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The microscopic structure of charge order in cuprates

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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 (CDW), has recently resurfaced as a prominent, universal ingredient for the physics of high-temperature superconductors. In such context, resonant x-ray scattering (RXS) has rapidly become the technique of choice for the study of charge order in momentum space, owing to its ability to directly identify a breaking of translational symmetry in the electronic density. In this talk, I will present our recent RXS studies of charge order in Bi2201, which reconciled years of apparently disconnected findings in different cuprate families by showing how charge order is a universal phenomenon in hole-doped cuprates [R. Comin, *et al.*, Charge Order Driven by Fermi-Arc Instability in Bi2Sr2−xLaxCuO6+d, Science 343, 390 (2014)]. Contextually, I will discuss very recent findings of charge order in NCCO, which project such phenomenology to the electron-doped materials [E. da Silva Neto*, R. Comin*, *et al.,* Charge ordering in the electron-doped superconductor Nd2-xCexCuO4, accepted (2014) – preprint at: http://arxiv.org/abs/1410.2253]. Furthermore, in YBCO, we have succeeded to fully reconstruct the CDW order parameter in the two-dimensional momentum space and demonstrate how resonant x-ray methods can be used to peer into the microscopic structure and symmetry of the charge order. Using this new method, we have been able to demonstrate the presence of charge stripes at the nanoscale [R. Comin, *et al.,* Broken translational and rotational symmetry via charge stripe order in underdoped YBa2Cu3O6+y, under review (2014)], as well as 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 [R. Comin, *et al.,* The symmetry of charge order in cuprates, under review (2014) – preprint at: http://arxiv.org/abs/1402.5415].