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Revised phase diagram and anomalous thermal evolution of the antinodal gap and Raman response in high-temperature superconductors YUAN ZHOU, Nanjing University and Brookhaven Natl Lab, ZUODONG YU, Nanjing University, WEIGUO YIN, Brookhaven Natl Lab, HAIQING LIN, Beijing Computational Science Research Center, CHANGDE GONG, Nanjing University —

The interplay of competing orders is essential to high-temperature superconductivity, which emerges upon suppression of an antiferromagnetic order typically via charge doping. However, where the zero-temperature quantum critical point (QCP) takes place — in terms of the doping level — is still elusive for it is hidden by the superconducting dome. The QCP has long been believed to follow the continuous extrapolation of the characteristic temperature (T*) for a normal-state order, but recently T* within the superconducting dome was found to exhibit unexpected back-bending in the cuprate $Bi_2Sr_2CaCu_2O_{8+\delta}$ and the iron-pnictide $BaFe_{1-x}Co_xAs$. Here we show that the original and the revised phase diagrams can be understood in terms of weak and moderate competitions, respectively, between superconductivity and a pseudogap state such as d-density-wave, based on Ginzburg-Landau theory and the microscopic extended t-J model. We further illustrate that the anomalous thermal dependences of the measured antinodal gap and Raman response in cuprates can be well understood by a two-step evolution, dominated by superconductivity and pseudogap, respectively.

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