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Integer and half-integer flux-quantum transitions in a niobium/iron-pnictide loop[1]

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The recent discovery of iron-based superconductors challenges the existing paradigm of high-temperature superconductivity. Owing to their unusual multi-orbital band structure, magnetism, and electron correlation, theories propose a unique sign-reversed s±-wave pairing state, with the order parameter changing sign between the electron and hole Fermi pockets. However, because of the complex Fermi surface topology and material related issues, the predicted sign reversal remains unconfirmed. Here we report a novel phase-sensitive technique for probing unconventional pairing symmetry in the polycrystalline iron-pnictides. Through the observation of both integer and half-integer flux-quantum transitions in composite niobium/iron-pnictide loops, we provide the first phase-sensitive evidence of the sign change of the order parameter in $NdFeAsO_{0.88}F_{0.12}$, lending strong support for unconventional s±-wave pairing symmetry. Implications on the microscopic pairing mechanism will also be discussed.

[1]Work done in collaboration with C. C. Tsuei, M. B. Ketchen (IBM TJ Watson Research Center), Z.-A. Ren, and Z. X. Zhao (Institute of Physics, Chinese Academy of Sciences)