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Field dependence of thermal conductivity in the iron-based superconductor KFe_2As_2: Evidence of a *d*-wave state FAZEL FALLAH TAFTI, ALEXANDRE JUNEAU-FECTEAU, PATRICK BOURGEOIS-HOPE, SAMUEL RENE DE COTRET, JEAN-PHILIPPE REID, NICOLAS DOIRON-LEYRAUD, LOUIS TAILLEFER, Univ of Sherbrooke, AIFENG WANG, XIGANG LUO, XIANHUI CHEN, University of Science and Technology of China — Pairing symmetry in the iron-arsenide superconductor KFe_2As_2 is the subject of active debate. Thermal conductivity at milliKelvin temperatures is a sensitive and directional probe of the superconducting gap structure. Thermal conductivity measured along both [100] and [001] directions reveal that all Fermi surfaces in KFe_2As_2 must have vertical line nodes. This stringent constraint is automatically satisfied by d-wave symmetry, but not likely to be satisfied by an s-wave state, where nodes are accidental. Here, we report a detailed study of the magnetic field dependence of thermal conductivity in KFe_2As_2, measured in the $T = 0$ limit. The data are found to be in excellent agreement with d-wave calculations. Our data are also compatible with low-temperature specific heat data as a function of field, within a multi-band d-wave scenario. Using Fermi surface parameters from quantum oscillations, we estimate the thermal conductivity expected of the gap structure extracted from ARPES measurements on KFe_2As_2 for the different Fermi surface sheets. We find a result that is incompatible with our thermal conductivity data, and conclude that the superconducting state at the surface, accessed by ARPES, must be different from the state in the bulk, accessed by transport and thermodynamic measurements.

Fazel Fallah Tafti
Univ of Sherbrooke

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