



The Vienna Doctoral Programme on Complex Quantum Systems  
invites you to a

## Seminar Talk

by

**Ronald Hanson**

*QuTech and Kavli Institute of Nanoscience, Delft University of Technology*

### ***Networks powered by quantum entanglement: from the first loophole-free Bell test to a quantum Internet***

Entanglement – the property that particles can share a single quantum state - is arguably the most counterintuitive yet potentially most powerful element of quantum physics. Future quantum networks may harness the unique features of entanglement in a range of exciting applications, such as quantum computation and simulation, secure communication, enhanced metrology for astronomy and time-keeping as well as fundamental tests of nature. To fulfil these promises, a strong worldwide effort is ongoing to gain precise control over multi-particle nodes and to wire them up using quantum-photon channels. Diamond spins associated with NV centers are promising building blocks for such a network as they combine a coherent electron-optical interface [1] (similar to that of trapped atomic qubits) with a local register of robust and well-controlled nuclear spin qubits [2].

Here I will introduce the field of quantum networks and present an overview of the latest progress, including the first loophole-free violation of Bell's inequalities [3,4] and the first primitive network experiments on a pair on spatially separated two-qubit nodes.

**Monday, 30 January 2017,  
16:30h get-together with coffee and snacks!**

Lise Meitner Hörsaal, Strudlhofgasse 4, 1<sup>st</sup> floor, Vienna

The seminar talk will be preceded by a CoQuS Student talk at 17:00h  
by

**Philippe Allard Guerin**

*University of Vienna*

*Exponential communication complexity advantage from quantum superposition of causal orders*

Hosted by: Philip Walther

- [1] W. Pfaff et al., Science 345, 532 (2014).
- [2] J. Cramer et al., Nature Comm. 7, 11526 (2016).
- [3] B. Hensen et al., Nature 526, 682 (2015).
- [4] B. Hensen et al., Scientific Reports 6, 30289 (2016).

