

Charge stripes and *d*-wave bond order in YBCO

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The spontaneous self-arrangement of electrons into periodically modulated patterns, a phenomenon commonly termed as charge order or charge-density-wave, has recently resurfaced as a prominent, universal ingredient for the physics of high-temperature superconductors. Its antagonist coexistence with superconductivity, together with its possible connection to a quantum critical point beyond optimal doping, are symptomatic of a very fundamental role played by this symmetry-broken collective electronic state.

Resonant x-ray scattering (RXS) has rapidly become the technique of choice for the study of charge order in momentum space [1,2], owing to its ability to directly identify a breaking of translational symmetry in the electronic density, even when the latter only involves a fraction of the electronic charge and its coherence does not extend beyond a few lattice constants [2,3,4].

In this talk, I will present our recent RXS studies of charge order in YBCO, which show how resonant x-ray methods can be used to peer into the microscopic structure and symmetry of the charge modulations. Using the information available from the full two-dimensional momentum space, we have been able to demonstrate the presence of charge stripes at the nanoscale [5]. In addition, the analysis of the polarization-dependent scattering intensities made it possible to evaluate the local symmetry in the charge distribution around the Cu atoms, which was found to be predominantly of a *d*-wave bond-order type [6].

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[2] J. Rosen*, R. Comin* *et al.*, *Surface-enhanced charge-density-wave instability in underdoped Bi₂Sr_{2-x}La_xCuO_{6+d}*, *Nature Communications* **4**, 1977 (2013).

[3] R. Comin *et al.*, *Charge Order Driven by Fermi-Arc Instability in Bi₂Sr_{2-x}La_xCuO_{6+d}*, *Science* **343**, 390 (2014).

[4] E. da Silva Neto*, R. Comin* *et al.*, *Charge ordering in the electron-doped superconductor Nd_{2-x}Ce_xCuO₄*, accepted (2014) – preprint at: <http://arxiv.org/abs/1410.2253>.

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[6] R. Comin *et al.*, *The symmetry of charge order in cuprates*, under review (2014) – preprint at: <http://arxiv.org/abs/1402.5415>.