

Title: Driving Quantum Readiness - An Innovation Perspective

Speakers: Sonali Mohapatra

Collection: PSI 15th Anniversary Reunion

Date: June 18, 2024 - 4:00 PM

URL: <https://pirsa.org/24060004>

Abstract: "In this talk, I will share insights from my journey in driving innovation within the quantum space across various sectors, including space, financial services, healthcare & pharmaceuticals and across various emerging technologies. Drawing from my current role at the National Quantum Computing Centre (NQCC), I will discuss the transformative potential of quantum readiness driven by the adoption of quantum computing use cases. I will briefly introduce the NQCC, which was established under the UK government's National Quantum Technologies Program, to address the challenge of scaling quantum computing and discuss the various support mechanisms we have put in place to support the quantum ecosystem in the UK, including our flagship user engagement program, SPARQ. Through these initiatives, the NQCC supports the discovery of relevant quantum computing use cases and spearheads the development of quantum computing applications. Throughout the talk, I will emphasize the importance of engaging stakeholders from government, industry, academia, as well as regulators and policymakers to spearhead responsible innovation."

Quantum Readiness, Emerging Technologies and Using your physics degree for Innovation

Dr Sonali Mohapatra

Quantum Innovation Lead
National Quantum Computing Centre

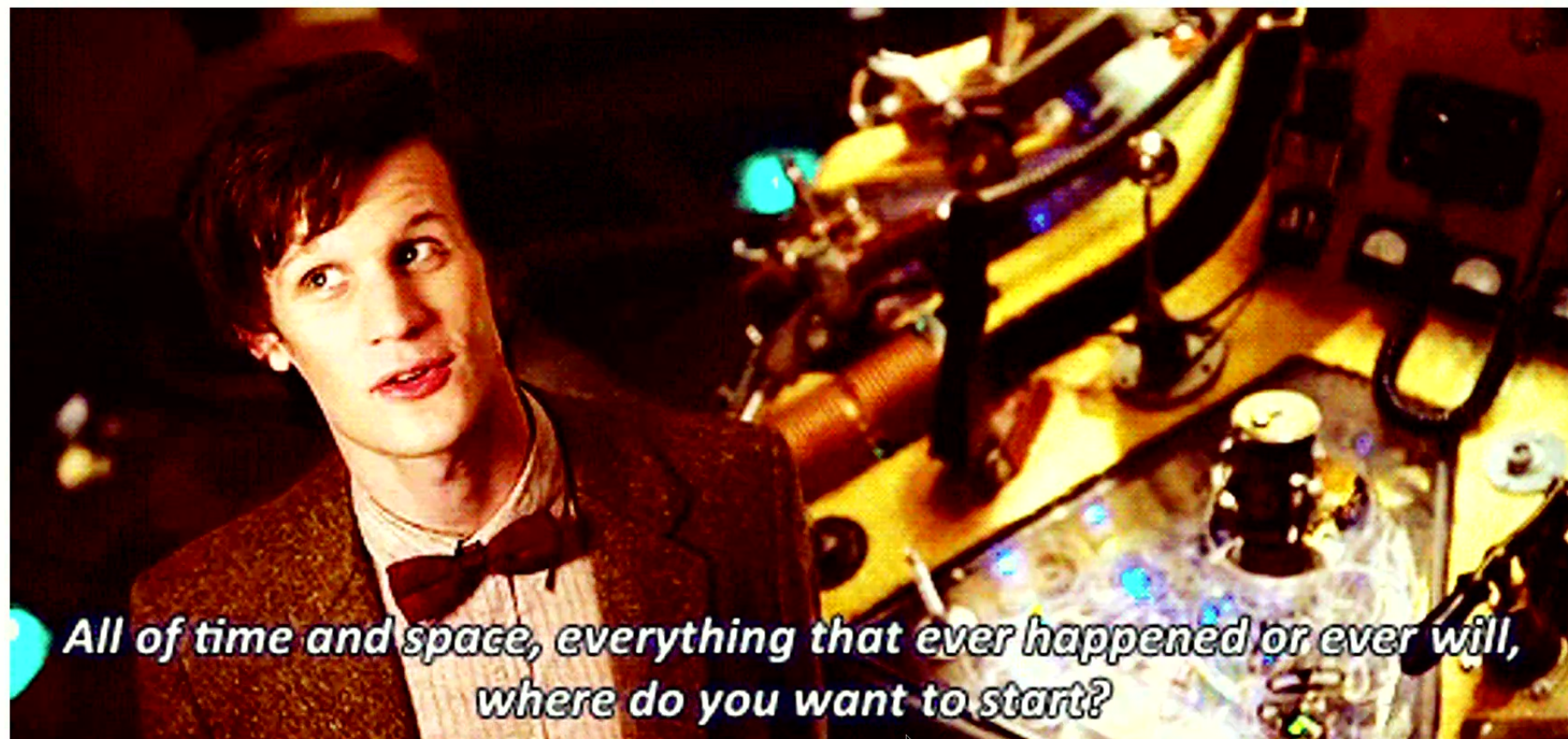
Director
Prospero Space Fellowship

Keynote - PSI 15th Anniversary Reunion

Perimeter Institute
Waterloo, Canada



National Quantum
Computing Centre



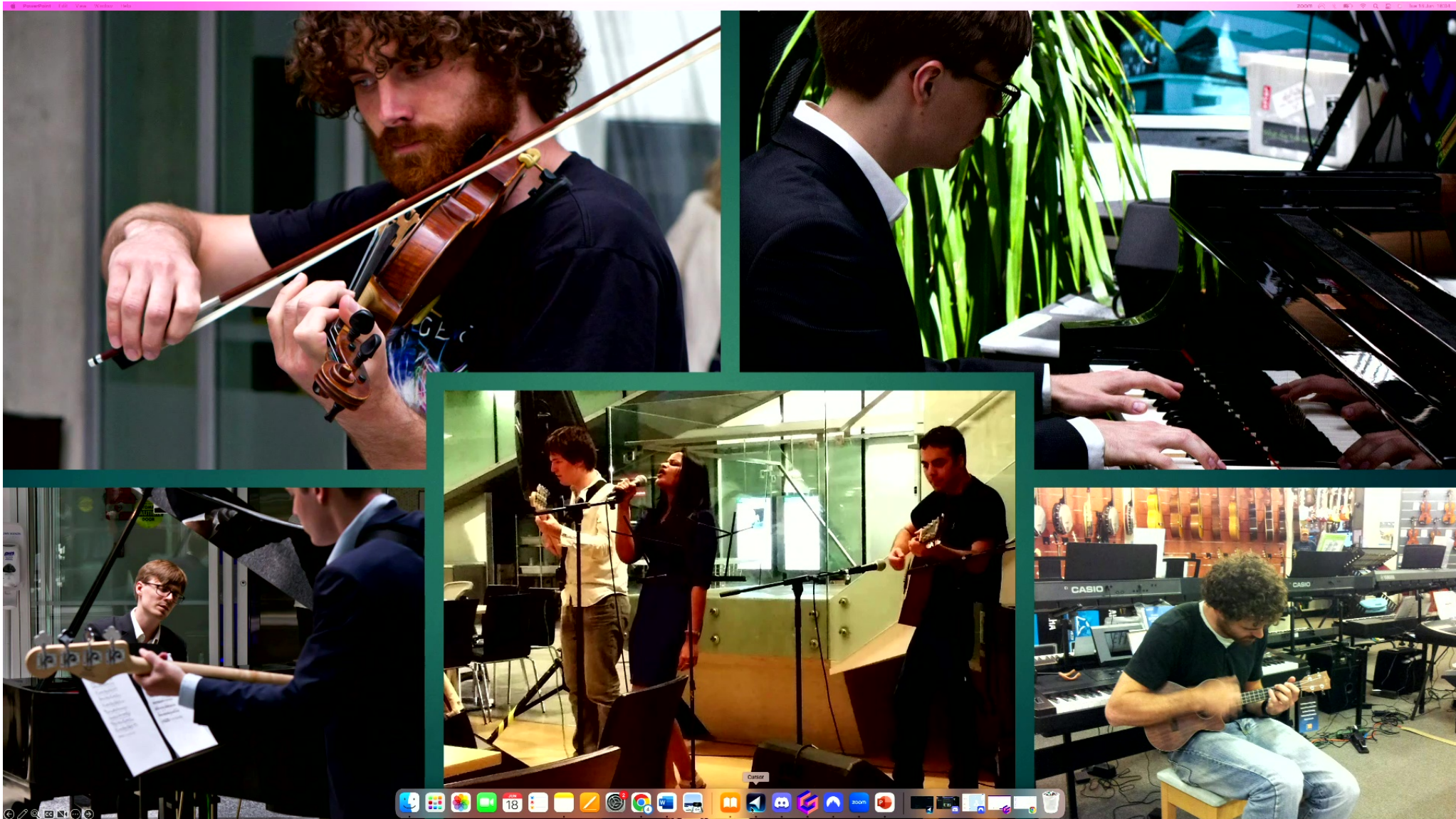


Sonali Mohapatra



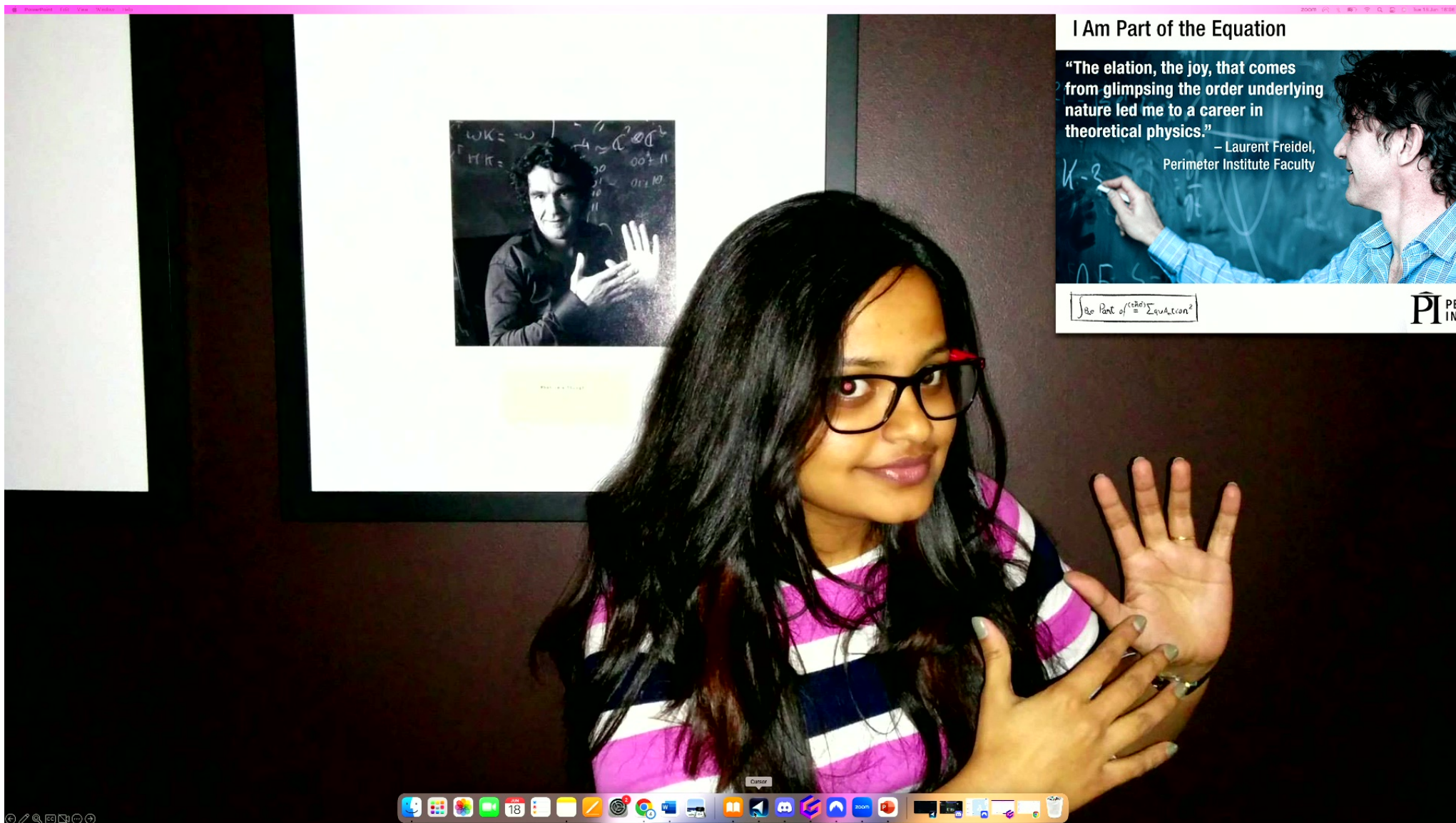
- India 
- The angle between Sonali's little toe and big toe is 45 degrees.
- Sonali's cheeks are like gulab jamuns.







Zoom Meeting | Join | Leave | Mute | Video | Chat | Screen | Share | Settings | Help | Log Out | Jan 15, 2020 7:00 PM



I Am Part of the Equation

"The elation, the joy, that comes from glimpsing the order underlying nature led me to a career in theoretical physics."

— Laurent Freidel,
Perimeter Institute Faculty

I Am Part of the Equation

PI PERIMETER INSTITUTE

Cursor

18

N-point Green's Function in Polymer Quantum Field Theory

Mohapatra, Sonali (2014) *N-point Green's Function in Polymer Quantum Field Theory*. Masters thesis, Indian Institute of Science Education and Research Kolkata.



