Webinar-41

Asian Consortium on Computational Materials Science (ACCMS) Global Centre

SRM University-*AP*, Amaravati

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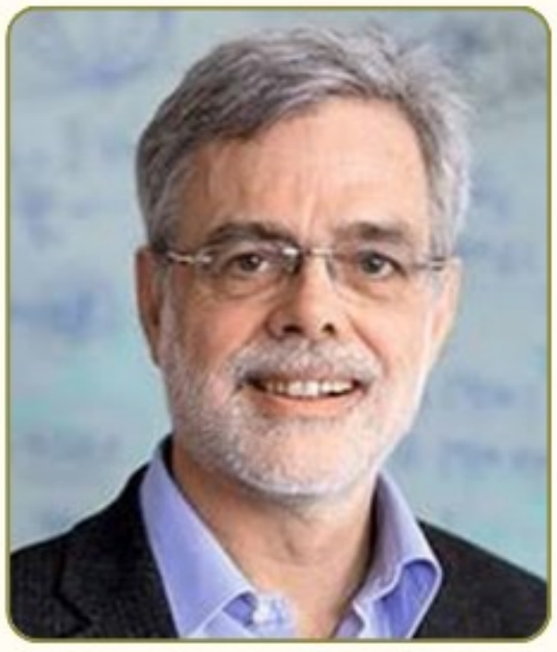
Chiral Magnons and Anisotropic Damping in Metallic Altermagnets



Prof. Stefan Blügel

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Short Biography

Dr Stefan Blügel is Professor emeritus of Theoretical and Computational Physics at RWTH Aachen University and was Institute Director of the Department of Quantum Theory of Materials, which is part of the Peter Grünberg Institute and an associate member of the Institute of Advanced Simulation of the Forschungszentrum Jülich, both in Germany. After studying physics at Saarbrücken University and at RWTH-Aachen University, he carried out research at the College of William and Mary, Williamsburg, VA, USA, and Forschungszentrum Jülich and graduated in 1988 with a Ph.D degree in Physics at RWTH-Aachen University. He completed his Habilitation degree in 1996. Between 1988 and 1990, he was a JSPS-postdoctoral fellow at the Institute of Solid-State Physics (ISSP) of the Tokyo University, Tokyo, Japan. Between 2001 and 2003, he was an Associate Professor of Theoretical Physics at the University of Osnabrück. He is active in several national and European science and science policy committees, is currently vice-president of CECAM (Centre Européen de Calcul Atomique et Moléculaire), Trustee of Psi-k, and has received several national research awards. His research interests lie in quantum materials, topology, spintronics, magnetism, electronic structure theory, and high-performance computing. He was engaged in collaboration with the EU-funded Center of Excellence "MaX-Materials Science at the Exascale" in the development of the Jülich DFT Simulation Infrastructure (www.juDFT.de), a virtual research environment enabling high-performance and high-throughput computing involving the FLEUR (www.flapw.de) and the juKKR (https://jukkr.fz-juelich.de) electronic structure codes. In the last decade, he focused on the investigation of spin-orbit-related phenomena in quantum materials and materials systems with emphasis on spin-orbitronics, materials for spin-orbitronics, and unconventional magnetism. He advocated the Dzyaloshinskii-Moriya interaction and skyrmions at surfaces and interfaces. In 2019, he received an ERC Synergy Grant (Three-dimensional magnetisation textures: Discovery and control on the nanoscale) from the European Research Council.

Abstract

Altermagnetism, a novel class of magnetic order, has recently attracted scientific interest. Combining the favourable properties of ferromagnets, such as spin-polarised conduction electrons, with the advantages of antiferromagnets, such as zero net magnetisation and high-frequency switching, it is a promising area of research [1]. While the ground state properties of altermagnets have been studied, their dynamic properties, such as magnon dispersions, remain elusive. Understanding these properties includes the investigation of magnon excitations, which is essential for the development of spintronic and magnonic devices based on altermagnets. In altermagnets, the chiral magnon degeneracy of antiferromagnets is lifted along certain wave-vector directions and chiral magnons emerge as a consequence of exchange interactions and crystal symmetry, rather than from spin-orbit coupling. Unlike chiral magnets, where chirality originates from the Dzyaloshinskii-Moriya interaction in noncentrosymmetric systems, altermagnetic chiral magnons arise from the momentum-dependent spin splitting enforced by symmetry, even in centrosymmetric materials. In this presentation, results are presented of our recent investigation [2] on the interplay between electronic band spin splitting and chiral magnon excitations in a series of metallic g-wave altermagnets of 3d-transition-metal pnictides, TmPn, in the NiAs structure with a 3d element (Tm=V, Cr), and a pnicogen (Pn= As, Sb, Bi) using density functional theory and many-body perturbation theory [3]. The latter theory allows a coherent investigation of Stoner and magnon excitations in metallic magnets. For example, we find that the magnon damping due to Stoner excitations is highly wavevector-dependent, reaching substantial values in specific Brillouin zone regions. I relate to recent RIXS experiments [4-6] on CrSb that confirmed the presence of polarization-dependent magnon modes.

Work was carried out in collaboration with W. Beida, E. Sasıoglu, C. Friedrich, G. Bihlmayer, and Y.

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