The Role of Charge Order in the Mechanism of High Temperature Superconductivity

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The focus of this paper is a "dynamic inhomogeneity-induced pairing" mechanism of high temperature superconductivity (HTC) in which the pairing of electrons originates directly from strong repulsive interactions. Repulsive interactions can be shown, by exact solution, to lead to a form of local superconductivity on certain mesoscale structures, but the strength of this pairing tendency decreases as the size of the structures increases above an optimal size. Moreover, the same physics responsible for pairing within a structure provides the driving force for the Coulomb frustrated phase separation that leads to the formation of mesoscale electronic structures in many highly correlated materials. ¿From this perspective, the formation of mesoscale structures (such as "stripes") in the cuprate superconductors may not be a problem for the mechanism of superconductivity but rather a part of the mechanism itself. This mechanism is not based, as is the BCS mechanism, on the pairing of preexisting well defined and essentially free quasiparticles. Rather, it is based on the physics of strong correlations and low dimensionality. In this approach, coherence and quasiparticles are *emergent phenomena* at low energy, not an assumed property of the "high energy physics" from which this state derives.