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Homochiral magnetism in low-dimensional magnets[1] STEFAN BLUGEL, MARCUS HEIDE, GUSTAV BIHLMAYER, IFF, Forschungszentrum Juelich, 52425 Juelich, Germany, IFF-1 TEAM — Spin structures observed in nanomagnets are commonly explained on the basis of the Heisenberg exchange and the magnetic anisotropy. Electrons propagating in the vicinity of inversion-asymmetric environments such as of surfaces, interfaces or in ultrathin films can give rise to the Dzyaloshinskii-Moriya (DM) interaction, typically unimportant for metals. Surprisingly, there is no hard number known from theory about its strength, as this requires supercomputing at the cutting edge. One deals with long-ranged complex magnetic structures in low-dimensions. Since the DM interaction arises from spin-orbit coupling, each atom of the long range structure has a different electronic environment and previous strategies, e.g. applying the generalized Bloch theorem, fail. But if DM is important, the so-far anticipated collinear magnetism become unstable, and homochiral spin structures occur. We developed a perturbative strategy implemented into the FLAPW code `FLEUR` which can cope with this challenge. We show by first-principles calculations based on the vector-spin density formulation of the DFT that the DM interaction is indeed sufficiently strong to compete with the interactions that favor collinear spin alignment. We predict new magnetic phases in thin films which had been overlooked during the past 20 years.

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