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Phase separation instabilities and pairing modulations in $\mathbf{Bi_2Sr_2CaCu_2O_{8+\delta}}$ ARMEN KOCHARIAN, California State University, Los Angeles, CA 90032, KUN FANG, GAYANATH FERNANDO, KALUM PALANDAGE, University of Connecticut, Storrs, CT 06269, ALEXANDER BALATSKY, Theoretical Division, LANL, Los Alamos, NM 87545 — There is a growing evidence that the unconventional spatial inhomogeneities accompanied with the pairing of electrons, subsequent quantum phase transitions (QPTs), and condensation control coherent states in doped high-Tc cuprate superconductors, iron pnictide and telluride materials. We show that these superconducting states can be obtained from the 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 dependence of the energy gap function in the vicinity of the sign change (nodes) as a function of position of the apical oxygen atom, due to vibration of apical atom and variation of inter-site coupling. The developed approach provides a simple microscopic explanation of (correlation) supermodulation of the coherent pairing gap observed recently in the scanning tunneling microscopy experiments at atomic scale in $Bi_2Sr_2CaCu_2O_{8+\delta}$.

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