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Metallic Spin Liquid Behavior and Unconventional Anomalous Hall Transport of the Geometrically Frustrated Kondo Lattice $Pr_2Ir_2O_7$[1]

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Among metallic magnets on geometrical frustrated lattices, the pyrochlore oxide $Pr_2Ir_2O_7$ is unique for its metallic spin liquid behavior [2], and unconventional Hall transport phenomena [3]. Despite the Weiss temperature $T^* = 20$ K deu to the RKKY interaction, $Pr_2Ir_2O_7$ exhibits no magnetic long range order, but spin freezing at a very low temperature ~ 120 mK. Instead, the Kondo effect, including $\ln T$ dependence in the resistivity, emerges and leads to partial screening of the $4f$-moments below T^*. Moreover, the underscreened 4f- moments show spin-liquid behavior below a renormalized energy scale of $\theta_{\rm w} \sim 1.7$ K. Interestingly, in this spin-liquidlike paramagnetic regime, the Hall resistivity ρ_{xy} becomes largely enhanced, and shows behavior far different from anomalous Hall effects (AHE) due to the spin- orbit coupling observed in ordinary magnetic conductors. We discuss the origin of the metallic spin liquid behavior and unconventional AHE in terms of the spin chirality due to the non-coplanar texture of the $< 111 >$ Ising-like Pr moments. This work is based on the collaboration with Y. Machida, T. Tayama, T. Sakakibara (ISSP, Univ.of Tokyo), Y. Maeno (Kyoto Univ.), S. Onoda (RIKEN, Tokyo), C. Broholm (Johns Hopkins Univ.), C. Stock and J. van Duijn (ISIS), L. Balicas (NHMFL), Jung Young Cho, and Julia Y. Chan (Louisiana State Univ.).

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