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Universal Heat Conduction in the Iron-Arsenide Superconductor KFe_2As_2: Evidence of a d-wave State

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The thermal conductivity κ of the iron-arsenide superconductor KFe_2As_2 was measured down to 50 mK for a heat current parallel and perpendicular to the tetragonal c axis. A residual linear term at $T \to 0$, κ_0/T, is observed for both current directions, confirming the presence of nodes in the superconducting gap. Our value of κ_0/T in the plane is equal to that reported by Dong et al. [Phys. Rev. Lett. 104, 087005 (2010)] for a sample whose residual resistivity ρ_0 was ten times larger. This independence of κ_0/T on impurity scattering is the signature of universal heat transport, a property of superconducting states with symmetry-imposed line nodes. This argues against an s-wave state with accidental nodes. It favours instead a d-wave state, an assignment consistent with five additional properties: the magnitude of the critical scattering rate Γ_c for suppressing T_c to zero; the magnitude of κ_0/T, and its dependence on current direction and on magnetic field; the temperature dependence of $\kappa(T)$.