

CEIPEX BUT TOPIC 5

Položka / Field	Obsah / Content
CEIPEX RESEARCH TOPIC LEVEL 1	Advanced Nano & Micro technologies
CEIPEX RESEARCH TOPIC LEVEL 2	Quantum Molecular Magnetism
NAME OF THE RESEARCH GROUP	Quantum Molecular Magnetism (RG-1-20)
SUPERVISOR	Dr. Vinicius Tadeu Santana
PROPOSED RESEARCH TOPIC TITLE	Molecular Magnetic Materials for Quantum Spin Control and Emerging Quantum Technologies
RESEARCH TOPIC DESCRIPTION	This topic aims to develop chemically programmable molecular magnetic materials for controlling quantum spin states and establishing design principles for future quantum technologies. Atomically precise molecular systems provide exceptional control over metal-ion identity, oxidation state, exchange interactions, magnetic anisotropy, ligand environment and molecular geometry, enabling direct magneto-structural correlations that are difficult to resolve in bulk materials. Particular interest will be given to high-nuclearity 3d/4f systems and molecular analogues of magnetic solids, including molecular perovskites, while remaining open to other promising molecular-spin architectures. Chemical design will be combined with structural characterization, SQUID magnetometry and advanced EPR spectroscopy to determine magnetic ground states, spin Hamiltonians, relaxation dynamics, quantum tunnelling, spin-phonon interactions and, where accessible, coherent or field-insensitive spin transitions. Selected systems may be transferred to surfaces to determine whether molecular integrity and spin functionality survive at interfaces. CEITEC Nano facilities, including AFM, XPS, SEM/TEM, thin-film deposition and nanofabrication, will provide a direct link between molecular quantum magnetism and nanoscale integration.
KEYWORDS	Molecular magnetism, single-molecule magnets, molecular perovskites, lanthanides, spin coherence, electron paramagnetic resonance
INTERDISCIPLINARY DIMENSION	The research should bridge synthetic chemistry, molecular magnetism, magnetic-resonance physics and nanotechnology, with relevance to quantum sensing, molecular spintronics and emerging quantum technologies.
WEBPAGE OF THE RESEARCH GROUP	https://www.ceitec.eu/quantum-molecular-magnetism/rg400/about-us