MOLECULAR FRONTIERS

CHALMERS
UNIVERSITY OF TECHNOLOGY

Claudia Felser

Max Planck Institute, Germany

Chirality and Topology

Chirality is a very active field of research in organic chemistry, closely linked to the concept of symmetry. Topology, a well-established concept in mathematics, has nowadays become essential to describe condensed matter [1]. At its core are chiral electron states on the bulk, surfaces and edges of the condensed matter systems, in which spin and momentum of the electrons are locked parallel or anti-parallel to each other. Magnetic and non-magnetic Weyl semimetals, for example, exhibit chiral bulk states that have enabled the realization of predictions from high energy and astrophysics involving the chiral quantum number, such as the chiral anomaly, the mixed axial-gravitational anomaly and axions [2,3]. Chiral topological crystals exhibit excellent chiral surface states [4,5] and different orbital angular momentum for the enantiomers, which can be advantageous in catalysis. The potential for connecting chirality as a quantum number to other chiral phenomena across different areas of science, including the asymmetry of matter and antimatter and the homochirality of life, brings topological materials to the fore. [6].

Literature:

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Claudia Felser studied chemistry and physics at the University of Cologne, completing there both her diploma in solid state chemistry (1989) and her doctorate in physical chemistry (1994). After postdoctoral fellowships at the Max Planck Institute in Stuttgart (Germany) and the CNRS in Nantes (France), she joined the University of Mainz in 1996 as an assistant professor (C1) becoming a full professor there in 2003 (C4). She is currently Director at the Max Planck Institute for Chemical Physics of Solids in Dresden. In 2001 Felser received Order of Merit (Landesverdienstorden) of the state Rheinland Pfalz for the foundation of the first NAT-LAB for school students at the University Mainz with a focus in female school students. She is fellow of the IEEE Magnetic Society, American Physical Society, Institute of Physics, London, CIFAR Canada and the Materials Research Society of India. In 2018, she became a member of the Leopoldina, the German National Academy of Sciences, and acatech, the German National Academy of Science and Engineering. In 2011 and again in 2017, she received an ERC Advanced grant. In 2019, Claudia Felser was awarded the APS James C. McGroddy Prize for New Materials together with Bernevig (Princeton) and Dai (Hongkong). In 2020, she was elected to the United States National Academy of Engineering (NAE) and in 2021 to the United States National Academy of Sciences (NAS). In 2022, she was awarded the Max Born Prize of DPG (German Physical Society) and IOP (Institute of Physics), the Liebig Medal of the German Chemical Society (GDCh), and the Wilhelm-Ostwald-Medal of the Saxon Academy of Science. Her research foci are the design, synthesis, and physical characterization of new quantum materials, in particular, Heusler compounds, and topological materials for energy conversion and spintronics.