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Superconductivity via Two-Phase Condensation of Localized Electrons STEVEN KAPLAN, Yorktown Heights, NY, ALAN KADIN, Princeton Junction, NJ — Superconductivity is believed to occur via the formation of bound Cooper pairs of charge $2e$, and Bose condensation of the pairs. Recently, a fundamentally different approach [1] was developed that combines two novel aspects. First, a "distortion lattice" akin to an incommensurate dynamic charge-density wave is induced by the electron-phonon interaction. This localizes individual electrons on the scale of the coherence length by diffraction at the Brillouin zone of this distortion lattice, thus forming an energy gap. Second, these localized electrons are packed together with others of the same energy in two interlocked close-packed sublattices, analogous to ions in an ionic crystal. The electron wavefunctions in each sublattice are coherently in phase with each other, but out of phase with those in the other sublattice. The two sublattices together constitute a stable condensed structure compatible with the Pauli principle, which maintains long-range order of the quantum phase of the localized electrons. This structure can move coherently without pinning or resistance, manifesting itself as a supercurrent. Remarkably, the electron localization gap maps onto the BCS gap equation, and the flux quantum $h/2e$ is reproduced, without the presence of bound electron pairs. Moreover, this picture is easily extended to electron localization mediated by spin waves or other excitations. Experimental approaches to distinguish this new picture from conventional theories will be discussed.

[1] A.M. Kadin, http://arxiv.org/abs/0909.2901; http://arxiv.org/abs/1007.5340.

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