PDF (MS dissertation of Sonali Mohapatra)
Sonali_Mohapatra_09MS026_2014.pdf - Submitted Version

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Abstract

The search for a consistent theory of gravity has led us to various theories. One candidate theory among the milieu is Polymer Quantum Field Theory. Polymer theory is based on the inherent discreteness of space and time as shown by the lack of a momentum operator. We define a lattice momentum operator which when

Item Type: Thesis (Masters)

Additional Information: Supervisor: Dr. Ritesh Singh

Uncontrolled Keywords: N-point; Green's Function; Polymer Quantum Field Theory; Quantum Field Theory; Scalar Fields.;

Keywords: Schrodinger Frameworks

Subjects: [Q Science > QC Physics](#)

Divisions: [Department of Physical Sciences](#)

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Date Deposited: 14 Jan 2015 10:48

Last Modified: 14 Jan 2015 10:48

URI: <http://eprints.iiserkol.ac.in/id/eprint/195>

Gravitational Waves, Blackholes and Quantum Gravity

What can Black Holes teach us about the IR and UV?

Basem Kamal El-Menoufi* and Sonali Mohapatra†

Department of Physics and Astronomy, University of Sussex, Brighton, BN1 9QH, United Kingdom

Combining insights from both the effective field theory of quantum gravity and black hole thermodynamics, we derive two novel consistency relations to be satisfied by any quantum theory of gravity. First, we show that a particular combination of the number of massless (light) fields in the theory must take integer values. Second, we show that, once the massless spectrum is fixed, the Wilson coefficient of the Kretschmann scalar in the low-energy effective theory is fully determined by the logarithm of a single natural number.

High Energy Physics – Theory

(Submitted on 20 Jul 2018)

Gravitational Waves in Effective Quantum Gravity

Xavier Calmet, Iberè Kuntz, Sonali Mohapatra

In this short paper we investigate quantum gravitational effects on Einstein's equations using effective field theory techniques. We consider the leading order quantum gravitational correction to the wave equation. Besides the usual massless mode, we find a pair of modes with complex masses. These massive particles have a width and could thus lead to a damping of gravitational waves if excited in violent astrophysical processes producing gravitational waves such as e.g. black hole mergers. We discuss the consequences for gravitational wave events such as GW 150914 recently observed by the Advanced LIGO collaborations.

