Centre for Quantum Optical Technologies

International Research Agenda Unit

Launch Event | 21 June 2018

Venue: Centre of New Technologies, Banacha 2c, 02-097 Warszawa,
Lecture Hall 0142 (Ground floor)

9:30 *Opening* | prof. Agnieszka Chacińska, Director, Centre of New Technologies

9:35 *Welcome* | prof. Marcin Pałys, Rector, University of Warsaw

9:45 *International Research Agenda Programme* | Prof. Maciej Żylicz, President, Foundation for Polish Science

9:55 *Centre for Quantum Optical Technologies* | Prof. Konrad Banaszek, Director of the International Research Agenda Unit

10:05 *UK National Quantum Technology Programme* | Prof. Sir Peter L. Knight FRS, Imperial College London

10:25 *Discussion panel*

Prof. Zbigniew Błocki, Director, National Science Centre Poland

Prof. Sir Peter L. Knight FRS, Imperial College London

Prof. Marek Kuś, Center for Theoretical Physics, Polish Academy of Sciences

Prof. Maciej Żylicz, President, Foundation for Polish Science

11:15 *Coffee break*

SCIENTIFIC SESSION

11:45 *Privacy for the paranoid ones – the ultimate limits of secrecy*
Prof. Artur K. Ekert FRS, University of Oxford and National University of Singapore

12:30 *Integrated photonics devices for quantum communications*
Prof. Paolo Mataloni, Dipartimento di Fisica, Sapienza Università di Roma

13:15 *Are there non-trivial quantum effects in Biology? A discussion on light harvesting processes* | Prof. Susana Huelga, Universität Ulm

14:00 *Lunch break*

SCIENTIFIC SESSION ABSTRACTS

Privacy for the paranoid ones - the ultimate limits of secrecy

Prof. Artur K. Ekert FRS, University of Oxford and National University of Singapore

Among those who make a living from the science of secrecy, worry and paranoia are just signs of professionalism. Can we protect our secrets against those who wield superior technological powers? Can we trust those who provide us with tools for protection? Can we even trust ourselves, our own freedom of choice? Recent developments in quantum cryptography show that some of these questions can be addressed and discussed in precise and operational terms, suggesting that privacy is indeed possible under surprisingly weak assumptions.

Integrated photonics devices for quantum communications

Prof. Paolo Mataloni, Dipartimento di Fisica, Sapienza Università di Roma

The importance of integrated quantum photonics in the telecom band consists of the possibility of interfacing with the optical network infrastructures developed for classical communications. In this framework, on-glass femtosecond laser-written integrated photonic circuits have great potential. They have been demonstrated capable to support, manipulate and measure polarization qubits. In addition, these circuits, can be perfectly mode-matched at telecom wavelength to the in/out coupling fibers, which is a key requirement for a low-loss processing node in future quantum optical networks. Finally, for several applications, quantum photonic devices can be also dynamically reconfigurable.

In this talk, we report on the high performance of femtosecond laser-written photonic circuits for use in quantum experiments, in particular in the telecom band.

Are there non-trivial quantum effects in Biology? A discussion on light harvesting processes

Prof. Susana F. Huelga, Universität Ulm

Quantum biology is an emerging field of research that concerns itself with the experimental and theoretical exploration of non-trivial quantum phenomena in biological systems (See references below for recent reviews on the subject). We will present an overview aimed to bring out fundamental assumptions and questions in the field, using light harvesting as a prototypical biological process. We will identify basic design principles and develop a key underlying theme -- the dynamics of quantum dynamical networks in the presence of an environment and the fruitful interplay that the two may enter.

A fundamental element in the discussion is the formulation of a microscopic model able to explain the observed persisting oscillatory features in the spectral response of different pigment-protein complexes at ambient temperatures. Along delocalized electronic excitations, we argue that quantum coherent interactions with near-resonant vibrations are instrumental for explaining long lived coherence and may contribute to light-harvesting performance.

Experimental results on both natural and artificial systems will be shown to be in agreement with this vibronic model which therefore provides an archetypical framework for the field.

S. F. Huelga and M.B. Plenio, Contemp. Phys. **54**, 181 (2013)
G. D. Scholes *et al*., Nature **543**, 647 (2017)
E. Romero, V. I. Novoderezhkin and R. van Grondelle, Nature **543**, 355 (2017)