Putative topological states in antiferromagnetic semimetal EuSnP

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The compound EuSnP crystallizes in a layered tetragonal unit cell (s.g. $P4/nmm$, NbCrN-type) and orders antiferromagnetically at $T_N = 21$ K [1-4]. The crystal structure is very robust against high pressure, and the Néel temperature strongly increases under pressure reaching a value of 100 K at 8 GPa, which is a record-high T_N for materials based on europium [3,4]. In a recent angle-resolved photoemission spectroscopy experiment, an intriguing electronic structure has been revealed, which suggests that EuSnP can be a nodal-line Dirac semimetal or topological crystalline semimetal [5]. In the present work, we re-examined the thermodynamic properties (magnetic susceptibility, magnetization, heat capacity) of high-quality single crystals of EuSnP, and studied in depth their electrical transport behavior (electrical resistivity, magnetoresistance, Hall effect) over a wide range of temperatures and magnetic fields. We observed an unusual linear variation of the electrical resistivity in the paramagnetic state, similar to that known for strange metals. Interestingly, the Hall conductivity measured at 2 K turned out to be very high, reaching a value of about 2 kS/m in a magnetic field of about 2 T. Combined with a strongly enhanced electrical conductivity, the Hall angle in the crystals investigated was estimated to be as large as about 20%. It still remains to be verified whether the observed extraordinary magnetotransport properties of EuSnP may be due to the alleged topologically nontrivial electronic structure of this material.

References:

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