High Energy Physics – Phenomenology

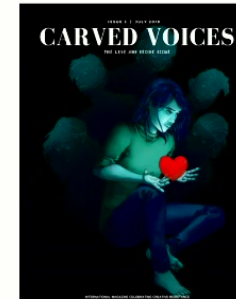
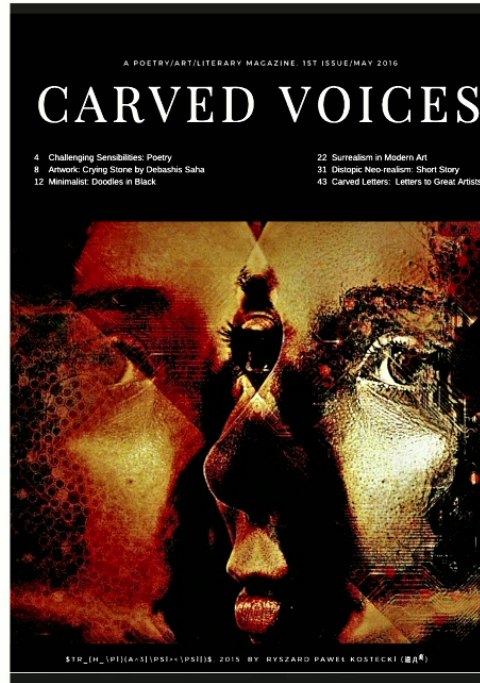
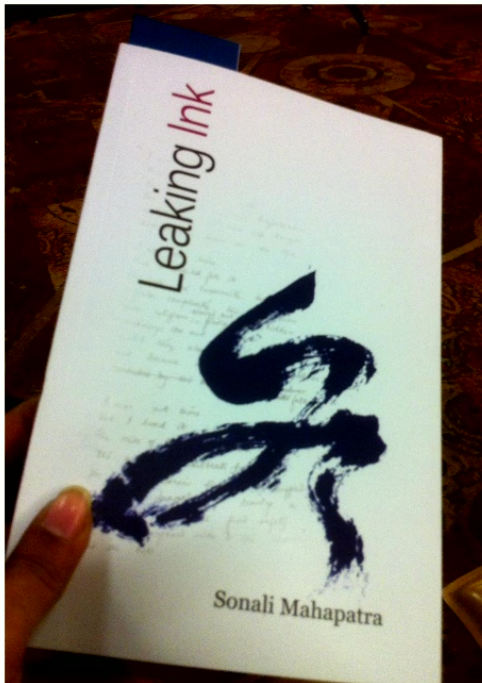
(Submitted on 22 Feb 2018)

Gravitational Radiation Background from Boson Star Binaries

Djuna Croon, Marcelo Gleiser, Sonali Mohapatra, Chen Sun

We calculate the gravitational radiation background generated from boson star binaries formed in locally dense clusters with formation rate tracked by the regular star formation rate. We compare how the frequency window in gravitational waves is affected by the boson field mass and repulsive f -coupling, exciting constraints from EPTA and LISA. We also comment on the possible detectability of these binaries.





Love and Desire Issue
July 16, 2019



Carved voices/2nd Issue/De...
December 4, 2017



Pre-Launch Teaser: Carved V...
February 14, 2019

NEW IDEAS



As a map, science is probably half-way between easy-to-use Google map and some kind of fantastical treasure map that sends you on a false errand.



QUANTUM & SPACE



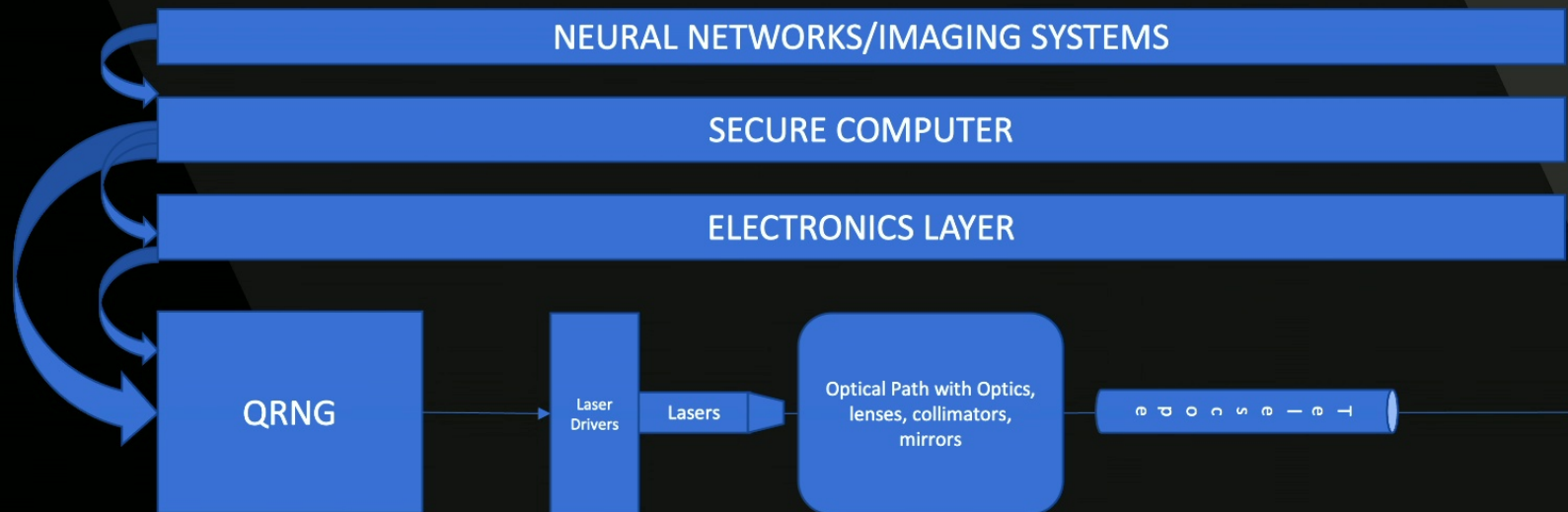
WHY?

Microgravity
No Atmosphere
High vacuum
Long freefall times
Low temperature

Enable:

- Tests of equivalence principle to test gravity and quantum gravity
- Long distance tests of entanglement of particles
- Precision of clocks and sensing
- Deviations from general relativity for high mass particles
- Enable long distance global communication infrastructure
- Enable a quantum internet
- Better Cybersecurity against Quantum Computers

