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Phase separation instabilities and modulated coherent pairing states in Bi-based cuprates ARMEN KOCHARIAN, California State University, Los Angeles, KUN FANG, GAYANATH FERNANDO, University of Connecticut, Storrs, ALEXANDER BALATSKY, Los Alamos National Laboratory, KALUM PALANDAGE, Trinity College, Hartford — There is growing evidence that the unconventional spatial inhomogeneities and structural changes in the doped high-Tc superconductors are accompanied by the pairing of electrons, subsequent quantum phase transitions (QPTs), and condensation in coherent states. We show that these superconducting coherent pairing with mediated opposite spin coupling are driven by phase separation instabilities near the quantum critical points. We examine electron coherent and incoherent pairing instabilities using our results on exact diagonalization in pyramidal and octahedron Hubbard-like clusters under variation of chemical potential (or doping), interaction strength, temperature and magnetic field. We also evaluate the behavior of the energy gap in the vicinity of its sign change in a real space as a function of out-of-plane position of the apical oxygen atom, due to vibration of apical atom and variation of inter-site coupling. Our results show direct correlation between the size of the energy gap characterizing the coherent superconducting state and a modulation of the structural positions of apical atom. These results provide a transparent microscopic explanation of (electron correlation induced) supermodulation of the coherent pairing gap observed recently in scanning tunneling microscopy.

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