ICFO COLLOQUIUM HUGUES DE RIEDMATTEN 'Quantum Communication between Disparate Quantum Nodes'

HUGUES DE RIEDMATTEN

May 04, 2018

Friday, May 4, 2018, 12:00. ICFO Auditorium

HUGUES DE RIEDMATTEN

Quantum Photonics With Solids And Atoms group at ICFO

$$Hugues de Riedmatten studied Physics Engineering at the Swiss Federal Institute of Technology in Lausanne (EPFL) and obtained his Ph.D. in experimental quantum optics in 2003 from the University of Geneva, Switzerland. After a two-year postdoc at the California Institute of Technology, he came back to Geneva to work as a senior scientist until 2010. Since then, he has been ICREA professor and head of the Quantum Photonics group at ICFO. The research of his group focuses on experimental quantum information science and quantum optics, including quantum memories for light, quantum light sources, quantum

frequency conversion and quantum non-linear optics.
Classical information networks such as the internet have revolutionized our way of transmitting and processing data. Now, scientists are trying to build the quantum version of such networks, which hold promise to provide radically new capabilities compared to their classical counterparts. Quantum information networks (consisting of matter quantum nodes and quantum communication channels) could for example enable perfectly secure data transmission or enhanced data processing via distributed quantum computing. While it is generally agreed that photons are the best choice to transmit quantum information, the optimal matter system for building the quantum nodes is still an open question, as each system provides different functionalities. Therefore, the implementation of a hybrid network has been proposed, searching to combine the best capabilities of different material systems.

In this talk, I will present our recent results demonstrating photonic quantum communication between two very distinct quantum nodes functioning at very different wavelengths placed in different laboratories, using a single photon as information carrier. The emitting node was a laser-cooled cloud of Rubidium atoms and the receiving node a crystal doped with Praseodymium ions. We transmitted a qubit from one system to the other, using quantum frequency conversion techniques. The results of the study have shown that two very different quantum systems can be connected and can communicate by means of a single photon and represent an elementary "hybrid" quantum network link.

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