论文題目要旨

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論文題目：Unique electrical transport properties of atomically layered antiferromagnets with high mobility

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Atomically layered materials are a group of materials where two-dimensional sheet-like blocks are stacked on top of each other. In recent years, this group of materials has been gaining large attention especially in the field of magnetism. While active research is being made to elucidate the detailed magnetic structure of various atomically thin magnets, studies of electrical transport in these thin-film devices are still largely under development. The purpose of this thesis is to investigate the electronic transport properties unique to the atomically thin-film magnetic materials fabricated through the scotch tape method. Specifically, we have focused on two atomically layered antiferromagnets with high mobility.

The first is the rare-earth antiferromagnet $CeTe_3$, which has recently gained attraction as an atomically layered magnetic material with high mobility. Through magnetoresistance measurments of the $CeTe_3$ thin films, we observed two characteristics that were previously unreported in the bulk samples. One is the magnetoresistance hysteresis, indicating the existence of anisotropy of the magnetic moments along the stacking direction of the thin film. The other is the clear quantum oscillation, originating from a small Fermi pocket because of the formation of the charge density wave. The temperature dependence of the quantum oscillation amplitude indicates a modulation of the Fermi surface with the onset of the magnetic order.

The second is the triangular-lattice antiferromagnet Ag_2CrO_2, which is one of the few metallic magnetic materials. This material possesses an exotic magnetic structure known as the “partially disordered state”. We have performed simultaneous magnetoresistance and Hall measurements for Ag_2CrO_2 thin-film devices. A clear anomalous Hall signal was observed. It has a maximum at the magnetic transition temperature. The analysis of the anomalous Hall conductivity and its temperature dependence strongly indicate that the fluctuating moment near the transition temperature plays a key role in the unique anomalous Hall effect.

Through these results, we have showcased the emergence of unique electrical transport phenomena which can only be accessed in the magnetic thin-film devices, and demonstrated that they also provide important information on the underlying electronic and magnetic physics within these materials.