METAMAGNETISM AND FERMI SURFACE CHANGE IN CeIrIn5: A HIGH FIELD TRANSPORT AND DHVA STUDY

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Metamagnetism refers to a magnetic field induced transformation from a state of low polarization to a state of high polarization in an itinerant paramagnet. While a complete microscopic description of this phenomenon is still missing, metamagnetic systems have attracted renewed attention in the context of quantum phase transitions. Experimental investigations in Sr$_2$RuO$_7$ suggested the possibility of a quantum critical point associated with metamagnetism[1]. CeIrIn$_5$, a recently discovered heavy fermion superconductor, offers yet another playground for such investigations[2]. A metamagnetic-like transition has been reported for fields exceeding 30T applied along the c-axis in this tetragonal material, based on a characteristic increase observed in magnetization[3] and an associated jump in specific heat[4]. Our preliminary investigations up to 17T have revealed a field induced Non Fermi Liquid behavior in both specific heat and resistivity for field parallel to c-axis and a strong anisotropy with respect to field orientation. We have tentatively attributed this behavior to a quantum critical point associated with the suppression of metamagnetism[5]. Here, we report our recent results of high field magnetization and resistivity up to 33T.

We have measured resistivity and cantilever magnetization in single crystals of CeIrIn$_5$ using a dilution refrigerator in the 33T magnet at NHMFL. We observe a metamagnetic anomaly at $H_M=28T$ in both quantities at the lowest temperatures. The thermodynamic signature is a kink followed by an increase in magnetization as the field is increased, corresponding to a second order transition, as shown on Fig.1. The transition gradually shifts to higher fields as the temperature is increased. There is a corresponding sharp drop in resistivity at low temperatures, as the field is increased above $H_M$, as shown on Fig.2. The maximum in resistivity decreases with increasing temperature and the magnetoresistance become positive above 0.7K with only a kink corresponding to the metamagnetic transition. The possibility of a quasiparticle mass enhancement related to the presence of a quantum critical point at $H_M$ is being investigated. The dHvA oscillations resolved in magnetization represent a complementary source of information to the magnetotransport data. The preliminary analysis of the dHvA data gives evidence for a Fermi surface rearrangement at the metamagnetic transition. A more detailed analysis is underway.

![Fig1: Magnetization vs. Field in CeIrIn5](image1.png)

![Fig2: Resistivity vs. Field in CeIrIn5](image2.png)

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References