerful technique for spatial chemical analysis of a specimen. However, the performance of infrared spectro -microscopy instruments can be affected by a strong water absorption, which may overlap with the spectral fingerprints of components of the sample. Microfluidic chips offer ultimate control over the water layer thickness and are widely used in the infrared spectro-microscopy. In our recent work, we perform infrared imaging with conventional FTIR and quantum infrared microscopy technique and test the limitations on water layer thickness in microfluidic devices. We show that novel quantum IR microscopy shows on-par performance with the FTIR allowing for measurement of the absorption spectrum in the mid-infrared region.

Javier Sabines Chesterking

Xanadu

Quantum measurement enables single biomarker sensitivity in flow cytometry

Exploiting the quantum properties of light enables unprecedented sensitivity, surpassing classical methods in both state generation and detection. In my talk, I will explore two examples of quantum advantage. First, I will discuss how generating photon pairs through down-conversion can surpass the shot noise limit, enabling sub-shot noise imaging and furthermore, our ability to probe biological samples at the single-photon level allow us to answer fundamental questions, such as the what are the mechanisms initiate photosynthesis. Second, I will delve into the detection of fluorescence and luminescence using autocorrelation (g2) measurements. This approach facilitates single-emitter resolution, enabling measurements with unprecedented sensitivity for the quantification of biomarkers.

Weijie Nie

University of Bristol

Quantum-Inspired Frequency -Agile Sources for Real-World Rangefinding

Quantum illumination has been investigated in the field of remote sensing due to its sensitivity enhancement in challenging sensing environments, stemming from the entanglement and correlation properties inherent in quantum light. Quantum rangefinding, illuminated by an energy-time correlated photon pair source, can heightened detection sensitivity by filtering uncorrelated noise. Moreover, the heralded single photon sent to the object, exhibits super-Poissonian statistics, essentially rendering them undetectable from the background. Nevertheless, the performance of quantum rangefinding is constrained by the source brightness, crucial for remote distance and practical detection scenarios. Inspired by the quantum illumination, we proposed a novel semi-classical optical source designed to enhance brightness while preserving the noise reduction advantages stemming from energy-time correlation, thus catering to real-world rangefinding applications. By dispersing a broad-band optical pulse in time and carving out three wavelength channels using an electro-optic modulator with suitably delayed drive pulses, we developed a three-channel frequency-agile source and incorporated it into a rangefinder. The feasibility of whole platform has been tested by illuminating a Lambertian target located over 150 meters away. The brightness achieved was orders of magnitude higher than that of a quantum source, showcasing the potential for extended distance and real-time covert rangefinding applications.

Martin Bielak

Palacký University Olomouc

All-fiber microendoscopic polarization sensing at single-photon level aided by deep-learning

The polarization of light conveys crucial information about the spatial ordering and optical properties of a specimen. However, precise polarization measurement in challenging conditions, including constrained spaces, low light levels, and high-speed scenarios, remains a severe challenge. Addressing this problem, we introduce a real-time polarization measurement method accurate down to a single-photon level that provides complete information about the polarization state. Free of moving components, the polarization sensor utilizes a few-mode fiber followed by a fiber array and a detector array. The calibration of the sensor relies on a neural network yielding unprecedented accuracy across all polarization states, including partially polarized light. We validate the approach by visualizing the polarization structure of a biological specimen. Our method offers an efficient and reliable solution for real-time polarization sensing and microendoscopy under low-light conditions.

DAY TWO AGENDA
TUESDAY APRIL 23

TIME	EVENT	LENGTH
Session Five: chaired by Andrew Young (University of Bristol)		
09.30	Carlos Anton Solanas (Universidad Autónoma de Madrid) *Photon number encoding: superposition, entanglement and beyond*	25 min
09.55	Arno Rauschenbeutel (Humboldt-Universität zu Berlin) *Correlating photons using the collective nonlinear response of atoms weakly coupled to an optical mode*	25 min
10.20	Sam Bayliss (University of Glasgow) *Optically detected coherent spin manipulation in molecules at room temperature*	25 min
Session Six: chaired by Jon Pugh (University of Bristol)		
11.15	**Equity, Diversity & Inclusion session : Inclusivity in Academic Networking** Co-chaired by Oliver Green, Siddarth Joshi and Zulekha Samiullah With talks by: Caroline McKinnon and Zulekha Samiullah	105 min

Session Seven: chaired by Oliver Green (University of Bristol)

14.00	Massimo Borghi (University of Pavia) *Photon statistics of squeezed light from a silicon nitride microresonator without photon number resolving detectors*	25 min
14.25	Molly Thomas (University of Bristol) *Path-encoded multidimensional entanglement distribution between integrated photonic devices*	25 min
14.50	Amy Foster (John Hopkins University) *Sputtered Metal Oxides for Linear and Nonlinear Integrated Photonics*	25 min
15.15	Kasper Nielsen (NBI) *Programmable nonlinear photonic circuits*	15 min

Session Eight: chaired by Ryan Tiew (University of Bristol)

15.50	Ophelia Crawford (Riverlane) *Error-corrected Hadamard gate simulated at the circuit level*	25 min
16.15	Armanda Quintavalle (Freie Universität Berlin) *(Some) Logical operations on (some) LDPC codes*	25 min
16.40	Dolev Bluvstein (Harvard University) - **presenting online** *Logical quantum processor based on reconfigurable atom arrays*	25 min
17.05	Georgia Nixon (University of Cambridge) *Local Control of Tunnelling in Optical Lattices*	15 min
18.30	**Drinks and dinner at the Bristol Museum & Art Gallery**	

Dinner at the Bristol Museum & Art Gallery

If you have registered for this year's conference dinner, please make your way to the Bristol Museum.

Drinks will be served at 6.30pm, dinner at 7.15pm.

