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Nonmonotonic gap in the coexisting antiferromagnetic and superconducting state for electron-doped cuprates QINGSHAN YUAN, FENG YUAN, CHIN-SEN TING, Texas Center for Superconductivity, University of Houston, Houston, TX 77204 — Recent measurements on the superconducting (SC) electron-doped cuprates $Nd_{1.85}Ce_{0.15}CuO_4$ and $Pr_{0.89}LaCe_{0.11}CuO_4$ (both at optimal doping) have revealed that the excitation gap does not fit the simplest commonly assumed d-wave function $\cos k_x - \cos k_y$, but exhibits a nonmonotonic behavior with the gap maxima locating midway between the Brillouin zone boundaries and the zone diagonals. This observed gap was naturally regarded as the SC gap and the previous theoretical explanations were limited to extending the SC gap out of the simplest d wave. Here we propose a new idea that the observed gap at optimal doping is the lowest quasiparticle excitation energy in the *coexisting* antiferromagnetic (AF) and SC state, which is not purely the SC gap. The idea is implemented by simply studying the coexistence of AF and SC orders within the slave-boson mean-field approach based on the t-t'-t''-J model. Although the pairing gap itself is assumed to be the simplest d wave which is monotonic, we have found that the quasiparticle excitation gap in the coexisting state is nonmonotonic, with the maxima around the hot spots where the Fermi surface is missing due to the AF gap. Within the same coexisting state the spectral function is also calculated at optimal doping. The obtained results are all consistent with experiments.

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