QUANTUM IN A CUBESAT : ROKS



The Making of a CubeSat QKD Payload

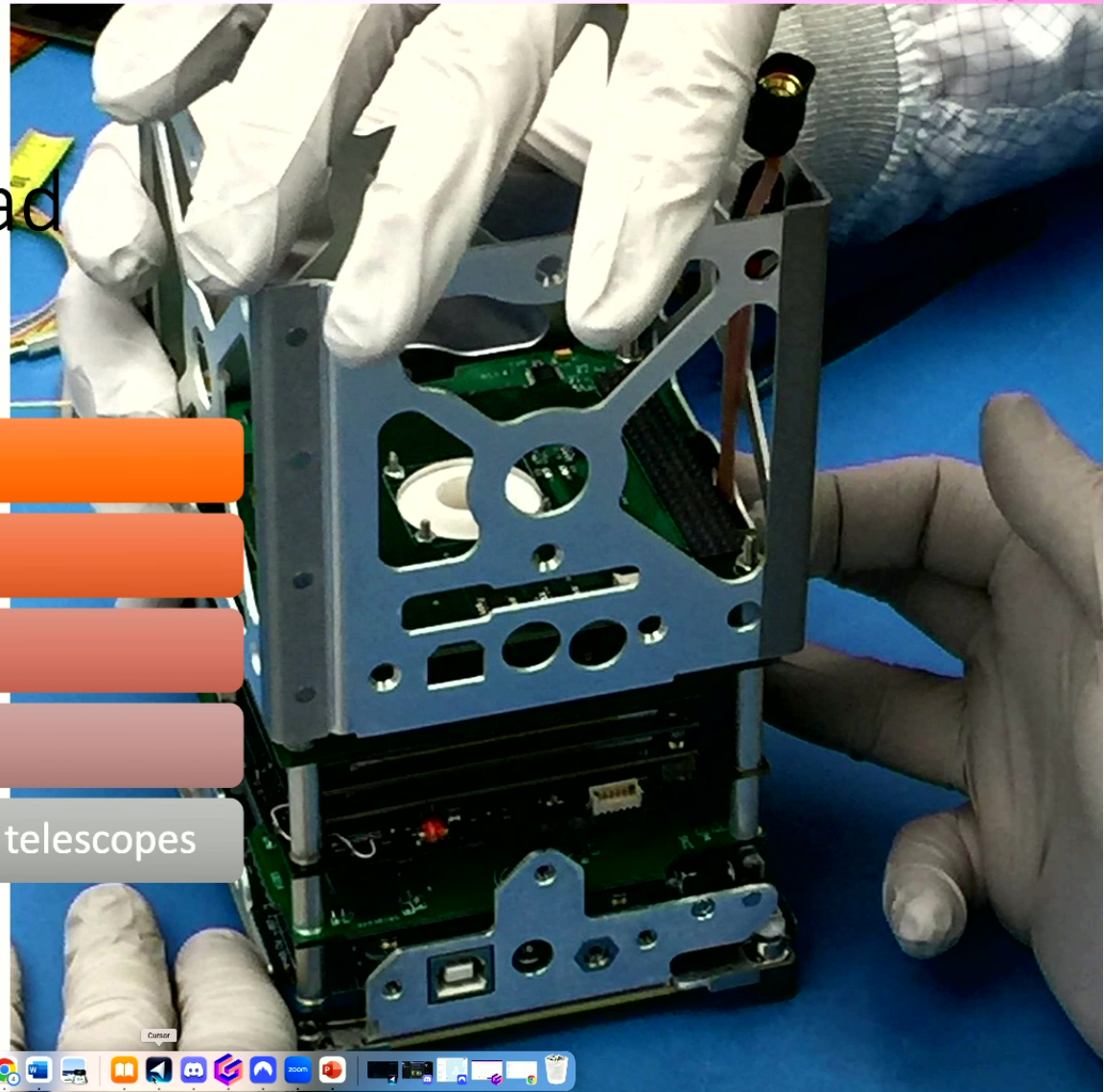
The CubeSat Computer Modes

The software/protocol layer

Embedded systems

Electrical and other hardware

Optical systems – lasers, LEDs, mirrors, telescopes





PRISMS: PROTOCOL, RANDOMNESS AND INFORMATION SECURITY MEASURES FOR SPACE

The Protocol Randomness and Information Security Measures for Space (PRISMS) project aims to address the problem that any system providing security services experiences – the overall security is equal to the most insecure system element. The PRISMS project is funded by Innovate UK.

In order to address the above problem, Craft Prospect has put together a consortium of organisations with strategic experts, to cover the following key sectors: Space, Quantum Key Distribution (QKD), and cybersecurity and lay the groundwork for a commercial space-based quantum cryptographic service.



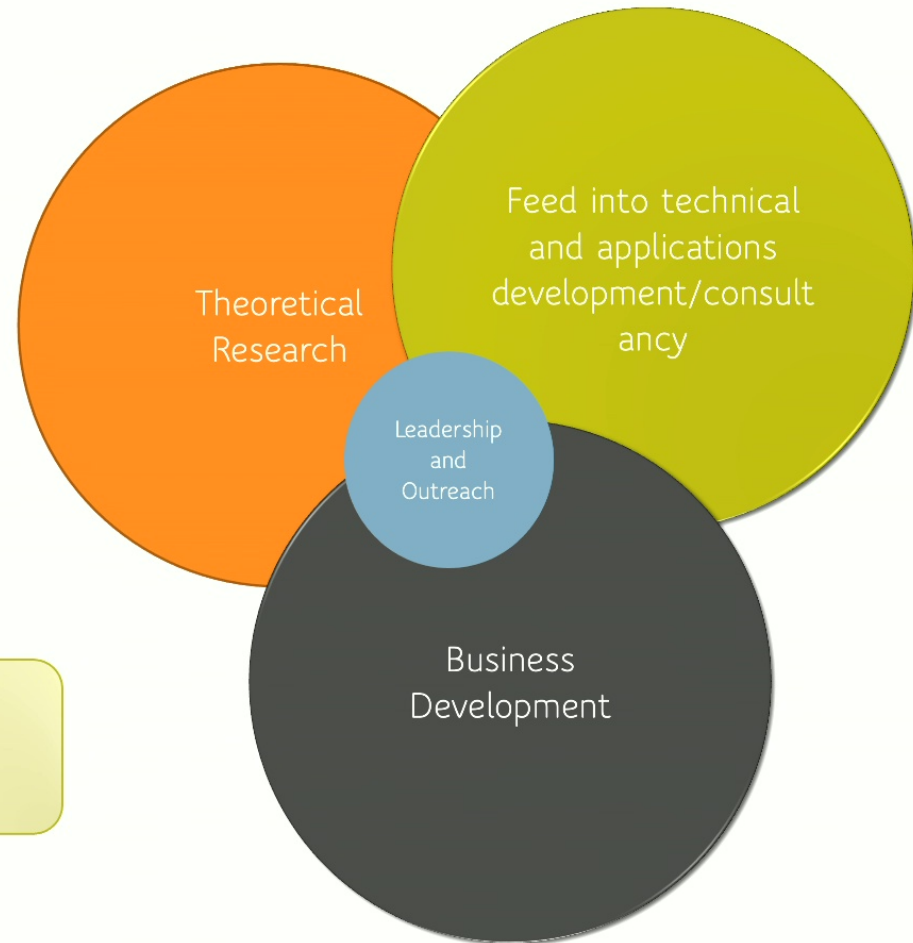
OS2-VOLT is a joint ESA/Craft Prospect Ltd (CPL) Mission for demonstrating products and services within a Versatile Optical Laboratory for Telecommunications. The CPL concept for the payload is a Quantum Classical Optical Communications Transceiver, coupled with an AI Computer and Hyperspectral Imager. CPL will lead a UK consortium for payload development and exploitation, together with KP Labs in Poland on the High-Performance Data Processing Unit. Several capability demonstrations are planned both as a quantum key delivery and optical communications platform, and for assured, taskable hyperspectral imagery capture for climate resilience applications. Payload experimentation will be accessible through a secure reconfigurable high-performance computing system.



MY ROLE

SPACE QUANTUM
TECHNOLOGIES DEVELOPER

Bringing Worlds Together



National Quantum Computing Centre

Our aims

To work across government, industry and the research community to enable the delivery of assured quantum computing capabilities for the UK

To focus on the challenge of scaling QC, and supporting growth of the wider UK ecosystem

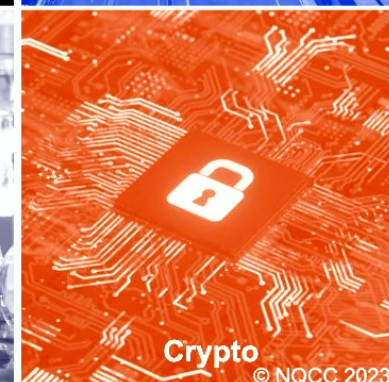
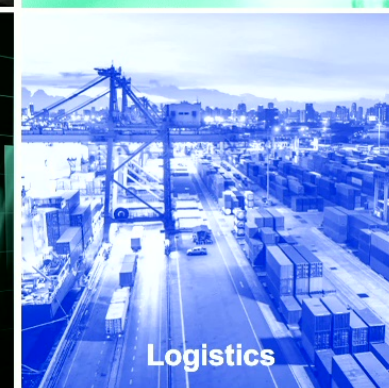
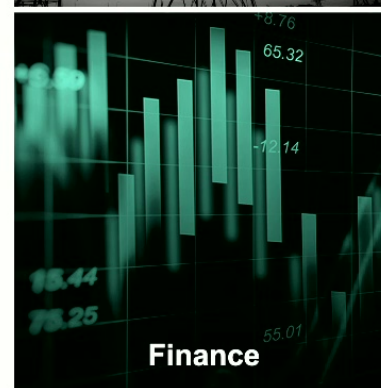
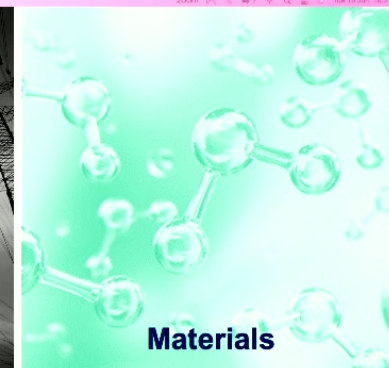
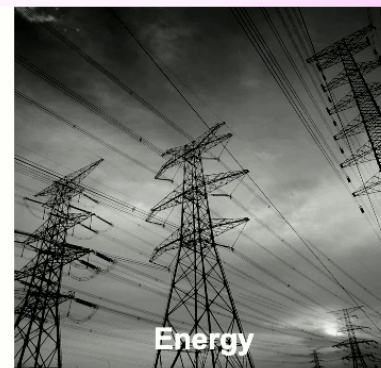