DAY TWO ABSTRACTS

Carlos Anton Solanas

Universidad Autónoma de Madrid

Photon number encoding: superposition, entanglement and beyond

A two-level system, excited under a pulsed resonant drive of area θ, emits photon-number superposition states composed by vacuum and a single photon in the form $\cos(\theta/2)|0\rangle+\sin(\theta/2)|1\rangle$. It has been observed that such superposition states may affect the performance of heralded quantum gates, and they could be useful in photon-based quantum information protocols. For example, these states have been recently used in a teleportation scheme. In parallel, recent experiments with natural and artificial atoms, using a sequential two-pulse excitation, have demonstrated the generation of time-entangled states of the form $1/\sqrt{2}(|0e0l\rangle+|1e1l\rangle)$ or $1/\sqrt{2}(|1e0l\rangle+|0e1l\rangle)$, where the subindex e and l refer to early and late time-bins, respectively. The generation of such entanglement is rooted to the atomic spontaneous emission mechanism, and it is easily scalable towards multi-partite entanglement simply by adding more consecutive laser pulses.

In this talk, we will discuss such superposition and entanglement generation schemes and show recent experimental results to generate high-dimensional entanglement (encoded in the photon number basis) from a three-level system (a biexciton-exciton cascade in a semiconductor quantum dot), using again a simple excitation scheme composed by two delayed resonant pulses. These complex states could offer some advantageous solutions in quantum communication protocols.

Arno Rauschenbeutel

Humboldt-Universität zu Berlin

Correlating photons using the collective nonlinear response of atoms weakly coupled to an optical mode

Non-classical states of light – such as single photons or entangled photon pairs – are a key resource for quantum science and technology, and their generation is a very active area of research. In this context, it has been predicted that resonant laser light, when simply transmitted through an ensemble of two-level emitters, can evolve into a quantum-correlated state of light [Phys. Rev. Lett. 121, 143601 (2018)]. According to this work, the weak nonlinear response of the individual emitters can be collectively enhanced, leading to a correlated transport of photons through the ensemble. Using laser-cooled atoms that are trapped and optically interfaced with a nanophotonic waveguide, this effect has recently been demonstrated by our group. Depending on the experimental parameters, the output light exhibits photon bunching and anti-bunching [Nat. Photonics 14, 719 (2020); Phys. Rev. Lett. 131, 183601 (2023)] or quadrature squeezing [Phys. Rev. Lett. 127, 123602 (2021)], while maintaining excellent coherence properties and indistinguishability. My talk will introduce this new mechanism of nonlinear photon transport and discuss its future applications.

Sam Bayliss

University of Glasgow

Optically detected coherent spin manipulation in molecules at room temperature

Optically addressable spins are a promising platform for quantum technologies due to their ability to be readily prepared, coherently controlled, and read out—even at room temperature—as exemplified by remarkable demonstrations with solid-state defects such as the nitrogen-vacancy centre in diamond. Due to their tunability through synthetic chemistry and the versatile deployment methods available to them, molecular systems offer an attractive complementary platform for hosting optical-spin interfaces. Such systems could be particularly beneficial for quantum sensing where, for example, precise spatial control between sensor and target is desired. To realise the potential of molecular spins for quantum sensing, achieving the combination of room-temperature operation, coherent spin control, and optical readout is desirable, however this has remained elusive. Here we demonstrate such room-temperature optically detected coherent control in a molecular platform, realising high spin-dependent optical contrasts and key optically detected coherence measurements. We demonstrate the opportunities of molecular deposition techniques by extending these results to a thermally evaporated thin film, and further show how multi-level spin manipulation can improve the spin-optical dynamics relevant for quantum sensing. Overall, these results highlight promise for room-temperature quantum sensing and imaging with molecular spins.

Caroline McKinnon & Zulekha Samiullah

University of Bristol

EDI session: Inclusivity in Academic Networking

Professional networking is deemed necessary in the field of science, often feeling like a requirement to form consortia/collaborations for grants and to disseminate research. The team realised that our networking tends to feature the same locations and with often the same group of people. Are we inadvertently excluding people and missing out on new contacts and opportunities as a result? This session will explore the efficacy of common networking methods and how inclusive our professional networks are to everyone in the field. We aim foster discussion about what we should be aware of and think about when engaging in professional networking and come up with new ideas of activities and networking opportunities we can take away with us. Spurred on by a recent push for different social opportunities within QET Labs, the BQIT team wanted to challenge the norm for networking through the Laser Fusion social on the first day of the conference and hope this unconventional session will be food for thought for this session.

Massimo Borghi

University of Pavia

Photon statistics of squeezed light from a silicon nitride microresonator without photon number resolving detectors

The measurement of the photon number distribution (PND) allows one to extract metrics of non-classicality of fundamental and technological relevance, but in principle it requires the use of detectors with photon number resolving capabilities. Alternative strategies based on threshold detectors, i.e. detectors that can only discriminate between vacuum and the presence of one or more photons, have been proposed. One of them consists in exploiting the nonlinear photodetection probability of Fock states with different photon numbers in presence of losses. In this work we reconstruct the PND of two-mode pulsed squeezed light generated from a silicon nitride microresonator using threshold detectors and variable optical attenuations. The PNDs are characterized up to ~ 1.2 photons/pulse, through which we extracted an on-chip squeezing level of 6.2(2) dB and a noise reduction factor of −3.8 (2) dB. The PNDs are successfully reconstructed up to an Hilbert space dimension of 6 × 6. We evaluate the impact of self and cross phase modulation on the generation efficiency in case of a pulsed pump, and validate the results through numerical simulations of the master equation of the system.

