Hall Measurement of CeIn₃ at High Pressure


**Introduction**

The Neel-ordered phase of CeIn₃ ($T_c \sim 10$K) is suppressed when pressure is applied up to a critical pressure of $\sim 26$ kbar where a small superconducting dome is found below $\sim 200$ mK. [1] Harrison, et al., [2] used the 100T pulse magnet at NHMFL’s LANL facility to investigate the field-temperature phase diagram to $\sim 90$T. In these ambient pressure measurements, the low-field AFM state becomes canted near $\sim 41$T and then suppressed at the Neel critical field of $\sim 60$T. High field measurements at ambient pressure have indicated a need for further measurements which include both high fields and pressure. Here we report Hall measurements under pressure on CeIn₃ in the hybrid magnet to 45T.

**Experimental Results and Discussion**

A single crystal of CeIn₃ was lapped down to a thickness of $\sim 50$ μm. Gold wires were attached with gold paste in a Hall configuration and the sample was loaded into a MP35N double-clamped pressure cell. The resistance was measured using a Lakeshore 370 resistance bridge. Often for a Hall effect experiment, measurements are taken with a positive and negative field sweep. Because of the superconducting outsert of the hybrid magnet, it is difficult process to reverse the magnetic field. A sample can also be rotated 180° for the same effect but the pressure cell was too large. In this case, the field was swept twice at each measured temperature with the voltage and current contacts interchanged between sweeps, as described in ref. 4. At low temperatures, a sharp cusp was observed in the Hall resistance which shifts to lower field with added pressure (Fig. 1a).

**Conclusions**

A Lifshitz topological transition is suggested near $\sim 40$T by the dHvA work of ref. 3, which likely corresponds to the phase boundary mapped out through the skin depth measurements under pressure in ref. 5. We have observed an acute change in the magnetoresistance at a similar field to the previous work. Using the highest intensity point from a derivative of the Hall resistance to determine a transition point, we have constructed a phase boundary, shown in Fig. 1b.

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**References**