Wiedemann-Franz law analysis near a pair-breaking quantum phase transition in superconducting nanowires

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We consider a dirty superconducting nanowire with diameter smaller than the coherence length. On applying a parallel magnetic field or some other pair-breaking perturbation, the wire can be tuned through a superconducting-normal quantum phase transition which is amenable to theoretical as well as experimental analysis. In the vicinity of such a pair-breaking quantum phase transition, we calculate the electrical and thermal conductivities and study the Wiedemann-Franz law in different regimes using the appropriate quantum critical theory as well as the diagrammatic perturbation method.