Photonic Quantum Sensing SEMINAR

From Single Photons to Quantum Computers

Prof. John G Rarity
University of Bristol



Date Thu. December 10, 2026

Time 11:00-12:00

Hybrid A1-313, Katsura campus/ Zoom

Registration https://forms.gle/G81iHmuEvZsB7RVF8

Deadline : Dec. 9

The theoretical prediction of counter intuitive non-local quantum correlations, entanglement, in the early 20th century intrigued scientists for decades until the discovery of simple statistical tests, Bell inequalities, in the 1960's. In the early 1980's we developed novel solid state detectors counting single particles of light: photons. This allowed us to study light interference effects of single photons and pairs of photons leading to the discovered a range of quantum interference phenomena and proving that this non-local entanglement exists. But what could this quantum entangled light be used for? A chance meeting with Artur Ekert at a ski conference in 1991 led to the realisation that our quantum interference experiments could be used to generate secure random bit strings (keys) at remote locations. This led to our early experiments showing single photon interference and entanglement over many kilometers proving that quantum secure key exchange is possible. This in turn led to the launch of various commercial quantum secured key exchange systems and their demonstration in a range of quantum networks over the past 20 years. Beyond the exchange of single Qubits the concept of entangling arrays of Qubits through quantum gates led Schor to discover exponential speed up is possible, in a future Quantum computer. In Bristol we developed the underpinning technologies, based on our original path interference experiments to develop small photonic quantum processors. The future quantum computer could be a very large array of these processors including integrated photonic pair photon sources linked by linear optic elements for high fidelity gates with on-chip fast switching to select the computational path and on-chip '100%' efficient detectors. However there are many technical/engineering hurdles to overcome. PsiQuantum, originally a Bristol start-up, has now raised billions of dollars to realise this dream.

Organizer: Photonic Quantum Sensing Science and Engineering Center
Co-organizer: ERATO Takeuchi, QLEAP, WISE Program "Innovation of Advanced Photonic and Electronic Devices", Kyoto University
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Super Quantum Entanglement

Kyoto University, WISE Program
Innovation of Advanced Photonic and Electronic Devices