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Kramers-Weyl fermions in chiral crystals

The study of chiral crystals is one of the frontiers in the field of topological materials. Weyl fermions with unique properties emerge in the absence of inversion and mirror symmetries [1]. Kramers-Weyl fermions, for example, are pinned at different high-symmetry points and surface arcs can connect them spanning over the entire Brillouin zone [2 - 4]. The physics of chiral crystals is further enriched by the spin arrangements in momentum space [5], that can go beyond those described by Rashba [6] and Dresselhaus [7].

In my talk, I will show the results of our research activity on chiral crystals. I will start by discussing the radial spin texture observed in tellurium, one of the simplest chiral crystals available [8]. I will explain how the spin texture evolves in the momentum space under the influence of the local point group symmetry. Based on symmetry constrains, we have screened materials databases for compounds that realize spin texture more complex than the basic hedgehog [9]. From this analysis we identify several interesting crystals: I will show you that in the semiconducting CdAs2 Weyl fermions of different origin and with different spin texture emerge in nearly degenerate valleys, connected by helicoid states [10].

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