Magnetic Materials and Topology

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Topology, a mathematical concept, recently became a hot and truly transdisciplinary topic in condensed matter physics, solid state chemistry and materials science. All 200 000 inorganic materials were recently classified into trivial and topological materials, such as topological insulators, Dirac, Weyl and nodal-line semimetals, and topological metals [1]. More than 25% of all materials host topological bands around the Fermi energy. Beyond the single particle picture, we have identified first antiferromagnetic topological materials [2]. Experimentally, we have realized ferromagnetic materials, examples are Co_2MnGa and $Co_3Sn_2S_2$. Surprisingly all crossings in the band structure of ferromagnets are Weyl nodes or nodal lines [3]. Mn_3Sn and $YbMnBi_2$ are examples of non collinear antiferromagnetic Weyl semimetals, which show giant values for the anomalous Hall and Nernst effect [4]. Our goal is to identify new quantum-materials for highly efficient spintronics, quantum computing and energy conversion.

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