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Wiedemann-Franz law and non-vanishing temperature scale across the field-tuned quantum critical point of $YbRh_2Si_2$ J.-PH REID, M. TANATAR, R. DAOU, Sherbrooke University, RONGWEI HU, C. PETROVIC, Brookhaven National Laboratory, LOUIS TAILLEFER, Sherbrooke University, BROOKHAVEN NATIONAL LABORATORY COLLABORATION — The in-plane thermal conductivity κ and electrical resistivity ρ of the heavy-fermion metal $YbRh_2Si_2$ were measured down to 50 mK for magnetic fields H parallel and perpendicular to the tetragonal c axis, through the field-tuned quantum critical point, H_c, at which antiferromagnetic order ends. The thermal and electrical resistivities, $w \equiv L_0T/\kappa$ and ρ, show a linear temperature dependence below 1 K, typical of the non-Fermi liquid behaviour found near antiferromagnetic quantum critical points, but this dependence does not persist down to $T = 0$. Below a characteristic temperature $T^\star \simeq 0.35$ K, which depends weakly on H, $w(T)$ and $\rho(T)$ both deviate downward and converge as $T \to 0$. We propose that $T^\star$ marks the onset of short-range magnetic correlations, persisting beyond H_c. By comparing samples of different purity, we conclude that the Wiedemann-Franz law holds in $YbRh_2Si_2$, even at H_c, implying that no fundamental breakdown of quasiparticle behaviour occurs in this material. The overall phenomenology of heat and charge transport in $YbRh_2Si_2$ is similar to that observed in the heavy-fermion metal $CeCoIn_5$, near its own field-tuned quantum critical point.

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