University of Stuttgart
Germany

Van Slageren Group

Postdoc recruitment

We are looking for candidates interested in applying for Alexander von Humboldt (no deadline), Walter Benjamin (DFG, no deadline) or Marie-Skłodowska-Curie (EU, deadline September) postdoc fellowships in the area of Molecular Quantum Bits, for example on one of the topics described below.

Quantum bits are two- or more-state systems that can be put into coherent superpositions of these states. Qubits are the building blocks of quantum technologies including quantum communication, quantum computing and quantum sensing. Spin qubits have the advantage that the lifetime of the superposition state is long compared to other qubit implementations and that they can be compatible with conventional electronics. Molecular spin qubits are relatively new in this area, but possess important advantages in that they can be: (i) tailored to specific applications, (ii) placed into highly ordered arrays, and (iii) part of two- and more-qubit systems with atomically precise positioning. We are looking to expand our activities especially in the following areas:

Experimental investigation of spin-phonon-coupling. This coupling determines the spin relaxation rate of paramagnetic molecules and is thus critically important for both molecular qubits and single-molecule magnets. In recent years, there has been tremendous progress in the theoretical understanding of these processes, especially regarding the role of molecular vibrations. The experimental side has been less developed. This work will involve development of measurement techniques (in-field, variable-temperature Raman- and IR-spectroscopy), measurements, and analysis. Samples can be obtained from collaborations or synthesized in the group. It is also possible to complement the work with high-level ab initio calculations.

Thin layers of molecular quantum bits. We have recently developed the capabilities to investigate the quantum dynamics of thin layers of molecular qubits. The deposition of molecular quantum bits in thin or monolayers is a necessary step on the way to implementing these species in quantum devices. This work can go in the direction of materials development focussing on the chemical modification and deposition of molecular qubits with ensuing morphological and functional characterization. Alternatively, this work can go into a more physical direction looking at the interaction of molecular qubits with (spin-polarized) mobile charge carriers.

Electrical addressing of molecular quantum bits. In recent years, convincing evidence of magneto-electric coupling has been reported, but many aspects concerning interaction mechanisms are as yet poorly understood. Furthermore, exploitation of the effect in any meaningful way is still at the start. Here we are especially interested in going to higher fields and frequencies, which could increase the strength of the effect. The work will include instrumental development (implementation of electrodes, adaptation of control software), measurements and analysis. Samples can be obtained from collaborations or synthesized in the group.

Switchable two-qubit systems. We have spent the past years building up the synthetic expertise to design and prepare molecular two-qubit systems featuring rigid bridging groups. As a next step, we are now interested in devising and preparing novel systems where the bridging group if switchable, especially by light irradiation. This work has a strongly synthetic component and is thus most suitable for someone well-versed in this area. In addition, the quantum dynamics of the systems will be studied in house and in collaboration with external partners.