Molly Thomas

University of Bristol

Path-encoded multidimensional entanglement distribution between integrated photonic devices

Here we present the experimental distribution of four-dimensional entangled qudits between integrated photonic devices. Qudits offer advantages over qubits such as higher information capacity, and improved noise robustness. Integrated photonics allows for the reliable preparation and manipulation of large-scale entangled quantum states on a single device, with outstanding phase stability. However, reliable transmission of these states between devices, integrated or otherwise, has been a challenge, mainly due to the difficulty of maintaining phase stability between multiple optical channels. We implement an active phase stabilisation algorithm, utilising the same circuitry as for the quantum states, enabling stable distribution of qudits.

Amy Foster

John Hopkins University

Sputtered Metal Oxides for Linear and Nonlinear Integrated Photonics

Integrated quantum photonics requires a platform with low propagation loss, high-refractive index contrast, transparency across visible to SWIR wavelengths, and high nonlinearity. While the foundry-available materials of crystalline silicon (c-Si) and stoichiometric silicon nitride (Si3N4) aim to address these needs, there is an opportunity to explore other materials that can improve on these metrics. For example, a trade-off exists between device compactness and low optical loss for these two commercially available platforms. Additionally, the foundry-level platforms suffer from limitations in their fabrication conditions that prevent them from back-end-of-the-line compatibility. Here we will present our results in sputtered metal oxide integrated photonics; a promising alternative platform for integrated quantum photonics over the industry-adopted silicon-based materials regarding both compatibility and optical performance. We will show that sputtered metal oxides provide broad transparency, high refractive index contrast, high nonlinearity, low-propagation loss, and BEOL compatibility.

Kasper Nielsen

NBI

Programmable nonlinear photonic circuits

The lack of direct interactions between photons prevents deterministic nonlinear operations in optical circuits processing single photons - a central obstacle in photonic quantum technologies.

Here, we demonstrate multi-mode nonlinear photonic circuits where both linear and nonlinear operations can be programmed with high precision and deterministically at the single-photon level.

This is obtained by embedding a tunable quantum dot mediating interactions between single photons within a temporal linear optical interferometer. By scattering photon pulses of the quantum dot the nonlinearity is obtained.

We demonstrate the capability to reprogram the nonlinear photonic circuits to implement various protocols where strong nonlinearities are required - deterministic photonic simulation of anharmonic quantum molecular dynamics and photon number sorting - showcasing new key functionalities enabled by our technology.

Ophelia Crawford

Riverlane

Error-corrected Hadamard gate simulated at the circuit level

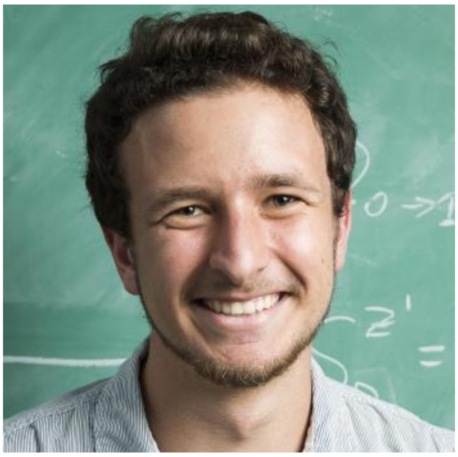
In this talk, I will present results of simulating the logical Hadamard gate in the surface code under a circuit-level noise model, compiling it to a physical circuit on square-grid connectivity hardware. This work is the first to do this for a logical unitary gate on a quantum error-correction code. Two proposals are considered, both via patch deformation: one that applies a transversal Hadamard gate (i.e. a domain wall through time) to interchange the logical X and Z strings, and another that applies a domain wall through space to achieve this interchange. The physical circuits are optimised, and their logical failure probabilities evaluated. They are found to be comparable to those of a quantum memory experiment for the same number of quantum error-correction rounds. I will present syndrome-extraction circuits that maintain the same effective distance under circuit-level noise as under phenomenological noise. I will also explain how a SWAP-quantum error-correction round (required to return the patch to its initial position) can be compiled to only four two-qubit gate layers. This can be applied to more general scenarios and provides an alternative construction of the “stepping” circuits of McEwen, Bacon and Gidney (2023).

Armanda Quintavalle

Freie Universität Berlin

(Some) Logical operations on (some) LDPC codes

Error correction codes would be of no use without a method for dynamically manipulating the information they store. While the literature offers several techniques for performing gates on codes with just one logical qubit, there are far fewer solutions available for codes that encode multiple logical qubits. In this paper, we introduce an approach to implement logical encoded gates within hypergraph product codes, even for codes with multiple logical qubits. Our method extends the concept of transversal gates and relies on partitioning the physical qubits within the code in alignment with its logical structure. After demonstrating the fault tolerance of our method, we showcase its application in realizing certain Clifford gates for hypergraph product codes that adhere to specific symmetry constraints.



Dolev Bluvstein

Harvard University

Logical quantum processor based on reconfigurable atom arrays

Suppressing errors is one of the central challenges for useful quantum computing, requiring quantum error correction for large-scale processing. However, the overhead in the realization of error-corrected "logical" qubits, where information is encoded across many physical qubits for redundancy, poses significant challenges to large-scale logical quantum computing. In this talk we will discuss recent advances in quantum information processing using dynamically reconfigurable arrays of neutral atoms. With this platform we have realized programmable quantum processing with encoded logical qubits, combining the use of 280 physical qubits, high two-qubit gate fidelities, arbitrary connectivity, and mid-circuit readout. Using this logical processor with various types of error-correcting codes, we demonstrate that we can improve logical two-qubit gates by increasing code size, outperform physical qubit fidelities, create logical GHZ states, and perform computationally complex scrambling circuits using 48 logical qubits and hundreds of logical gates. We find that this logical encoding substantially improves algorithmic performance with error detection, outperforming physical qubits at both benchmarking and quantum simulations. These results herald the advent of early error-corrected quantum computation, enabling new applications and inspiring a shift in both the challenges and opportunities that lay ahead.

