Angle-resolved photoemission spectroscopy of high-temperature superconductors: Present status and outlook

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For more than twenty years after the discovery of the cuprate high-temperature superconductors, two outstanding issues have remained unresolved: (i) the mechanism of the high-temperature superconductivity and (ii) the origin of the mysterious pseudogap. Information from angle-resolved photoemission spectroscopy (ARPES) is considered to give essential information to resolve these issues.

In this talk, I first give an overview on the present status of the phenomenological understanding of the superconducting gap and the pseudogap based on ARPES experiments, in particular, their momentum, temperature and doping dependences. Close relationship between the "Fermi arc" length measured by ARPES and the superfluid density measured by μ-SR points to conventional d-wave superconductivity realized in the unconventional pseudogap phase. Implications of ARPES, μ-SR, and neutron scattering data for the nature of the pseudogap phase are discussed.

Next, I describe signatures of coupling between electrons and boson excitations and their implication for boson-mediated Cooper pairing mechanisms. Through the studies of electron-boson coupling effects both in ARPES and neutron and x-ray scattering spectra, a clue for the mechanism of superconductivity may be obtained.