novel SuperConductors and Synchrotron Radiation: state of the art and perspectives
SCSR2014 Adriatico Guesthouse, Trieste, Italy / 10-11 December 2014
Elettra Sincrotrone Trieste

Control of collective quantum phenomena in metal-oxide superlattices

Bernhard Keimer

Max Planck Institute for Solid State Research, D-70569 Stuttgart, Germany

E-mail: b.keimer@fkf.mpg.de

A grand challenge in the field of correlated-electron physics is the transition from conceptual understanding of collective ordering phenomena to their control and design. We will outline recent results of an experimental program designed to meet this challenge through the synthesis and characterization of metal-oxide superlattices, with particular emphasis on copper and nickel oxides. We will show how synchrotron-based methods such as resonant x-ray scattering and far-infrared spectral ellipsometry can be combined with laboratory-based methods such as Raman scattering to obtain a comprehensive description of the electron system in metal-oxide superlattices, and outline perspectives for control of the phase behavior of correlated electrons in these structures by modifying the occupation of transition metal d-orbitals, the dimensionality of the electron system, and the electron-phonon interaction.

[1] N. Driza, S. Blanco-Canosa, M. Bakr, S. Soltan, M. Khalid, L. Mustafa, K. Kawashima, G. Christiani, H.-U. Habermeier, G. Khaliullin, C. Ulrich, M. Le Tacon, B. Keimer, Nature Mater. **11**, 675 (2012).

[2] A. Frano, S. Blanco-Canosa , E. Schierle, Y. Lu, M. Wu, M. Bluschke, M. Minola, G. Christiani, H. U. Habermeier, G. Logvenov, E. Benckiser, E. Weschke, M. Le Tacon, B. Keimer, to be published.

[3] A.V. Boris A. V. Boris, Y. Matiks, E. Benckiser, A. Frañó, P. Popovich, V. Hinkov, P. Wochner, M. Castro-Colin, E. Detemple, V. K. Malik, C. Bernhard, T. Prokscha, A. Suter, Z. Salman, E. Morenzoni, G. Cristiani, H.-U. Habermeier, B. Keimer, Science **332**, 937 (2011).

[4] E. Benckiser, M. W. Haverkort, S. Brück, E. Goering, S. Macke, A. Frañó, X. Yang, O. K. Andersen, G. Cristiani, H. U. Habermeier, A. V. Boris, I. Zegkinoglou, P. Wochner, H. J. Kim, V. Hinkov, B. Keimer, Nature Mater. **10**, 189 (2011).

[5] M. Wu, E. Benckiser, M. W. Haverkort, A. Frano, Y. Lu, N. Nwanko, S. Brück, P. Audehm, E. Goering, S. Mache, V. Hinkov, P. Wochner, G. Christiani, S. Heinze, G. Logvenov, H.-U. Habermeier, B. Keimer, Phys. Rev. B **88**, 125124 (2013).

[6] A. Frano, E. Schierle, M. W. Haverkort, Y. Lu, M. Wu, S. Blanco-Canosa, U. Nwankwo, A. V. Boris, P. Wochner, G. Cristiani, H. U. Habermeier, G. Logvenov, V. Hinkov, E. Benckiser, E. Weschke, B. Keimer, Phys. Rev. Lett. **111**, 106804 (2013).

[7] M. Hepting, M. Minola, A. Frano, G. Cristiani, G. Logvenov, E. Schierle, M. Wu, M. Bluschke, E. Weschke, H.U. Habermeier, E. Benckiser, M. Le Tacon, B. Keimer, arXiv:1410.8323 (Phys. Rev. Lett., in press)