Georgia Nixon

University of Cambridge

Local Control of Tunnelling in Optical Lattices

Ultracold atoms in optical lattices have emerged as powerful quantum simulators of translationally invariant systems with many applications e.g. in strongly-correlated and topological systems. However, the ability to locally tune all Hamiltonian parameters remains an outstanding goal that would enable the simulation of a wider range of quantum phenomena. Motivated by recent advances in quantum gas microscopes and optical tweezers, we here show theoretically how local control over individual tunnelling links in an optical lattice can be achieved by incorporating local time-periodic potentials. We propose to periodically modulate the on-site energy of individual lattice sites and employ Floquet theory to demonstrate how this provides full individual control over the tunnelling amplitudes. We provide various example configurations realising interesting applications such as measuring the Hawking radiation of 1D and 2D black holes and extended Su-Schrieffer-Heeger models that would be challenging to realise by other means. In two dimensions, we demonstrate that local periodic driving in a Lieb lattice engineers a 2D network with fully controllable tunnelling magnitudes. In a three-site plaquette, we show full simultaneous control over the relative tunnelling amplitudes and the gauge-invariant flux piercing the plaquette, providing a clear stepping stone to building a fully programmable 2D tight-binding model. We also explicitly demonstrate how utilise our technique to generate a magnetic field gradient in 2D. This local modulation scheme is applicable to many different lattice geometries.

ED&I SESSION INFORMATION SHEET

Networking in academia

Introduction

Professional networking is deemed necessary in the field of science, often feeling like a requirement to form consortia/collaborations for grants and to disseminate research. The team realised that our networking tends to feature the same locations and with often the same group of people. Are we inadvertently excluding people and missing out on new contacts and opportunities as a result? This session will explore the efficacy of common networking methods and how inclusive our professional networks are to everyone in the field. We aim foster discussion about what we should be aware of and think about when engaging in professional networking and come up with new ideas of activities and networking opportunities we can take away with us. Spurred on by a recent push for different social opportunities within QET Labs, the BQIT team wanted to challenge the norm for networking through the Laser Fusion social on the first day of the conference and hope this unconventional session will be food for thought for this session.

What is ED&I?

ED&I stands for "equity, diversity, and inclusion". Often, this is also written as "equality, diversity, and inclusion". Equity/equality mean that one's identity should be independent of the opportunities available to them. In our context, this ensures that those from disadvantaged backgrounds get the tools they need to access the same opportunities as their peers. "Diversity" is often thought of as highlighting what makes people different, but it really means that instead of putting the spotlight on our differences, we should respect and celebrate what makes us different and what common ground exists across people from different groups. "Inclusion" effectively means that within diverse teams, people from different backgrounds are not segregated off in their own little bubble, nor integrated into the wider team but seen as obvious outliers, but truly included in that they feel a sense of belonging within the group. In practice, what this means is that all members of a team feel that their contributions matter. In the context of this workshop, this means that while a PhD student may have less experience than a postdoc, they should feel that they can freely offer suggestions without being made to feel less than or excluded.

Code of conduct

This workshop will discuss a number of topics surrounding equity, diversity, and inclusion issues in quantum technologies. In keeping with the above on what ED&I is, the theme of the workshop is respect. That is, efforts should be taken to ensure that everyone that has something to say is allowed to say their piece, and disagreements should be handled professionally. Many people have strong opinions about the topics that will be discussed today. A healthy debate is encouraged. However, unprofessional behaviour will not be tolerated. Everyone at the workshop is required to abide by the BQIT Code of Conduct outlined on pg. 32-33 of the programme.

DAY THREE AGENDA
WEDNESDAY APRIL 24

TIME	EVENT	LENGTH
Session Nine: chaired by Maria Violaris (University of Oxford)		
09.30	Alexia Auffeves (CNRS MajuLab) - **presenting online** *Bipartite Quantum Energetics: Analyzing energy exchanges between a qubit and a light field*	25 min
09.55	Twesh Upadhyaya (University of Maryland, QuICS) *Non-Abelian transport distinguishes three usually equivalent notions of entropy production*	25 min
10.20	Gerardo Adesso (University of Nottingham) *Every quantum helps*	25 min
Session Ten: Poster session		
11.15	Poster session	75 min (continues into lunch)

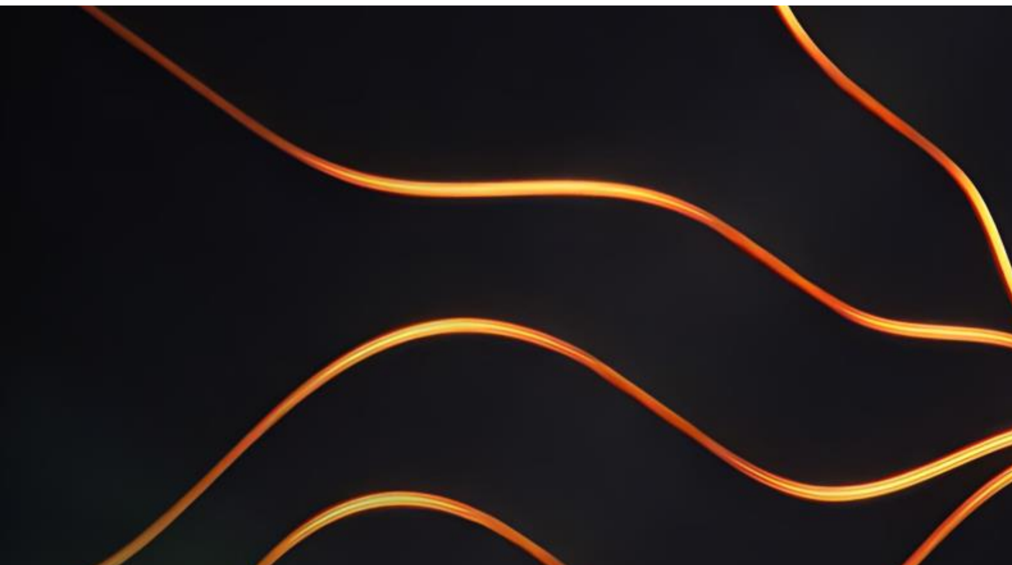
Session Eleven: chaired by Vivek Tiwari (University of Bristol)

