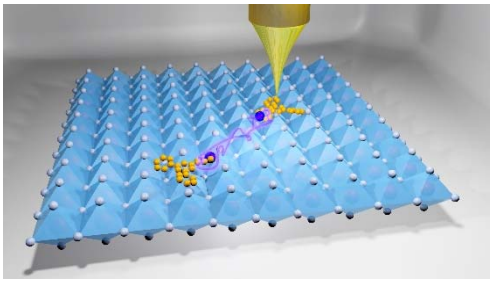
Molecular quantum spins on complex oxides | 17GS	**Start Date:**
PhD: *not yet started*	**PIs:** Prof. Sebastian Loth (Stuttgart) Prof. Bernhard Keimer (MPI)



Abstract: Most quantum spin systems used to date are embedded either in an insulator or a semiconductor. These materials are optimized to minimize spin-environment coupling, thus enabling long coherence times but also limiting usable interaction mechanisms for spin manipulation and spin-spin interaction. We will use the surface of complex oxide materials as functional substrates for surface-grafted molecular spins. Complex oxides derive their electronic properties from Coulomb interaction of the electrons. They offer new states of matter that can provide functional and tunable spin-environment interaction. Of particular interest are Mott insulating states and insulating magnetic phases that could mediate long-range magnetic coupling between spin centers without loss of coherence by electron-spin scattering. The electronic properties of the complex oxides are well-studied by a multitude of techniques ranging from neutron scattering, to nuclear-magnetic resonance spectroscopy, and scanning tunnelling spectroscopy. But little is known about the behaviour of spin centers in or on these materials. We will focus on molecular radicals and metal-organic complexes adsorbed to the surface of complex oxides, in particular the ruthenates of the Ruddlesen-Popper series Ca2RuO4, Ca3Ru2O7 and Sr2RuO4. These materials offer Mott-insulating phases as well as correlated metal-behaviour, various magnetic states and even p-wave superconductivity. These phases are expected to form exotic many-body states when coupled to localized spins. We will use the spectroscopy tools of the Keimer group to characterize the bulk phase transition points and the magnetic correlations of the ruthenate samples. The single-molecule measurements will then be performed in the new high-resolution spectroscopy scanning-probe microscope of the Loth group. The ultimate goal of this project will be to exchange-couple adsorbed spins through long-range interaction by the ruthenate's surface.