COLLOQUIUM: Entangled Crystals for Quantum Repeaters

HUGUES DE RIEDMATTEN

December 10, 2021
12:00 to 13:30
ICFO Auditorium

Profile:
Hugues de Riedmatten has been ICREA professor and head of the Quantum Photonics group at ICFO since 2010. He 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. After a postdoctoral experience at the California Institute of Technology, he came back to Geneva to work as a senior scientist until 2010. The research of his group at ICFO focuses on creating the physical resources and the quantum technologies to build quantum information networks, including quantum memories for light, quantum light sources, quantum frequency conversion, quantum non-linear optics and quantum processing nodes. Hugues was awarded an ERC starting grant and holds a Frontier Research grant from the Moore Foundation. He was also awarded the City of Barcelona prize

in 2018 for the contributions of his group in hybrid quantum networks.

Abstract:
The distribution of entanglement between the nodes of a quantum network will allow new advances e.g. in long distance quantum communication, distributed quantum computing and quantum sensing. On the ground, quantum information can be distributed across the nodes using single photons at telecommunication wavelengths traveling in optical fibers. The maximal distance that can be reached in optical fibers with direct transmission is however limited to a few hundred km due to the loss in the fiber. In classical communications, this problem is solved by placing amplifiers every 50 to 100 km in the fiber network (so called repeaters). However, this kind of repeaters cannot be used with quantum bits, due to the unavoidable noise they produce. One solution is to use quantum repeaters which use entanglement between quantum memories as main building block. In this talk, I will describe our efforts to build quantum repeater nodes and generate entanglement between them. In particular, I will present a recent experiment demonstrating entanglement between two remote solid-state quantum memories, heralded by a photon at telecommunication wavelength [1]. I will also discuss the prospects to extend these experiments to long distance, an essential step towards the realization of a quantum repeater.
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[1] D. Lago-Rivera, S. Grandi, J.V. Rakonjac, A. Seri and H. de Riedmatten, Telecom-heralded entanglement between multimode solid-state quantum memories. Nature **594**, 37-40 (2021)

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