13.30	Dorian Gangloff (University of Cambridge) *Operating a Collective Nuclear Spin Register in a Quantum Dot*	25 min
13.55	Yiwen Chu (ETH Zürich) - **presenting online** *Engineering multimode interactions in circuit quantum acoustodynamics*	25 min
14.20	Lucien Besombes (Institut Neel / CNRS) - **presenting online** *Individual magnetic atoms in a quantum dot: spin to strain coupling and carriers induced correlation*	25 min
14.45	Jan Ole Ernst (University of Oxford) *Fast and deterministic generation of large entangled photonic resource states in a time binned basis*	15 min

Session Twelve: chaired by Alex Clark (University of Bristol)

15.20	Paolo Barigelli (University of Rome - Sapienza) *Generation and characterization of polarization-entangled states using quantum dot single-photon sources*	15 min
15.35	Djeylan Aktas (IPSAS) *Development of the Slovak National Quantum Communication Infrastructure*	25 min
16.00	Martin Loincaric (Ruder Boskovic Institute) *Croatian Quantum Communication Infrastructure - CroQCI*	25 min
16.25	Anindya Rastogi (University of Alberta) *Harnessing the superradiant regime in atomic ensembles for broadband quantum memories and generation of correlated single-photon- pairs*	25 min
16.50	Alex Clark (University of Bristol) *Workshop close*	10 min

17.00 WORKSHOP CLOSE



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BQIT:25

SPRING 2025

DAY THREE ABSTRACTS

Alexia Auffeves

CNRS MajuLab

Bipartite Quantum Energetics: Analyzing energy exchanges between a qubit and a light field

When coupled, two quantum systems can exchange energy in two forms: through effective unitary interactions, or through correlations. We dub the former (the latter) bipartite work or b-work (b-heat), both concepts forming the basis of Bipartite Quantum Energetics (BQE). Focusing on the case of a qubit interacting with a light field, we show that the b-work (b-heat) is equal to the change of the coherent (incoherent) energy of the field. It can thus be measured through dyne experiments, as recently realized with a semi-conducting quantum dot where nearly ideal energy transfers have been reported. As it captures basic mechanisms at play in quantum gates, this framework is relevant to understand the energetic cost of quantum computing.

Twesh Upadhyaya

University of Maryland, QuICS

Non-Abelian transport distinguishes three usually equivalent notions of entropy production

We extend entropy production to a deeply quantum regime involving noncommuting conserved quantities. Consider a unitary transporting conserved quantities ("charges") between two systems initialized in thermal states. Three common formulae model the entropy produced. They respectively cast entropy as an extensive thermodynamic variable, as an information-theoretic uncertainty measure, and as a quantifier of irreversibility. Often, the charges are assumed to commute with each other (e.g., energy and particle number). Yet quantum charges can fail to commute. Noncommutation invites generalizations, which we posit and justify, of the three formulae. Charges' noncommutation, we find, breaks the formulae's equivalence. Furthermore, different formulae quantify different physical effects of charges' noncommutation on entropy production. For instance, entropy production can signal contextuality—true nonclassicality—by becoming nonreal. This work opens up stochastic thermodynamics to noncommuting—and so particularly quantum—charges.

Gerardo Adesso

University of Nottingham

Every quantum helps

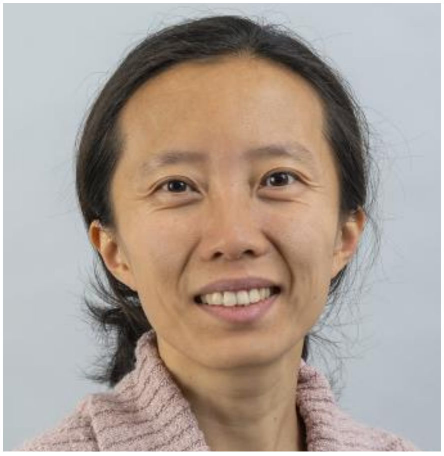
What makes quantum technologies tick? Advantages in communication, computation, metrology and other applications can be traced back to distinct manifestations of quantum theory, such as coherence and entanglement. We characterise these elusive quantum signatures and their operational power under the unifying lens of resource theories. We then show that every quantum resource yields an advantage in a channel discrimination task, enabling a strictly greater success probability than what is achievable by any state without the given resource. We further discuss recent progress in untapping these benefits for practical quantum-enhanced imaging and sensing tasks.

Dorian Gangloff

University of Cambridge

Operating a Collective Nuclear Spin Register in a Quantum Dot

Engineering the collective state of a dense spin ensemble can turn it into a robust quantum memory or a multi-qubit computational register. Recent experimental progress in dense central spin systems, particularly in enhancing the electronic coherence time in semiconductor quantum dots, motivates the design of control protocols that use a central-spin qubit as a convenient proxy to engineer both classical and quantum resource states of a mesoscopic spin system. Using a GaAs quantum dot system, we perform complete and reversible quantum information transfer between an arbitrary state of the electronic central spin and a nuclear register. We further show that the Overhauser field on the central spin produced by a tuneable nuclear polarisation can be used as an in-situ control mechanism for the exchange rate between the central spin and the nuclear register. These results open the way to a multi-qubit register directly and efficiently interfaced to quantum light.



