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Correlating off-stoichiometric doping and nanoscale electronic inhomogeneity in high-T_c superconductor $Bi_2Sr_2CaCu_2O_{8+\delta}$ SEN ZHOU, HONG DING, ZIQIANG WANG, Boston College — A microscopic theory is presented for the dopant induced nanoscale electronic disorder observed by scanning tunneling microscopy in superconducting $Bi_2Sr_2CaCu_2O_{8+\delta}$. We demonstrate that the essential phenomenology is consistent with the existence of two types of interstitial oxygen dopants in the doped Mott insulator. The nonlinear screening of the dopant potential produces atomic scale variations in the doped hole concentration and electronic inhomogeneity in the CuO_2 plane. Based on a spatially unrestricted Gutzwiller approximation of the extended t-J model including the dopant potential, we provide a consistent explanation of the weak correlation between the observed dopant location and the pairing gap and its spatial evolutions. We show that the off-plane oxygen dopants are the primary cause of both the pairing gap disorder and the quasiparticle interference patterns.

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