ICFO Colloquium RONALD HANSON 'Quantum networks based on diamond spins'

RONALD HANSON

January 16, 2015

Friday, January 16th, 12:00, ICFO's Auditorium

RONALD HANSON

Professor and PI of the Quantum Science and Technology in Diamond group at QuTech and Kavli Institute of Nanoscience, Delft University of Technology, the Netherlands $$Ronald Hanson?s work in experimental quantum physics aims at achieving full state-of-the-art control of coupled quantum systems. His research aims for insights into fundamental concepts in quantum science as well as for realizing proof-of-principle quantum information technologies. His group was the first to establish entanglement between qubits on different chips.

Hanson is recipient of several awards including the QIPC Young Investigator Award (2012) and the Nicholas Kurti European Science prize (2012). He is a member of the Young Academy of the Royal Dutch Academy of Sciences.

The realization of a multi-node network of qubit registers is a central challenge for quantum information processing and long-distance quantum communication, as well as for fundamental physics experiments. Diamond spins associated with NV centers are promising building blocks for such a network as they combine a coherent optical interface (similar to that of trapped atomic qubits) with a local register of robust nuclear spin qubits [1]. At the same time, the excellent control of NV centers allows for testing and demonstrating fundamental concepts in physics such as qubit steering by real-time adaptive measurements [2].
Here I will introduce the concepts and techniques used in our research by using a few example experiments. Then I will present our latest progress towards scalable quantum networks. We have recently realized unconditional teleportation between long-lived qubits residing in independent setups separated by 3 meters [3]. Current efforts are aimed at creating heralded entanglement over >1km with the goal of a loophole-free violation of Bell?s inequalities. Latest results towards this goal will be given.

[1] T. H. Taminiau et al., Nature Nanotechnology 9, 171 (2014).

[2] M.S. Blok et al., Nature Physics 10, 189 (2014).

[3] W. Pfaff et al., Science 345, 532 (2014).

Friday, January 16th, 12:00, ICFO's Auditorium