Images: ©Hawkins\Brown

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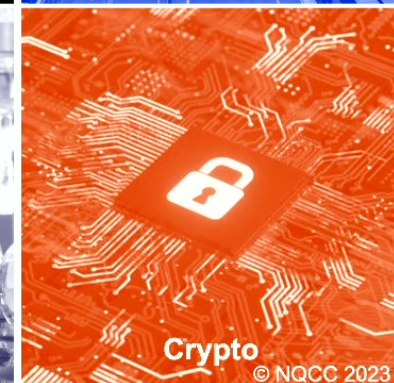
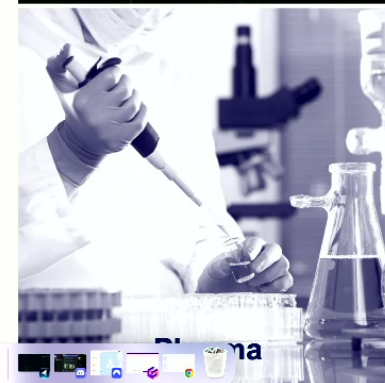
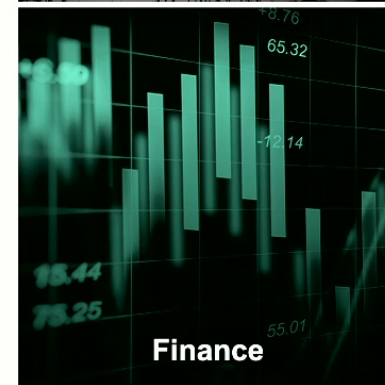
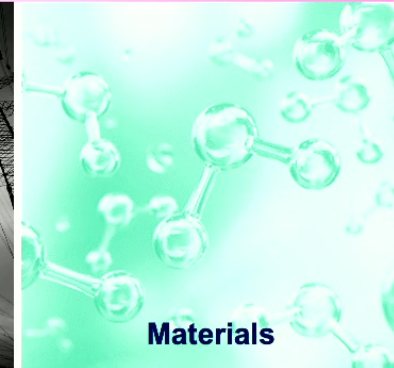
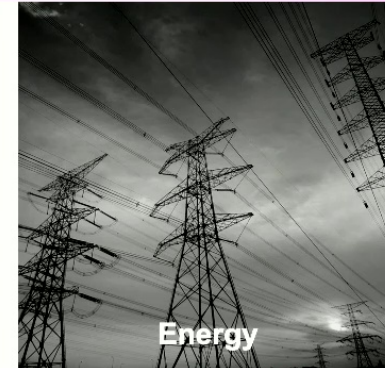
Quantum Readiness

- A **quantum-ready economy** can take advantage of the opportunities presented by quantum computing to generate and retain value, leading to societal benefits, prosperity, and security.
- **Early adopters** stand to gain expertise, market visibility, intellectual property and structural preparedness ahead of widespread adoption.
- This is a long-term endeavor **keeping pace with technology** breakthroughs as new research and commercial platforms become available.



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SparQ User Engagement Programme

- To discover and develop **USE CASES** and **APPLICATIONS**
- To enhance **QUANTUM LITERACY** and **UPSKILLING**
- To facilitate **NETWORKING** and **IDEAS SHARING** and build the **USER COMMUNITY**



National Quantum
Computing Centre



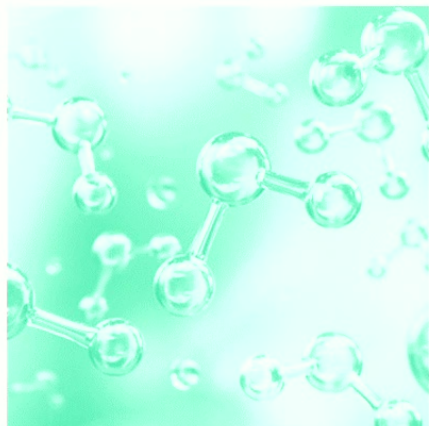
**Launched:
26th May, 2022**

- Collaborating with Oxford Quantum Circuits + IBM for access to QC Hardware
- Educational training platform Black Opal
- Hackathon July 2022, 2023
- Feasibility study call for proposals: Autumn 2022, 2023
- Industrial applications call launched with Innovate UK, Feb 2023

Quantum advantage – Domains

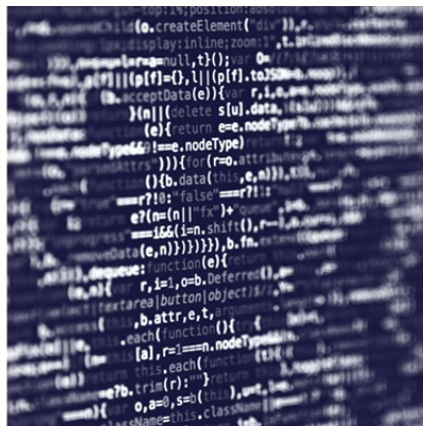
Quantum advantage:

The threshold point when a quantum computer out-performs a classical computer – especially when practically useful.



Simulation

Pharma: Drug discovery
Aero: Fluid dynamics
Chemicals: Catalysis
Finance: Market scenarios
Research: Bio-chemistry



Machine Learning

Auto: Autonomous vehicles & AI
Finance: Fraud detection
Healthcare: Personal Diagnostics
Technology: Search Engine & Ads
Research: Particle Physics



Optimization

Finance: Portfolio & Risk Mgt
Telecoms: Network Resourcing
Logistics: Routing
Transport: Emissions
Research: Engineered Materials



Cryptography

Finance: Privacy & Security
Security: Encryption
Telecoms: Security
Government: Resilience
Research: Distributed resources

£21bn

UK Pharma sector in 2019, employing
63,000 people in 610 companies



National Quantum
Computing Centre

47,000

Forecast accidents prevented in coming
decade through driver assistance

£132bn

UK Financial Services sector in 2019
Employing 1.1m people

1,480

Cyber security companies in the UK



Sectoral Engagement

Sector based engagement to **understand** the potential

Exploring solutions to real world problems

Shaping the technology evolution

Taking action and building a **business case**

Growing quantum computing capabilities

Engagement with various sectors will enable the **large-scale impact** of quantum computing.

In the UK, there are many companies with a strong presence that could **benefit from adoption of quantum computers**.

Potential end-users are **only just beginning** to consider the technology and the **impact it will have on their end users**.

Of the key quantum computing end-user target sectors, **financial services, chemicals, pharmaceuticals and energy contributed over £260bn** to the UK economy.

Consequently, the UK quantum computing market is expected to **grow rapidly**.



Energy



Materials



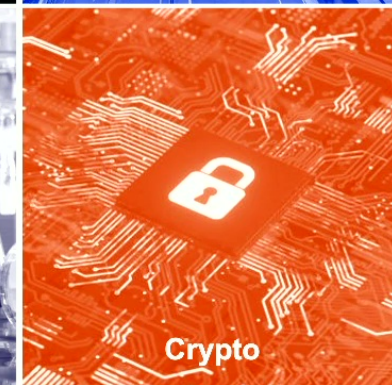
Finance



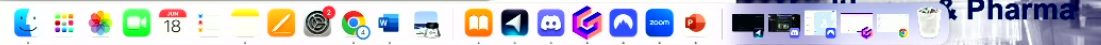
Logistics



Pharma



Crypto



Developing the Quantum Ecosystem and Commercialization

Funding competition

Feasibility Studies in Quantum Computing Applications

UK registered businesses can apply for a share of up to £8 million for innovative solutions to industrial problems using Quantum Computing. This funding is from the National Quantum Computing Centre (NQCC) programme.

Competition opens: Monday 13 February 2023

Competition closes: Wednesday 29 March 2023 11:00am

Start new application



Updates

Announcing STFC's Cross-Cluster Proof of Concept Grant and Highlight Call on Quantum Computing in collaboration with the NQCC

19 October 2022

STFC and the National Quantum Computing Centre are pleased to announce a joint call for proposals.

The NQCC has provided funding for a **Highlight Call on Quantum Computing** through its Applications Discovery Programme, **SparQ**. The call aims to stimulate industry engagement and interactions with the NQCC.



