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From insulator to d-wave superconductor: a persisting nodal gap and its interaction with superconductivity YU HE, Department of Applied Physics, Stanford University, MAKOTO HISHIMOTO, SLAC, INNA VISHIK, Department of Physics, MIT, RUIHUA HE, Department of Physics, Boston College, SUNG-KWAN MO, ALS, LBNL, SEIKI KOMIYA, CRIEPI, Japan, YOICHI ANDO, Osaka University, Japan, ZHI-XUN SHEN, Department of Applied Physics, Stanford University — Gapless quasiparticle excitations along (pi,pi) direction in cuprate superconductors are enforced by sign-changing d-wave pairing symmetry. However, increasing number of evidences has been uncovered to support a finite gap along nodal direction in various families of underdoped cuprate superconductors. In this work, we will demonstrate with very comprehensive doping and temperature dependent nodal gap evolution in single layer LSCO system. The continuous doping evolution of the gap extending from insulating region of phase diagram all the way into superconducting dome indicates an origin other than d-wave superconductivity that interacts fundamentally with the superconducting order parameter. By lifting the symmetry-protected node, this gap coexists with superconductivity, meanwhile shows vivid interaction with superconductivity in low temperature underdoped region.

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