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Preformed pairing in superconducting FeSe in the BCS-BEC cross-over regime SHIGERU KASAHARA, Y. SHIMOYAMA, R. KOBAYASHI, T. YAMASHITA, T. WATASHIGE, Y. MATSUDA, Kyoto University, T. SHIBAUCHI, The Univ. of Tokyo, T. WOLF, A. E. BÖHMER, F. HARDY, C. MEINGAST, H. V. LÖHNEYSEN, Karlsruhe Institute of Technology — The BCS-BEC cross-over bridges the two important theories of bound particles (Bardeen-Cooper-Schrieffer theory and Bose-Einstein condensation) in a unified picture with the ratio of the attractive interaction to the Fermi energy as a tuning parameter. A key issue is to understand the intermediate regime, where new states of matter may emerge. It has been shown that the Fermi energy of FeSe ($T_c \sim 10$ K) is extremely small, with the result that this system is located at the verge of a BCS-BEC cross-over [1]. Here we show that resistivity, Hall effect, Seebeck and Nernst coefficients all exhibit anomalies at $T \sim 2T_c$, well above the superconducting transition temperature. Moreover, our highly sensitive torque magnetometry shows a suppression of the Pauli susceptibility in the same regime. These anomalies appear to suggest a reduction of the density of states (pseudogap) caused by the onset of pair formation. Based on these results, a new phase diagram of FeSe above T_c is proposed.
[1] S. Kasahara *et al.*, Proc. Nat. Accad. Sci. (USA), Early Edition, 10.1073/pnas.1413477111 (November 6, 2014).

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