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Case Study: Financial Services

Sector engagement convening:

- **End Users:** Banks & Financial Services Organisations
- **Regulators:** FCA, Bank of England
- **Government:** HMT, BEIS
- **National Labs:** NQCC
- **Academia:** QCS Hub
- **Tech Developers:** Start-ups, Industrials, IT Majors

Understand status
& potential
applications

Identify sector
opportunities &
actions

Converge on
potential
mechanisms &
solutions

Data privacy and sharing

Financial crime – detection & reporting, collaboration between banks, secure multi-party computation

Data identification and preparation

Speed up data analytics for risk profiling, security analyses to improve monitoring capabilities

Optimisation

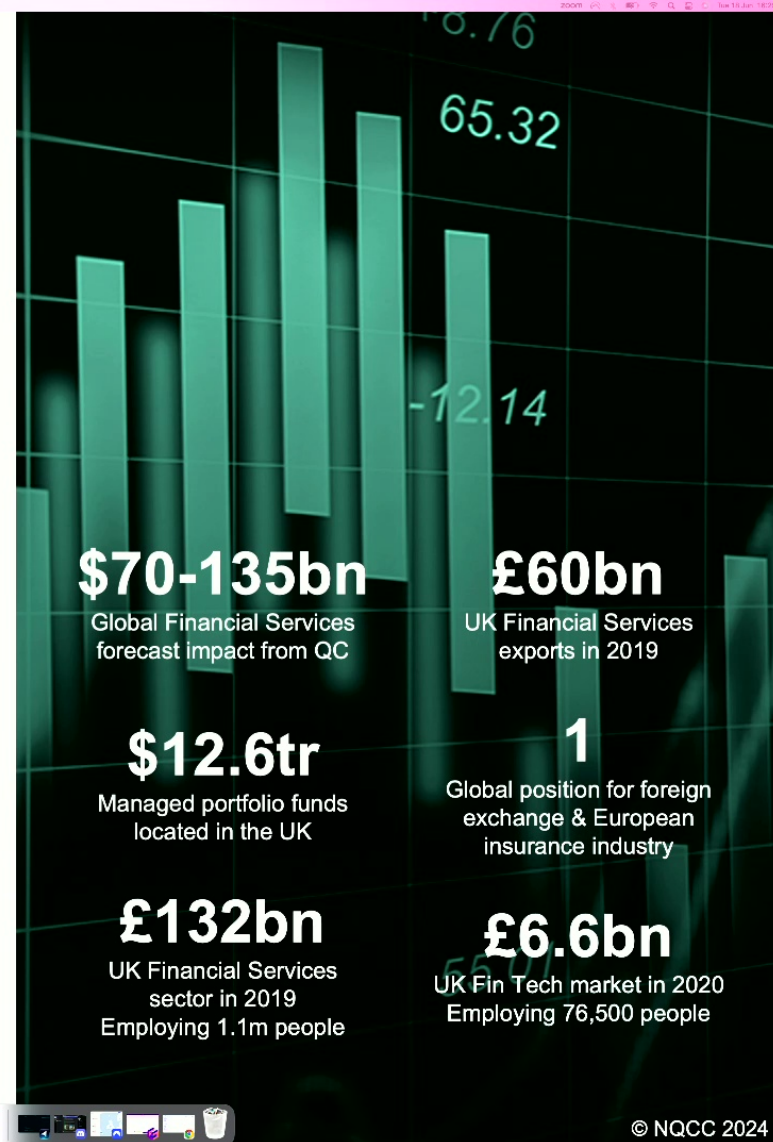
Streamlined settlement processes and improved portfolio diversification

Quantum AI

Fraud detection, anticipative personalised products and services

Quantum-resistant cryptography

Quantum-safe Distributed Ledger Technology, encryption to secure data in motion and at rest



A project to enhance quantum machine learning methods for anti-money laundering detection has been awarded to Rigetti Computing by Innovate UK.

Rigetti will be joined by HSBC, the Quantum Software Lab based at the University of Edinburgh, and the National Quantum Computing Centre to work to improve the performance of quantum algorithms for anomaly detection, a critical method for identifying and preventing financial crime.

Money laundering poses a significant threat to financial institutions and society. Machine learning technology has the power to detect and prevent financial crime by flagging suspicious transactions and adapting to ever-changing criminal behavior. Quantum computing has the potential to enhance existing classical computing workflows, and in turn, could offer improved machine learning methods. In this work, the consortium will aim to extend current anomaly detection quantum machine



National Quantum
Computing Centre
Nov 08 - 2 min read time



DRCF-led engagement on quantum regulatory needs

Regulatory engagement convening:

- **Regulators:** DRCF (CMA, Ofcom, ICO, FCA)
- **National Labs:** NQCC
- **Academia:** QCS Hub
- **Tech Developers:** Start-ups, Industrials, Quantum Platform Providers, IT Majors (Symposium Panels)
- **End Users:** Participation through Symposiums/Feedback

Understand status
& potential
applications

Identify sector
opportunities &
actions

Converge on
potential
mechanisms &
solutions

Regulator's Teach-In

Reverse Teach-In

Regulator's
Symposium

White
Paper/Dissemination








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Case Study: Quantum Computing for Healthcare & Pharmaceuticals

Quantum computing's primary value for pharma lies in R&D.

Quantum computing (QC) use cases along pharma value chain

Research	FOCUS 	Development 	Production 	Logistics and supply chain 	Market access, commercial and medical 
Disease understanding and hypothesis development		Patient identification and stratifications	Calculation of reaction rates	Route/network optimization	Advanced forecasting
Target finding		Patient pharmacogenetic modeling	Optimization of catalytic processes	Dynamic inventory/warehouse/procurement optimization	Patient understanding
Hit generation and identification		Site selection optimization	Product formulations		Tailored healthcare provider-patient engagement
Lead generation		Causality analysis for side effects	Quality monitoring		Automatic drug recommendations
Optimization of candidate properties			Predictive maintenance		
ADME, ¹ activity and toxicity prediction for organ systems and other safety issues					
Dosing optimization					
Solubility optimization					
(Semantic) data management (graphs) "Deepfaking" data					

¹Absorption, distribution, metabolism, and excretion.

McKinsey
& Company



Applications	Solutions			End-Users	
Drug Discovery & Development	Software	Software Library	Open & Closed Source Software	Pharma & Biopharma Companies	<ul style="list-style-type: none">• Drug Discovery• Prediction of 3D Protein Structures• Protein Engineering & Design• Clinical Trials
Medical Diagnostics		Toolkits	Compiler		
		Quantum Algorithm Design Software			
Genomics & Precision Medicine	Hardware	Quantum Computers	Programming Environment Toolkits	Labs & Research Institutes	<ul style="list-style-type: none">• Genomics• Precision Medicine
Radiotherapy		Processors	ML Frameworks		
		Manufacturing and Testing Equipment	Quantum Chips		
Risk Analysis	Services	Measurement & Control Systems		Providers	<ul style="list-style-type: none">• Disease Diagnosis• Security of Healthcare Data Management• Operational and Logistical Healthcare Management
Security		Consulting Services	QC as a service		
Operational Healthcare & Logistics – Population Health Management		Implementation of Services, Logistics and operations, Ongoing IT support	Post-sales & Maintenance	Payers	<ul style="list-style-type: none">• Risk Analysis• Pricing Optimisation• Population Health Management
			Training & Education		



National Quantum Computing Centre



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Collaborative R&D and applications development



**Collaborative
R&D and
applications
expertise**



**Access to
quantum
computing
resources**

Data-driven reactivity prediction using computed quantum features for drug discovery

Sector: Pharmaceuticals & Drug Design

Lead organisation: Capgemini UK Plc

Consortia: Capgemini UK Plc, GSK, National Quantum Computing Centre (NQCC)

Within the pharmaceutical and drug design sector, this project, Capgemini UK Plc, in collaboration with GSK and the NQCC, tackled a central challenge in the design of targeted covalent drugs which lies in the reactivity of the 'warhead'. The partners on this project had already developed an approach to warhead reactivity prediction, which centres on deriving chemical features from quantum calculations. Crucially, this project aimed to find a general approach where rich quantum-derived features can be used for downstream modelling without a significant understanding of reaction mechanisms being known a priori. To date, work has almost entirely been performed on quantum simulators. The focus of this project under the POC call was to identify how to calculate such quantum features so that they are both informative for predictions such as reactivity and can further be calculated on quantum hardware in a scalable way.

Focussing on predicting the reactivity of a chemical series of sulfonyl fluoride compounds, a robust software pipeline was created, which allowed data-driven workflow using quantum features of molecules to make predictions using a machine learning model. The approach potentially offers better generalisation from fewer measured examples, compared to conventional machine learning techniques. The project concluded that the quantum-driven reactivity prediction approach has the potential to significantly accelerate the molecular design process, and eventually, reduce costs and allow for higher throughput.



