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Interplay between the pseudogap, mode coupling and superconductivity in Bi-based cuprates[1]

MAKOTO HASHIMOTO, SLAC National Accelerator Laboratory

Complexity of the high-Tc cuprate superconductors is partly due to the coexisting energy scales that are of the order of superconducting gap (<50 meV). The pseudogap (<100 meV) and bosonic mode (<100 meV) could be relevant to superconductivity, but they have not been understood in a unified picture. We first show the commencement of the pseudogap state at temperature T* using three different techniques (ARPES, polar Kerr effect, and Time-resolved reflectivity) on the same optimally doped Bi2201 crystals. The result suggests that the pseudogap is a disinct phase that shows broken symmetry,[2,3] which could be consistent with the two-dimentional charge ordering observed by STM and scattering measurements. Further, we discuss how this distinct pseudogap order is entangled with superconductivity below Tc. In Bi2212, by analyzing the ARPES spectral weihgt in the antinodal region, we show compelling evidence for the dynamic competition between the two order parameters for the pseudogap and superconductivity as a function of temperature.[4] Such competition can naturally result in the shift of the critical point for the pseudogap.[5] Moreover, by studying the detailed temperature and doping dependence of the spectral lineshape in the antinodal region, we reveal that the interplay between the pseudogap, bosonic-mode coupling and superconductivity with similar energy scales is crucial and they have to be considered in a integrated picture to understand the cuprates electronic structure.[6]

*These authors equally contributed to the work.

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