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Incommensurate charge ordered states in the $t - t' - J$ model PEAYUSH CHOUBEY, University of Florida, WEI-LIN TU, National Taiwan University, Taiwan., TING-KUO LEE, Institute of Physics, Academia Sinica, Taiwan., PETER HIRSCHFELD, University of Florida — We solve the $t - t' - J$ model within the Gutzwiller approximation to obtain commensurate and incommensurate charge ordered states, namely anti-phase charge density wave (APCDW) and nodal pair density wave (nPDW), respectively, which have been earlier shown to possess dominant d-form factor. We address a recent STM experiment [Hamidian *et al.*, Nat. Phys. 3519 (2015)] on BSCCO-2212 by calculating the spatial pattern and spectrum of local density of states (LDOS) at typical STM tip heights in APCDW and nPDW states using a recently developed Wannier function based approach. With the help of Cu and O sub-lattice LDOS maps, we extract the bias dependence of the intra-unit cell form factors and average spatial phase difference in a manner very similar to the experiment. We find that the LDOS maps exhibit ladder like structures similar what has been observed in the STM studies. Moreover, the bias dependence of form factors and spatial phase difference in the nPDW state agrees very well with the experiment. With these findings, we propose that the nPDW states are good candidates for charge ordered states observed in the superconducting phase of underdoped cuprates. We also study the effects of a single impurity and random disorder in the APCDW and nPDW states

Peayush Choubey
University of Florida

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