National Quantum Computing Centre
May 30 - 2 min read time

Share



**Successful kick-off
of twenty-one new
collaborative end-user
led R&D projects - Sep-
Oct 2023**



**National Quantum
Computing Centre**

SparQ



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Collaborative R&D and applications development



**Collaborative
R&D and
applications
expertise**



**Access to
quantum
computing
resources**

Federated quantum machine learning for genomics data

Sector: Healthcare (*Healthcare Data Privacy and Sharing*)

Lead organisation: Zaiku Group Ltd

Consortia: Zaiku Group Ltd, North East Yorkshire Genomics Lab Hub, National Quantum Computing Centre (NQCC)

Biomedical data is an essential resource for developing machine learning (ML) models, with these models being able to aid in diagnosis, treatment, and prevention of diseases. However, the collection, storage, and sharing of biomedical data presents significant challenges due to their sensitive nature, and the ethical considerations. Healthcare data is also subject to strict regulations and privacy laws, making it challenging for researchers to access and share data. This project, led by Zaiku Group Ltd, focused on utilizing quantum computing for federated learning (FL) in genomics data. FL allows multiple organizations to collaboratively train machine learning models without directly sharing data, which is particularly important for sensitive biomedical data. Under this project, the team has investigated the power of quantum computing to enable such privacy-preserving data sharing, with the benefits of classical FL, namely, hybrid classical-quantum FL to benefit the biomedical sector. The project has led to the creation of a cloud-based proof-of-concept platform that enables the training of hybrid quantum machine learning models on genomics datasets without sharing raw data. This project has potential far-reaching implications in accelerating innovation while ensuring data privacy and security.



National Quantum Computing Centre
May 30 - 2 min read time

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Collaborative R&D and applications development



**Collaborative
R&D and
applications
expertise**



**Access to
quantum
computing
resources**

Investigating the application of near-term quantum computing techniques to addressing operational healthcare use cases important to NHS health and care provision

Sector: Healthcare (*Operations and Logistics*)

Lead organisation: Applied Quantum Computing Ltd (AQC)

Consortia: AQC, The Public Service Consultants Limited, Digital Analytics and Research Team – Innovation Transformation Directorate, NHS England, National Quantum Computing Centre (NQCC)

This project, led by Applied Quantum Computing Ltd (AQC), was aimed at addressing operational healthcare challenges faced by the National Health Service (NHS). Accounting for about 10% of the UK's GDP, the healthcare sector requires optimization for efficient service delivery. The project investigated the application of near-term quantum computing techniques in various operational challenges within the NHS. By identifying over ten applications, AQC and its consortium members, including NQCC and NHS England, assessed the impact and suitability for optimization of these challenges through quantum computing. Specifically, the project delved into operating theatre planning and urgent care patient allocation. The team successfully created a small-scale demonstration for theatre planning that could be encoded onto a quantum computer. Even a modest 1% efficiency improvement could yield potential savings of approximately £1.5bn annually. This project indicates that the application of quantum computing techniques could be enormously beneficial in optimizing operational healthcare services.



National Quantum Computing Centre
May 30 – 1 min read time

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SparQ

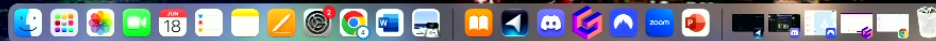


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Next Sectors: Quantum Computing for Space, Energy and Transport



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Quantum Readiness: Access to QC and Testbeds

Quantum Computing Testbeds

Strategic Intent:

- Gain access to a range of platforms enabling evaluation and benchmarking of performance
- Drive both in-house development and external platform evaluation
- Evaluate and de-risk deployment to help drive user-adoption
 - cost, time, performance ...
- Accelerating UK Government as an informed customer and user

£30m investment,

- 15 month deployment
- 24 month evaluation

Supplier	Platform Type
AEGIQ	Photonic
Cold Quanta UK	Cold Atom Tweezer Array
ORCA Computing	Photonic
Oxford Ionics	Trapped Ions
Quantum Motion	Si Quantum Dots
QuEra Computing	Cold Atom Tweezer Array
Rigetti UK	Superconducting

Infrastructure



National Quantum Computing Centre

Quantum Software Lab

- The Quantum Software Lab (QSL) will have a key focus on investigating practical ways to exploit quantum computing for solving problems that are beyond the reach of classical machines
- Launched in April 2023, under the leadership of our chief scientist, Professor Elham Kashefi
- Hosted by the University of Edinburgh in collaboration with the NQCC
- Aims to create an open environment that fosters collaboration with both academic groups and industry partners
- Aligns with the NQCC's key objectives - SparQ



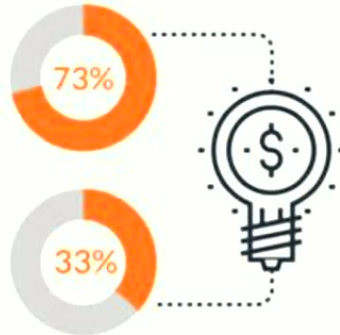
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DIVERSITY PAYS

Companies with diverse leadership teams attain **73% more in revenue from innovation** than less diverse companies.¹

Companies with diverse boards and leadership are **33% more likely** to outperform less diverse companies on profitability.

Source: McKinsey & Company. <https://www.mckinsey.com/business-functions/organization/our-insights/delivering-through-diversity>



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11.3 Acknowledgements	
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New Voices in Space are currently delivering a satellites in schools programme to reach rural children and teachers. This important and inspiring initiative was kindly sponsored by Intel. Previously, the group led the creation of an EDI guidance pack for Scottish space companies that can be downloaded from our Strategic Documents tab in the main menu of the Space Scotland website. The group has also worked with ROOM Space Journal to write and publish a series of informative articles regarding space sector opportunities beyond the typical 'science and technology' roles for university graduates. With these collaborations, we aim to create a more inclusive space community that celebrates diversity at all levels.





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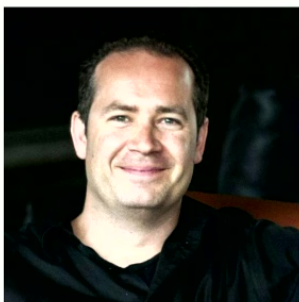


Science Communication, Writing & Op-Eds



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PI Director, Communications and Media
Perimeter Institute
Jun 2013 – Jun 2023 · 10 yrs 1 mo
Perimeter Institute for Theoretical Physics

Not all men: What it means for a young woman scientist to encounter Emmy Noether

The giants of science are mostly male. But not all of them – and that discovery can prove deeply revelatory, writes Sonali Mohapatra.

by PERIMETER INSTITUTE /
on MAR 22, 2019

It's 2 pm on a Wednesday. At Perimeter Institute for Theoretical Physics, [that means colloquium time](#), and if you're a certain sort of nerd, that's exciting. The Time Room is packed. Typically the colloquium is on some recent cutting-edge bit of science, but today is a little different. Yvette Kosmann-Schwarzbach is giving a talk: "[Emmy Noether's two theorems, a hundred years later](#)".

I've gone through a tough time recently and have started having doubts about academia. It feels like I've opened Pandora's box: a single doubt unleashes a swarm of doubts about my abilities as a physicist, threatening to engulf.

It is in this mood that I sit now, listening to an amazing woman scientist talk about another amazing woman scientist: the "mother" of modern algebra. The inventor of Noether's theorem almost a century ago. The discoverer of symmetries and conserved charges. The master of group theory. The one without whom modern physics could not be where it is now. The one of whom there are



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Ideas

Similes and Science, Part 2

CBC News · Posted Aug 30, 2018 9:08 AM EDT | Last Updated: Aug 30, 2018



Spiral galaxy NGC 5752 (ESA/Hubble Image)

f x o in 1 comments

Video 3:55
Similes and Science, Part 2

The Big Bang, string theory, black holes. Theoretical physics may conjure up complicated equations filling up several blackboards. But central to the quest of understanding the universe is the role that the imagination plays. And that means the creation of images through simile and metaphor – usually the purview of novelists and poets. Four prominent physicists join host Paul Kennedy in conversation about the vitality and centrality of the scientific imagination. ** This episode originally aired September 17, 2015.

• **Dr. S. James Gates** is the John S. Toll Professor and Director of the Center for String and Particle Theory at the University of Maryland. He also serves on US President Barack Obama's Council of Advisors on Science and Technology. He is a world authority on supersymmetry, string theory, and superstring theory.

• **Sonali Mohapatra** did her Masters in Theoretical Physics at **Perimeter Institute** as one of Perimeter Scholars International, and is now doing her doctorate in India.



News • Scottish Women in Business

To celebrate International Women's Day, we're focusing on female entrepreneurs and leaders

News By [Peter A Walker](#) *Content Editor*
15:01, 7 MAR 2022 [UPDATED: 13:02, 8 MAR 2022](#)

Bookmark    



 Sairah Bashir, a research and development engineer at the Lightweight Manufacturing Centre

For International Women's Day, we've put together a list of just a few of the females in business, doing great work in Scotland today.