Yiwen Chu

ETH Zürich

Engineering multimode interactions in circuit quantum acoustodynamics

Mechanical resonators have unique properties that make them useful as components in quantum processors, including long coherence times and the ability to host many modes in a small volume. In order to take advantage of the latter, it is necessary to be able to engineer coherent quantum operations between multiple mechanical modes.

In this talk, I will present our recent work on implementing bilinear, beamsplitter-type interactions between different modes of a bulk acoustic wave resonator by using the nonlinearity of a transmon qubit to which the modes are coupled. I will show that these interactions allow us to generate entangled Bell states of these mechanical modes and perform a Hong-Ou-Mandel experiment on phonons.

Lucien Besombes

Institut Neel / CNRS

Individual magnetic atoms in a quantum dot: spin to strain coupling and carriers induced correlation

Individual magnetic atoms in semiconductors (Mn, Cr, Co, Ni, ...) offer a playground for fundamental physics and are interesting for potential applications as qubits in quantum technologies. After a general discussion of the processes that enable the spin of a non-optically active magnetic atom to be interfaced with photons, I will present recent progress in the development of these systems. First, I will show that some of these localized spins can exhibit significant spin to strain coupling. Such atoms, with optical access through their interaction with carriers confined to a quantum dot, could be used to couple sound, spin and light at the quantum level. I will also discuss how the injection of carriers into a quantum dot can induce a correlation between two distant localized spins. I will illustrate this in the case of cobalt, a magnetic atom that also exhibits strong spin to strain coupling, and show how resonant optical access to the spin state of each atom is conditioned by their position in the dot and by the local configuration of the strain.

Jan Ole Ernst

University of Oxford

Fast and deterministic generation of large entangled photonic resource states in a time binned basis

Measurement based quantum computing is an appealing alternative quantum computing paradigm, where quantum operations are implemented as sequences of adaptive single qubit measurements on an entangled resource state. The high rate and high fidelity preparation of large entangled resources remains a challenge and is central to measurement based quantum computing. Probabilistic photon sources exhibit severe scaling limitations for preparing larger resource states. But deterministic schemes using quantum dots or single atoms have shown promise for preparing larger resources with high expected coincidences. We describe an improved scheme to be implemented on a cavity-QED platform and make crucial changes with respect to the state of the art, namely: improved Raman pulses, a change in photonic basis and a change in quantisation axis. This allows us to simulate the generation of large linear cluster states, as well as GHZ states with three orders of magnitude higher expected coincidences compared to the state of the art with feasible experimental parameters. Moreover, our proposal is more robust with respect to cavity birefringence, as well as photon polarisation drifts due to the choice of a time binned basis. We show this in a physically realistic numerical simulation of a single 87Rb atom in a state of the art optical cavity.

Paolo Barigelli

University of Rome - Sapienza

Generation and characterization of polarization-entangled states using quantum dot single-photon sources

The generation of entangled states is the fundamental step in most of the quantum information applications. The sources based on spontaneous parametric down-conversion can be employed to obtain high-fidelity entangled photons, but have an inevitable trade-off between the brightness and quality of the state. In this work, we implement and characterize a method for the creation of entangled states based on probabilistic interference of identical photons emitted from the same single-photon source; Semiconductor Quantum Dots are the ideal candidates due to their high single-photon indistinguishability, on-demand generation and low multiphoton emission. The generation scheme has been implemented via a simple, compact design that produces entangled photon pairs in the polarization degree of freedom. The proposed platform has been tested and analysed with single photons produced through two different pumping schemes, the resonant excited one and the longitudinal-acoustic phonon-assisted configuration. A novel theoretical model has been developed to characterize the entangled two-photon states and determine the experimental variables limiting Bell's inequality's maximum violation. The source shows long-term stability in terms of fidelity and Bell's parameter, thus constituting a reliable building block for optical quantum technologies and communications protocols.

Djeylan Aktas

IPSAS

Development of the Slovak National Quantum Communication Infrastructure

The European Commission is working with 27 EU Member States, and the ESA, to design, develop and deploy the EuroQCI, which will be composed of a terrestrial segment relying on fibres linking strategic sites at national and cross-border level, and a space segment with satellites. It will be an integral part of IRIS², the new EU space-based secure communication system. The EuroQCI will safeguard sensitive data and critical infrastructures by integrating quantum-based systems into existing communication infrastructures, providing an additional security layer based on quantum physics. It will reinforce the protection of Europe's governmental institutions, their data centres, hospitals, energy grids, and more, becoming one of the main pillars of the EU's Cybersecurity Strategy.

The first implementation phase began in 2023 with the support of the commission's Digital Europe Programme with a focus National projects allowing each Member States to design and build a national quantum network that will form the basis of the terrestrial segment, testing different technologies and protocols and adapting them to the specific needs of each country. In this talk we will present both short- and long-term vision for our national Slovak QCI infrastructure and put it in the context of the whole EuroQCI endeavour. We will present the latest results building up our quantum testbed with the support of the underlying SANET infrastructure.

Martin Loincaric

Ruder Boskovic Institute

Croatian Quantum Communication Infrastructure - CroQCI

The Croatian quantum communication infrastructure project - CroQCI is an initiative by which Croatia lays the foundations for the implementation of an advanced quantum communication network, with the aim of integration into the wider European quantum communication infrastructure, EuroQCI. As part of the strategic initiatives of the European Union, CroQCI is an experimental project focused on the development of a conceptual solution and the establishment of an experimental network for quantum communication, including the development and demonstration of key devices for secure communication. To ensure realization of stated goals, CroQCI Consortium was formed, comprising major national research institutions and universities, key public institutions, and relevant public companies, under the scientific lead by Ruđer Bošković Institute. The implementation of a metropolitan-sized entanglement-based quantum communication network with several trusted nodes is planned in the City of Zagreb. Use cases foreseen in the project are: enhancing the distributed storage security, QKD encrypted delivery of vulnerability service data between member institutions for improved confidentiality, preparatory steps for space connectivity through an optical ground terminal for satellite QKD, and synchronisation of atomic clocks at optical frequencies.

