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Intertwined evolution of superconductivity and pseudogap in the presence of strong mode coupling YU HE, Stanford Univ, MAKOTO HASHIMOTO, SLAC National Laboratory, DONGJOON SONG, AIST, Tsukuba, Japan, SUDI CHEN, Stanford University, JUNFENG HE, SIMES, SLAC National Laboratory, DONGHUI LU, SSRL, SLAC National Laboratory, HIROSHI EISAKI, AIST, Tsukuba, Japan, ZHI-XUN SHEN, Stanford University — A commonly perceived salient feature of the otherwise extremely complex electronic phase diagram in cuprate high temperature (T_c) superconductors is the appearance of relatively simple superconductivity in the deeply overdoped regime. In a recent measurement of superfluid density only a small fraction of carriers are found to participate in the superconductivity in this region, violating a simple fermionic description. Here we report systematic angle-resolved photoemission spectroscopy (ARPES) study that provides a complementary fermionic perspective. Increasing the doping through a narrow range in the overdoped regime, the single particle spectrum divorces itself from a pseudogap-infected uncanonical behavior, characterized by a large gap-T_c ratio and non-BCS temperature dependence, to the canonical d-wave BCS superconducting gap over the entire Fermi surface. Accompanying this evolution, an electron-phonon coupling (EPC) feature, modified by the pseudogap, also abruptly disappears in an equally narrow doping range, suggesting its potential role as the superconductivity 'enhancer' near the optimal T_c. A combined perspective of the complementary bosonic and fermionic picture is needed to fully describe the phase diagram.

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