They span sectors as diverse as whisky distilling to quantum computing, face lifts to book shops - with start-ups, corporates and charities among them.

So here's our selection of inspiring ladies.



Donne Burrows, co-founder and chief operating officer of Engine B

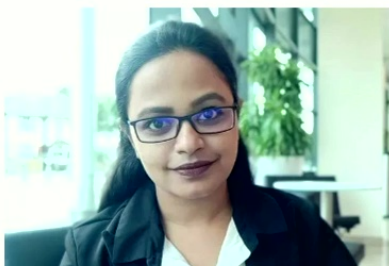
After years working in senior positions within management consultancies - most recently as digital programme lead at KPMG - Burrows set up Engine B two years ago in order to combat a major problem for professional services firms everywhere: access to quality data.

The company has just launched its Integration Engine to further improve the way professional services firms operate, by simplifying data preparation for auditors, reducing the time taken to understand client data and speeding up fundamental audit tasks like reconciliation.

During her time at one of the UK's top accountancy firms as an operational advisor to one of the functional leadership teams, Burrows pushed partners to address the gender pay gap that had existed for a long time. Using data to demonstrate the disparity, she challenged partners to commit to closing the gap within three years of annual pay reviews and to ensure that all new hires were paid the same regardless of gender.

She says: "We all have so many conflicting priorities and demands, so it's good to remind ourselves that we are often our own harshest critics and there are times when we need to put ourselves first."

Recognition & Motivation



Dr Sonali Mohapatra, space applications lead at Craft Prospect

Monapatra leads space applications at Craft Prospect, a company in Glasgow developing quantum and artificial intelligence (AI) technologies for space.

Previously, she co-led quantum technology and the early development of Craft's quantum test bench for the upcoming ROKS mission - the first ever CubeSat launch in the world to demonstrate quantum proof cyber security augmented by AI. In the past, she has worked on the gravitational wave detector at the California Institute of Technology's Laser Interferometer Gravitational-Wave Observatory.

Mohapatra chairs the 'New Voices in Space' subgroup of Space Scotland, which promotes diversity, equity and inclusion across UK space sector and sits on the board of Qindia, a community-led initiative to make quantum more accessible. She is also the founder and creative director of the



Daniel Goldsmith - Senior Quantum Computing Technologist - Digital Catapult



Daniel worked on the Digital Catapult Quantum Technology Access Programme (QTAP), and supported eleven participants, including Airbus, Rolls-Royce and the UKAEA, on their journey from quantum computing theory to hands-on work. The participants contributed a wide range of use cases from industry, and ran scaled down versions of these use cases on the ORCA P7-1 photonic computer.

Daniel has a Masters in Quantum Technology at University College, London, and researched Quantum Error Correction Codes. He has experience working with quantum annealing and photonic computers, as well as the standard quantum circuit model. He has a good understanding of algorithms for the NISQ and the fault tolerant era. He is particularly interested in quantum machine learning, and has written a guide on machine learning for quantum computing specialists.



**Dr. Sonali Mohapatra - Quantum
Innovation Sector Lead - National
Quantum Computing Centre**

Dr. Sonali Mohapatra is a Quantum Innovation Sector Lead at the NQCC leading and supporting the NQCC's innovation strategy and sectoral engagement framework. In her role, Sonali works across government, policymakers, regulators, industry and academia to support QC use-case discovery and application development work across a portfolio of sectors such as healthcare, pharmaceuticals, aerospace, financial services, energy, space and AI to deliver quantum readiness for the UK.

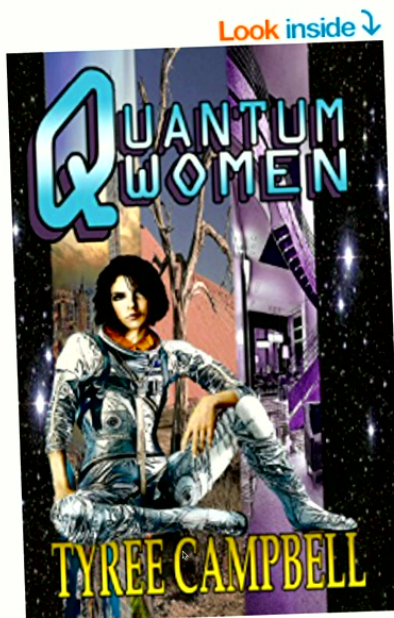
Dr. Mohapatra has an interdisciplinary research and technical background leading the development of a variety of world first technical projects and extensive industry experience leading the development and commercialisation of early stage quantum and AI technologies for new space.



Dr. Corey O'Meara - Chief Quantum
Scientist - E.ON

Dr. Corey O'Meara's work has covered various ways quantum computers could help contribute to solutions around managing the future decentralized energy grid. His work showcases several results relating to optimization problems which have an emphasis on renewable energy integration.

Dr. O'Meara and his team are working on some interesting use cases for potential quantum utility, as Google has just announced a \$5 million dollar prize pool for the industry to apply for demonstration. He is publishing interesting studies demonstrating competitive and in some cases, better scaling results of using a quantum computer to solve optimization problems in the energy sector.



Quantum Women Kindle Edition

by Tyree Campbell (Author) Format: Kindle Edition

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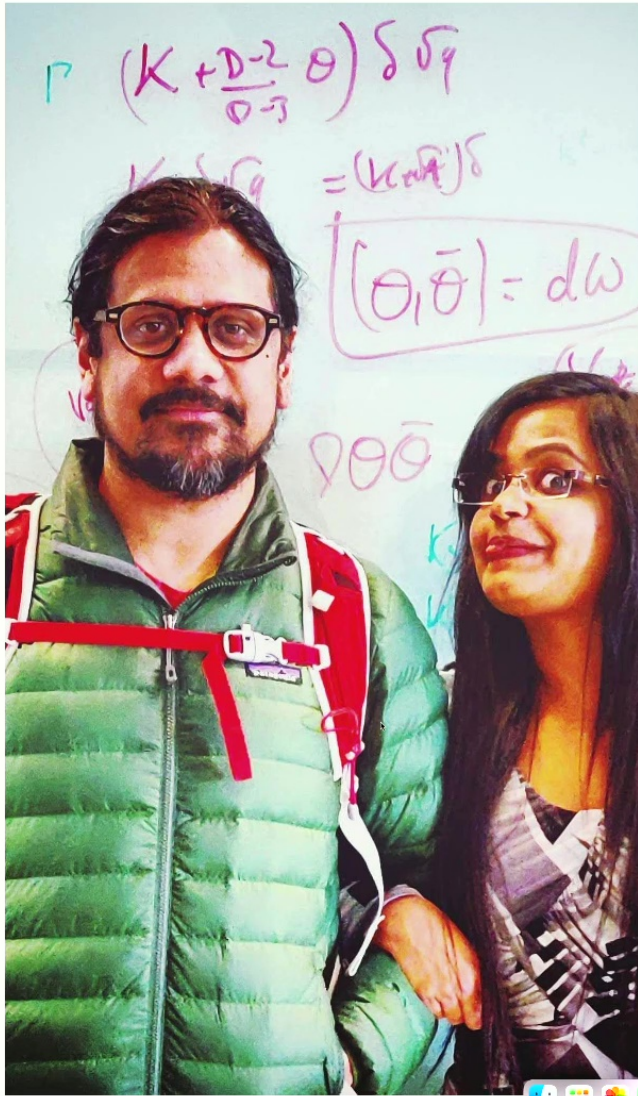
A quantum is a self-contained unit—of energy, light, and so forth. It exists in and of itself, irrespective of its surroundings. But it can be, and usually is, part of a team.

A quantum woman, then, is a self-contained person, independent, yet willing to be part of a team if the right teammate comes along.

Quantum women aren't superheroines with superpowers, they're not "chicks in chain mail," although they might be, as Pamela Sargent wrote, "Women of Wonder." For the most part, quantum women are everyday folks in a science fiction or fantasy setting. They might be home-makers or home-wreckers, homely or homey, but all of them are focused, determined, willful, and independent. To those who have men in their lives, they are partners and companions, equals and not subordinates.

And yet, like any of us, they can find themselves in extraordinary situations where a bit of heroism can save the day. You'll encounter them on these pages.

[Read less](#)



But above all, it's the public who stand to benefit most, with the acceleration of previously unimagined technological innovations capable of vastly improving the environmental, social, and economic prosperity of all.

