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Floating zone growth and characterization of topological materials

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Materials hosting Weyl nodes (a pair of linear crossings in the band-structure, similar to Dirac points) yield an enormous potential for applications since they enable massless electrons leading to fast transport properties. A ferromagnetic Weyl semimetal enables a tuning of the berry curvature by an external field. Bandstructure calculations promise the *R* AlGe family (*R* = La, Ce, Pr) [1] to be a promising candidate.

The tetragonal I41md (#109) structure of *R* AlGe is non-centrosymmetric and its magnetism offers rich possibilities for Weyl fermions since both spatial and time-reversal symmetries are broken. While already discovered in 1992 [2] the interest in the context of topology has only been realized in the last years. Until 2018 only specific heat and magnetization data were published on CeAlGe powder samples while PrAlGe still remained unstudied. Since the theoretical proposal the material class is heavily researched [2-5]. In my talk I will shortly introduce the single crystal growth by floating zone of both CeAlGe (Tc = 5 K) and PrAlGe (Tc = 16 K) [2] and elaborate their physics probed by SANS and elastic neutron diffraction. Reports of large magnetoresistance gives a first hint at the weyl properties of these systems [4,5], in addition to this topology we find a topological magnetic groundstate for CeAlGe with a novel kind of striped meron groundstate quite in contrast to the original ferromagnetic claim. PrAlGe on the other hand has the Γ point groundstate, but still is no simple ferromagnet as we find some diffuse scattering at low q and frequency dependence indicating some sort of spin freezing.

[1] G. Chang et al., PRB 97, 041104(R) (2018).
[2] P. Puphal et al., PRM 3, 024204 (2019).
[3] H. Hodovanets et al. PRB 98, 245132 (2018).
[4] T. Suzuki et al., Science 10.1126 (2019).
[5] Biao Meng et al., APL Mater. 7, 051110 (2019).

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