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A novel non-Fermi-liquid state in the iron-pnictide FeCrAs WENLONG WU, ALIX MCCOLLAM, University of Toronto, IAN SWAINSON, National Research Council of Canada, PATRICK ROURKE, University of Toronto, DENIS RANCOURT, University of Ottawa, STEPHEN JULIAN, University of Toronto —
We report transport and thermodynamic properties of stoichiometric single crystals of the hexagonal iron-pnictide FeCrAs. The in-plane resistivity shows an unusual "non-metallic" dependence on temperature T, rising continuously with decreasing T from $\sim$ 800 K tobelow 100 mK. The c-axis resistivity is similar, except for a sharp drop upon entry into an antiferromagnetic state at $T_N \sim 125$ K. Below 10 K the resistivity follows a non-Fermi-liquid power law, $\rho(T) = \rho_0 - AT^x$ with $x < 1$. The specific heat, on the other hand, shows typical Fermi liquid behaviour with a linear temperature dependence and a large Sommerfeld coefficient, $\gamma \sim 30$ mJ/mol K^2. The magnetic susceptibility does not follow Curie-Weiss law and it is rather weakly temperature dependent at low temperature. The high temperature properties of FeCrAs are reminiscent of those of the parent compounds of the new layered iron-pnictide superconductors, however the $T \rightarrow 0$ K properties suggest a new class of non-Fermi liquid. This low temperature state has some features expected of a fractionalized electron system, in which conduction electrons break up into a charge carrying part that scatters anomalously and a spin part that has the thermodynamic properties of a Fermi liquid.

Stephen Julian
University of Toronto

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