Anindya Rastogi

University of Alberta

Harnessing the superradiant regime in atomic ensembles for broadband quantum memories and generation of correlated single-photon-pairs

Superradiance, characterized by the collective, coherent emission of light from an excited ensemble of emitters, generates photonic signals on timescales faster than the natural lifetime of an individual atom. The rapid exchange of coherence between atomic emitters and photonic fields in the superradiant regime enables a fast, broadband quantum memory. We demonstrate this superradiance mediated memory mechanism in an ensemble of lasercooled Rb atoms by storing and subsequently retrieving short optical pulses on demand. Our memory scheme requires an initial excitation of the atomic polarization followed by its fast mapping to a long-lived spinwave, realizing a distinct mechanism that is inherently suited for storage of very broadband pulses. Simulations indicate that the superradiance memory protocol yields the highest bandwidth storage among other protocols, in systems where the atomic linewidths (homogeneous or inhomogeneous) are much narrower than the signal bandwidth to be stored. In our more recent experiments, we are exploring the resonant absorption followed by coherent reemission in this superradiant regime, for the generation of non-classical pairs of single photons featuring both high coincidence detection and optimal retrieval efficiency.

POSTER SESSION

1. Eesa Ali
University of Bristol
Interfacing solid state single emitters with atomic quantum memories

2. Harsh Arora
Indian Institute of Science
Multimode interactions and non-Markovian dynamics of a driven qubit in an engineered Cavity

3. Paolo Barigelli
University of Rome - Sapienza
Generation and characterization of polarization-entangled states using quantum dot single-photon sources

4. Martin Bielak **(online)**
Palacký University Olomouc
All-fiber microendoscopic polarization sensing at single-photon level aided by deep-learning

5. Georgia Booton
University of Bath
A scanning transfer cavity lock for high-speed low-loss optical switching in rubidium vapour

7. Susan Chen
University of Bristol
Towards a measurement-based implementation of Bivariate Bicycle qLDPC codes

8. Pasquale Cilibrizzi
Heriot-Watt University
Ultra-narrow inhomogeneous spectral distribution of telecom-wavelength vanadium centres in isotopically-enriched silicon carbide

10. Debarshi Das
University College London, UK
Testing whether gravity acts as a quantum entity when measured

11. Jinghan Dong
University of Bristol
Sensing Methane with Undetected Mid-Infrared Photons

12. Mateusz Duda
The University of Sheffield
Efficient, High-Fidelity Single-Photon Switch Based on Waveguide-Coupled Cavities

13. Sophie Engineer
Heriot-Watt & University of Bristol
Certifying the Dimensionality of a Quantum Channel

14. Jan Ole Ernst
University of Oxford
Fast and deterministic generation of large entangled photonic resource states in a time binned basis

15. Carlos Faurby
University of Copenhagen
Photonic fusion of entangled resource states from a quantum emitter

16. Imogen Forbes
University of Bristol
Towards Path-Transverse Electric Mode Hyperentanglement on an Integrated Photonic Chip

17. Samuel Gears
University of Bristol
Mid-Infrared Entanglement of Qubits in Silicon

18. Jonte Hance
Newcastle University
Contextuality, Coherences, and Quantum Cheshire Cats

19. Alexander Jones
Heriot Watt University
Scalable Registration of Silicon Vacancies in Solid Immersion Lenses by Femtosecond Laser Writing

20. Matt Jones
University of Bristol
Small footprint modulators for fast reprogrammable photonic experiments

21. Feng-Ming Liu **(online)**
University of Science and Technology of China
Realization of fractional quantum Hall state with interacting photons

22. Matthias C. Löbl **(online)**
Niels Bohr Institute - University of Copenhagen
Loss-tolerant architecture for quantum computing with quantum emitters

23. Sarah McCarthy
Fraunhofer CAP/University of Strathclyde
A model for dual-downlink satellite -to-ground entanglement-based quantum key distribution

24. Will McCutcheon
BBQLabs, Heriot-Watt University
Compressive Tomography of Unstructured High-Dimensional Photonic Entanglement

25. Cameron McGarry
University of Bath
Towards atoms in an optical fibre – modulating, multiplexing and memorising photons for quantum networks and computing

26. James Miklaucich
University of Bristol
Resonant Avalanche Photodiodes fabricated in a Silicon-on-Insulator foundry platform for Red and NIR Photo Detection

27. Michael Neville
University of Bristol
Towards a Vertical Defect Cavity for Enhancing Photonic Emission from Dibenzoterrylene

28. Kasper Hede Nielsen
NBI
Programmable nonlinear photonic circuits

29. Georgia Nixon
University of Cambridge
Local Control of Tunnelling in Optical Lattices

30. Rodrigo Piera
Technology Innovation Institute (TII)
External Validation Protocol for Quantum-Generated Random Sequences in Cryptography without Loss of Privacy.

