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Bulk crystal growth of materials with possible novel quantum states with RMX structure-type

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First discovered in 1992, RAlGe (R –rare earth metal) was reported initially to crystallize in the so-called ThSi2 structure-type with a centrosymmetric space group I41/amd (No. 141) [1]. Later on, it has been realized instead that RAlGe crystallizes in the LaPtSi-type structure [2,3] with a body-centered space group I41md (No. 109). From recent first principle theoretical calculations, it has been predicted that the members of the RAlGe (R = Pr, Ce) system, which crystallize in the LaPtSi-type structure, are new magnetic Weyl semimetals [4]. This system offers remarkable tunability, since the number and location of Weyl nodes may be controlled by choice of the rare-earth metal, and the types of broken symmetry, via the Al/Ge content. In addition, in the presence of combined broken symmetries, the system offers a rich phase diagram that may be explored via self-doping or chemical substitution. Therefore, to enable a broad range of experimental studies on this class of material, there is a clear interest in establishing the details for the growth of sizable (mm3) single crystals and their basic physical characterization.
Recently we have reported on the crystal growth by floating zone and a flux-growth techniques and basic characterization of RAlGe family (R = Ce, Pr) [5]. We investigated the macroscopic and microscopic physical properties of the solid solution of Ce1−xPrxAlGe [6] and reported the discovery of topological magnetism in the candidate magnetic Weyl semimetal CeAlGe [7].

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