Magnetothermopower and anomalous magnetotransport in half-Heusler topological materials

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Half-Heusler compounds form a chemically diverse class of materials with a broad spectrum of physical properties. Even relatively small subgroups, such as *RE*PdBi and *RE*PtBi compounds (*RE* is rare-earth elements), which we have intensively investigated in recent years, host a wealth of intriguing physical phenomena, including chiral magnetic anomaly, anomalous Hall effect, unconventional superconductivity, and large longitudinal and transverse magnetothermopower.

In this work, we review the results of our recent investigations of magnetothermopower and magnetotransport properties of selected *RE*PdBi and *RE*PtBi compounds. Most of these materials have a zero-gap electronic structure that is highly sensitive to external perturbations such as temperature and magnetic field. In particular, as proposed for GdPtBi, external magnetic field reconstructs the zero-gap band structure, leading to the formation of Weyl nodes close to the Fermi level [1]. In this context, we experimentally confirmed the topologically non-trivial character of several half-Heusler compounds by observing negative longitudinal magnetoresitance and anomalous Hall effect. Using GdPtBi as an example, we further demonstrated that the magnitude of both these effects can be tuned by shifting the Fermi level via high-energy electron irradiation [2]. The zero-gap band structure is also highly sensitive to temperature. We proposed that thermal broadening in half-Heusler compounds leads to multi-band transport involving both electrons and holes, resulting in a strong enhancement of the transverse magnetothermopower via the ambipolar effect. Interestingly, due to imperfect charge carrier compensation and asymmetry of bands, these materials also demonstrate large longitudinal magnetothermopower [3]. Our results show that half-Heusler bismuthides combine topologically non-trivial electronic structure with pronounced magnetothermoelectric effects.

References:

[1] M. Hirschberger et al., *Nat. Mat.* **15**, 1161 (2016).
[2] O. Pavlosiuk et al., *Mater. Horiz.* **12**, 4749 (2025).
[3] O. Pavlosiuk et al., *Adv. Funct. Mater.* e22474 (2025).

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