31. Beth Puzio
University of Bristol
Continuous Variable Distributed Quantum Sensing in Integrated Photonics

32. Tom Reinacher
University of Bristol
Microwave to Telecom Quantum Transduction on Suspended ScAlN Platform

33. Phila Rembold
Atominstitut, TU Vienna
The Role of Bases in Quantum Optimal Control

34. Ry Render
University of York
Phase and Coupling efficiency stabilisation in horizontal free-space quantum key distribution

35. Shradhanjali Sahu **(online)**
University of Leeds
Finite key analysis for CV QKD in Multiple-Input Multiple-Output Settings

36. Hanna Salamon
University of Copenhagen
Heterogenous integration of GaAs single phources embedded in a p-i-n diode with silicon photonics using wafer bonding method.otons

37. Hannah Seabrook
University of Bristol
Noiseless quantum key distribution across lossy unitary noise channels

38. Zhi Shi
University of Bristol
Integrated Lamb Wave Resonator with Nano-waveguide in Suspended Gallium Arsenide Platform

39. Elnaz Shokati
University of Bristol
Suspended high overtone lateral bulk acoustic wave resonators (XBARs) for efficient microwave to optical signal transduction

40. Jaideep Singh
Technology Innovation Institute
Low-cost compact QRNG using balanced detection of shot noise

41. Vatshal Srivastav
Heriot-Watt University
Programmable Generalised Measurements for Photonic Time-Bins using Complex Media

42. Patrik Sund
Niehls Bohr institute
Logarithmic-depth time-bin interferometer architectures

43. Athanasios Tzemos **(online)**
Research Center for Astronomy and Applied Mathematics of the Academy of Athens
Bohmian Quantum Potential and Chaos

44. Sander van Haagen
Delft University of Technology
Deep Learning-Optimized, fabrication-error tolerant nanobeam photonic cavities for scalable diamond quantum systems

45. Pablo Veganzones Parellada **(online)**
University of Valladolid
Invariants in linear quantum optics

46. Maria Violaris
University of Oxford
Quantum teleportation using a genuinely classical communication channel must fail

47. Hao-Cheng Weng
University of Bristol
Site-defined microelectronics for optically-active spins

48. Rongjie Zhang
Centre for Quantum Technology
Quantum Bosonic Machine Learning with Trapped Ions

49. Haichen Zhou
University of Bristol
Controlling nonlinear coherence by changing indistinguishability of idler on silicon chip

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CODE OF CONDUCT

BQIT:24 is a workshop intended for networking and collaboration in the quantum technology community. We value the engagement of each attendee and work to ensure all participants have an enjoyable and fulfilling experience. Accordingly, all attendees are expected to show respect and courtesy to other attendees throughout the workshop and at all workshop events. All attendees, speakers, sponsors and volunteers at BQIT:24 are required to agree with the following code of conduct. Organisers will enforce this code throughout the event. We expect cooperation from all participants to help ensure a safe environment for everybody. Thank you for helping make this a welcoming, friendly event for all.

THE SHORT VERSION

The BQIT team is dedicated to providing a harassment-free conference experience for everyone, regardless of gender, gender identity and expression, age, sexual orientation, disability, physical appearance, body size, race, ethnicity, religion (or lack thereof), or technology choices. We do not tolerate harassment of workshop participants in any form. Sexual language and imagery is not appropriate for any workshop venue or platform, including talks, panels, dinners, Twitter and other online media. Workshop participants violating these rules may be sanctioned or expelled from BQIT:24.

THE LONGER VERSION

Harassment includes, but is not limited to:

- Verbal comments that reinforce social structures of domination related to gender, gender identity and expression, sexual orientation, disability, physical appearance, body size, race, age, religion, or technology choices.
- Sexual images in public spaces.
- Deliberate intimidation, stalking, or following.
- Harassing photography or recording.
- Sustained disruption of talks or other events.
- Unwelcome sexual attention.
- Advocating for, or encouraging, any of the above behaviour.

Participants asked to stop any harassing behaviour are expected to comply immediately. Sponsors are also subject to the anti-harassment policy. In particular, sponsors should not use sexualised images, activities, or other material.

If a participant engages in harassing behaviour, the workshop organisers may take any action they deem appropriate, including warning the offender or expulsion from BQIT:24.

WHO TO CONTACT

If someone makes you or anyone else feel unsafe or unwelcome, please contact our team as soon as possible, either in person or through our email bqit-admin@bristol.ac.uk. Harassment and other code of conduct violations reduce the value of our event for everyone. We want you to be happy at our event. People like you make our event a better place.

The BQIT team will be happy to help participants contact local law enforcement or otherwise assist those experiencing harassment to feel safe for the duration of the workshop.

We expect participants to follow these rules in all workshop venues, platforms and workshop-related online social events.

ATTENDEE PROCEDURE FOR INCIDENT HANDLING

1. The BQIT team will be prepared to handle the incident. All our staff are informed of the code of conduct policy and guide for handling harassment at the workshop.
2. Report the harassment incident to a BQIT team member either in-person or through email at bqit-admin@bristol.ac.uk (this inbox will be frequently checked for the duration of the event). All reports are confidential. When taking a personal report, our staff will ensure this is confidential. They may involve other event staff to ensure your report is managed properly. During the reporting process, we'll ask you to tell us about what happened. This can be upsetting, but we'll handle it as respectfully as possible. You won't be asked to confront anyone and we won't tell anyone who you are.
3. We will only involve law enforcement or security at a victim's request. If you are not in the UK, please note that you can ask a member of the BQIT team to call the UK authorities on your behalf.

ATTRIBUTION

This Code of Conduct was adapted from confcodeofconduct.com and Geek Feminism Wiki.

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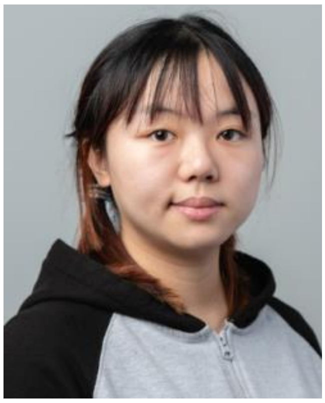

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THE BQIT TEAM WOULD LIKE TO THANK

Our speakers and panellists for sharing their work and opinions on an expansive range of topics, and our sponsors for helping to make BQIT a continued success.

The BQIT board members, advisors and helpers for their innovative ideas and diligent work throughout the year. Thank you for your support and enthusiasm during the whole process.

And finally, all of our BQIT:24 attendees for participating. Thank you for joining us, and we look forward to welcoming you back to Bristol soon!

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