Microsymposium

MS90.O04

Nanoscale phase coexistence at the metal-insulator transition in $Cu(Ir_{1-x}Cr_x)_2S_4$

E. Bozin[1], K. Knox[1], P. Juhas[1], Y. Hor[2], J. Mitchell[2], S. Billinge[1,3]

[1]Brookhaven National Laboratory, Condensed Matter Physics and Materials Science Department, Upton, NY, USA, [2]Argonne National Laboratory, Materials Science Department, Argonne, IL, USA, [3]Columbia University, Applied Physics and Applied Mathematics Department, New York, NY, USA

Increasingly, nanoscale phase coexistence and hidden broken symmetry states are being found in the vicinity of metal-insulator transitions (MIT), for example, in high temperature superconductors, heavy fermion and colossal magnetoresistive materials, but their importance and possible role in the MIT and related emergent behaviors is not understood. Despite their ubiquity, they are hard to study because they produce weak diffuse signals in most measurements. Here we propose $Cu(Ir_{1-x}Cr_x)_2S_4$ as a model system for studying nanoscale phase coexistence at the MIT, where robust local structural signals lead to key new insights. We demonstrate by x-ray scattering measurements and atomic pair distribution function approach a hitherto unobserved coexistence of a Ir^{4+} charge-localized dimer phase and Cr-ferromagnetism. The resulting phase diagram that takes into account the short range dimer order, is highly reminiscent of a generic MIT phase diagram similar to the cuprates. The results represent the first observation of nanoscale phase coexistence in iridates [1]. We suggest that the presence of quenched strain from dopant ions acts as an arbiter deciding between the competing ground states.

[1] *E. S. Bozin, K. R. Knox, P. Juhas, Y. S. Hor, J. f. Mitchell, and S. J. L. Billinge, Sci. Rep. 4, 4081 (2014).*

Keywords: iridates, nanoscale phase separation, metal-insulator transition