MAR07-2006-001002

Abstract for an Invited Paper
for the MAR07 Meeting of
the American Physical Society

Magnetism at the interface between ferromagnetic and superconducting oxides.[1]

JAK CHAKHALIAN, University of Arkansas

Atomically controlled interfaces between two materials can give rise to novel physical phenomena and functionalities not exhibited by either of the constituent materials alone. Modern synthesis methods have yielded high-quality heterostructures of oxide materials with competing order parameters. Although magnetic correlations at the interface are expected to be important in determining the macroscopic properties of such nanosystems, a quantitative determination of the interfacial magnetic structure in oxides has thus far been very limited. Here we examine superlattices composed of the half-metallic ferromagnet $La_{2/3}Ca_{1/3}MnO_3$ and the high-temperature superconductor $YBa_2Cu_3O_7$ by core-level absorption spectroscopy with circularly polarized x-rays and by diffuse neutron reflectometry. The resulting data yield microscopic insight into the interplay of spin and orbital degrees of freedom at the interface. The data also reveal an extensive rearrangement of the magnetic domain structure at the superconducting transition temperature. The combination of techniques establishes an incisive probe of the interplay between competing electronic order parameters in oxide heterostructures. J. Chakhalian, J. W. Freeland, G. Srajer, J. Strempfer, G. Khaliullin, J.C. Cezar, T. Charlton, R. Dalgliesh, C. Bernhard, G. Cristiani, H.-U. Habermeier and B. Keimer, "Magnetism at the interface between ferromagnetic and superconducting oxides," Nature Physics, v.2 , 244 (2006).

[1]Work at Argonne National Laboratory is supported by the United States Department of Energy, Office of Basic Energy Sciences, under contract No. W-31-109-ENG-38.