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CMQT Symposium

Guest Lecture Information

Joris van Slageren

Joris van Slageren (1973) studied chemistry at the University of Utrecht. He obtained his PhD degree (2000) from the University of Amsterdam (Netherlands) on a thesis dealing with the photochemistry and photophysics of transition metal compounds. He then switched fields to Molecular Nanomagnetism, which has been his main field of study ever since. He was a post-doc with Profs. Gatteschi and Sessoli in Florence, Italy (2000 – 2002). Subsequently, he became Molecular Magnetism group leader at the First Institute of Physics at the University of Stuttgart (Germany) culminating in the award of a Habilitation degree (2007). He then took up his first permanent position as Lecturer in Inorganic Chemistry at the University of Nottingham (UK). Just three years later, he was offered a position as Professor in Physical Chemistry at the University of Stuttgart, where he currently still is.

Molecules for Quantum Technologies: Towards Device Development

Abstract: Quantum technologies are set to change the world we live in in many more ways than one. Immense advances have been made, but potential show-stoppers, especially concerning scalability, loom on the horizon. Therefore, the search for an alternative quantum technological platform is on. Molecular quantum bits are the basis for such an alternative platform, because they are highly scalable, tunable and positionable. Coherence times have been shown by ourselves and others to be competitive with other quantum technological platforms.[1-3] Current challenges in the field are individual readout and device integration.

Here we present our past and recent advances in this area. First, we have immobilized molecular qubits in self-assembled monolayers on surfaces. We have conclusively proven monolayer formation. We have demonstrated quantum coherence in the immobilized qubits, which is an essential step towards device integration.[4] Secondly, we have developed hybrid materials of molecular qubits with semiconducting polymers. We have shown by organic field-effect transistor measurements that the electrical properties of the polymers are unimpeded by the incorporation of the quantum bits. Furthermore, the embedded molecular qubits were shown to still possess long coherence times, even in the presence of mobile charge carriers.[5] These are important steps on the way to electrical readout of (individual) molecular quantum bis in spintronic devices. Finally, we will present our results on strong coupling between spin ensembles and microwave resonators.[6] Static and dynamic investigations revealed very strong cooperativity factors, long coherence times and efficient microwave pulse storage. These results pave to way toward application in quantum memories and quantum repeaters.

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