Rare-earth based half-Heusler phases and monopnictides - magnetotransport, superconductivity and antiferromagnetism.

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Experimental studies of half-Heusler phases: REPdBi (RE= Lu, Gd, Tb, Dy, Ho, Er), LuPtBi, YPtBi, and monopnictides: YSb and LuSb are reviewed. Several of presented half-Heusler phases exhibit band inversion effect and superconducting ground state of most likely unconventional nature due to their common non-centrosymmetric crystal structure and very low carrier densities. Moreover, for (RE= Dy, Ho, Er)PdBi series the superconductivity coexists with antiferromagnetic order. Characteristic features in their magnetotransport (weak antilocalization effect, very large and nonsaturating magnetoresistance, Shubnikov–de Haas oscillations revealing charge carriers of small effective masses and Berry phases close to π) indicate that these materials host topologically nontrivial electronic states, which may be directly involved in forming Cooper pairs. On the other hand, for YSb and LuSb, despite the band inversion, their extraordinary magnetotransport properties (including giant magnetoresistance) may be ascribed in full to nearly perfect charge compensation of bulk 3D Fermi surfaces.

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