TWO GAPS, ONE SYMMETRY, AND HALF OF A THEORY FOR THE HIGH-TC SUPERCONDUCTORS

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Superconductivity is intertwined with spin and charge degrees of freedom in the new materials forming a highly correlated electronic system. The simplest possible framework to describe the superconducting state is through the quantum macroscopic approach, whose goal is to obtain the order parameter Ψ. To describe the high temperature superconductors at least a two-component Ψ is required since Kaminski (*Nature 416, 2002*) has reported that time-reversal symmetry is spontaneously broken in the pseudogap phase and Sigrist and Ueda (*Rev.Mod.Phys. 63, 1991*) have shown that only a multicomponent Ψ can yield a time-reversal-breaking state. Here we take this point of view and consider a SU(2) invariance between the gap and the pseudogap in the kinetic energy, broken by the condensate energy. We show that the Abrikosov-Bogomolny first order equations associated to the proposed kinetic energy indeed describes an intrinsically magnetic superconducting layer, similarly to the long ago proposal of Volovik and Gorkov (*JETP 61, 1985*), who pointed out to the existence of an spontaneous surface magnetization in the multicomponent superconductor. We show that behind the Abrikosov-Bogomolny first order equations there is a deep mathematical structure, symbolized by the Lichnerowickz-Weitzenbock formula, which provides a twofold view of the kinetic energy of the superconductor. We propose that the SU(2) invariance of the kinetic energy is in fact local (*Mod. Phys. Lett. B 26, 2012*) and show that this opens a venue to describe inhomogeneous superconducting states intertwined by spin correlations and charged dislocation. We obtain the Abrikosov-Bogomolny first order equations invariant under such local rotational invariance to find that the kinetic energy contains a term $R|\Psi|^2$, where R is the Riemannian spatial curvature induced by spin correlations and charge dislocations.