High field study of topological Kondo semimetals

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Introduction

Topological materials have attracted considerable attention due to the presence of a non-trivial band topology, resulting in numerous exotic physical properties [1]-[3]. To date, multiple types of topological semimetals have been discovered, but in most cases these are weakly correlated systems [3]. As such, it is of great interest to search for topological semimetals in strongly correlated systems [4]. A topological Kondo semimetal candidate will provide a suitable platform for studying the interplay between band topology and electronic correlations. The antiferromagnetic semimetal SmSb belongs to a family of rare-earth monoantimonides, which have been the focus of much research due to the observation of an extremely large magnetoresistance [5]. We have observed an anomalous temperature dependence of quantum oscillation amplitudes, which is possibly related to its topological properties [6]. To explore this possibility, it is necessary to examine the band topology of this material.

Experimental

The magnetotransport properties are measured using the 65T pulse field magnet in Los Alamos National Laboratory. Twisted copper wires are used to reduce the noise level, and the wires are attached to the sample with silver paint to minimize the contact resistance.

Results and Discussion

We performed high field magnetotransport measurements on SmSb at various temperatures and clear SdH oscillations have been observed, providing vital information about the Fermi surface topology. By subtracting the residual Landau index in the Landau fan diagram, as displayed in Fig. 1, a geometric phase factor close to π is obtained. These results suggest that SmSb is a topological semimetal with a non-trivial band topology, which makes it of great interest for exploring the relationship between the non-trivial band topology and anomalous behavior in temperature dependence of SdH oscillation amplitudes, as well as the interplay between the band topology and magnetism [6].

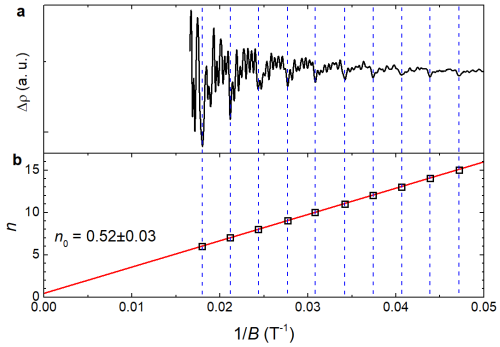

Fig.1 (a) The results of high field SdH oscillation measurements. (b) Landau fan diagram analysis.

Conclusions

We have performed high field magneto-transport measurements on the topological semimetal candidate SmSb. By Landau fan diagram analysis, we have determined the geometric phase factor of the oscillations, which indicates the non-trivial topological nature of this material.

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