Shubnikov-de Haas Oscillations in GdSi

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Introduction

The antiferromagnetic Gd binary compound GdSi [1-2] is believed to be largely free of the crystal field effect due to the spin nature of Gd ions, and could provide a rare opportunity to study pure spin behaviors of a metallic antiferromagnet. Recently, resonant x-ray magnetic diffraction of GdSi at the zero-field limit [3] revealed that GdSi possesses an incommensurate antiferromagnetic ground state. In addition, significant band crossing behavior also develops below 20K from Hall coefficient measurements [3]. We probed the magnetoresistance (MR) with a focus on Shubnikov-de Haas (SdH) oscillations to probe the Fermi surface morphology of GdSi in the antiferromagnetic phase.

Experimental

We used the 35 Tesla DC resistive magnet in Cell 12 of NHMFL. Metallic resistivity of several oriented samples was measured under bar-shaped four-probe geometry using a LR700 resistance bridge. Samples were mounted in a He^3 probe that reaches down to 0.33 K.

Results and Discussion

We measured MR along three principle axes (*a, b, c*) at several temperatures, We saw clear signatures of SdH oscillations at low temperature (**Figure 1**), which eventually disappear above 15 K.

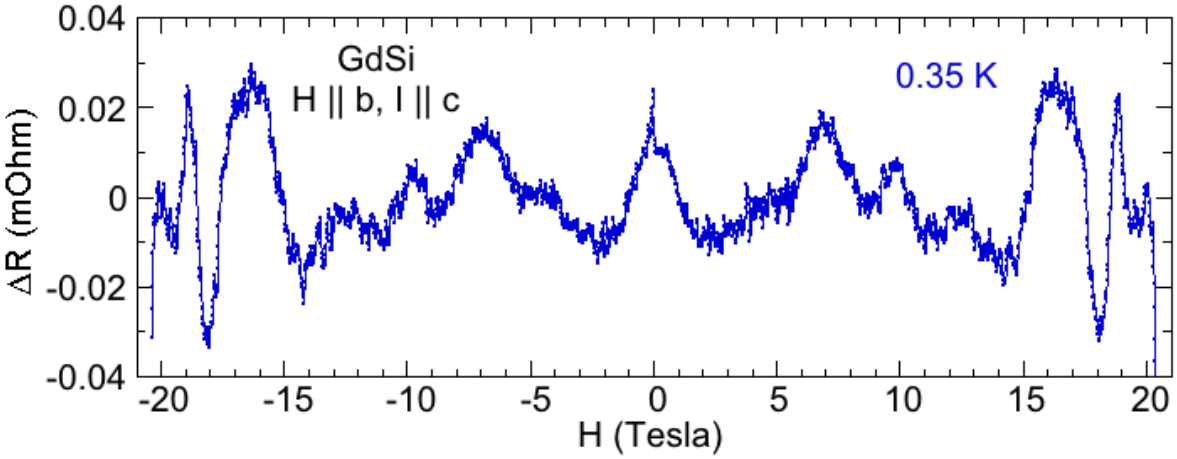

Figure 1: SdH oscillations observed from the mangetoresistance. A 3rd order polynomial background has been used to remove the overall trend in field to show the fine oscillations in ρ(H).

Conclusions

Our observation of SdH oscillations at low temperature clearly shows the dominant existence of small Fermi surface pockets.

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