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Anomalous quasiparticle thermal transport in the superconducting state of ultra pure URu_2Si_2 single crystals YUICHI KASAHARA, T. IWASAWA, T. SHIBAUCHI, Kyoto Univ., Y. MATSUDA, Kyoto Univ., Institute for Solid State Physics, Univ. of Tokyo, K. BEHNIA, Laboratoire de Physique Quantique, ESPCI, T. D. MATSUDA, Y. HAGA, Japan Atomic Energy Agency (JAEA), Y. ONUKI, Osaka Univ., JAEA — In heavy fermion superconductor URu_2Si_2, although it is believed that superconductivity in this material ($T_c \sim 1.5$ K) is unconventional, details of the superconducting gap structure are still unknown. To investigate the quasiparticle transport in the superconducting state of URu_2Si_2, the thermal conductivity κ is measured in ultra pure single crystals with residual resistivity ratio ~ 600. In zero field, κ/T shows a steep increase below T_c, indicating that the quasiparticle mean free path is strongly enhanced in the superconducting state. A finite residual term of κ/T as $T \to 0$ is clearly resolved, together with a T^2 dependence at very low temperatures. With applying magnetic field, thermal conductivity grows rapidly at low magnetic fields, and exhibits a $\sqrt{H}$-dependence. These results strongly indicate a presence of line nodes in the superconducting gap function. We found that κ/T exhibits a sudden drop at upper critical field, which has never been observed in any superconductors. We discuss this unusual behavior of thermal conductivity in the context of anomalously large $\omega_c\tau(> 1)$ and giant magnetoresistance observed in this material.

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