**The ABC Field Combination Theory of Superconductivity: Synergy of Electron-Phonon Interaction and Macroscopic Quantum Locking of C-Field Background**

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**Abstract:**  
Based on Li Zhijun’s ABC field combination theory, this paper proposes a new microscopic mechanism model of superconductivity. The theory posits that all fundamental particles are specific coupling states of the electromagnetic vortex field A, the color charge vortex field B, and the Higgs vortex field C. Within this framework, the superconducting phase transition is essentially a transition of the C-field background from a disordered state to a macroscopic quantum coherent state. During this process, the electron-phonon interaction is reconstructed through the synergistic resonance of the A-field and B-field, transforming from a random scattering force that causes resistance into a quantum entanglement force that constructs Cooper pairs. Simultaneously, the C-field background enters a phase-locked state, causing Cooper pairs to exhibit the characteristics of an ultra-low-energy diffuse state with infinite wavelength, fundamentally eliminating momentum dissipation channels. This paper introduces concepts such as the synergistic matrix element and C-field coherence degree establishes a new superconducting order parameter equation, and derives the necessity of zero resistance from first principles.

**Keywords:** ABC field theory; Superconductivity; Cooper pair; Electron-phonon interaction; Low-energy diffuse state; Macroscopic quantum coherence

1. **Introduction**

Although traditional superconducting theories have successfully described many phenomena, they have not fundamentally explained the dual role of electron-phonon interaction in the superconducting transition. According to Li Zhijun’s ABC field combination theory, fundamental particles are specific coupling states of the A, B, and C vortex fields. An electron can be expressed as:

where characterizes electromagnetic properties, is the color singlet state, and couples with the Higgs field. This theory provides a new perspective for understanding the superconducting phase transition.

1. **Framework of ABC Field Combination Theory**

**2.1 Fundamental Particles as Field Coupling States**

* A-field (electromagnetic vortex): Determines electromagnetic properties such as charge and spin
* B-field (color charge vortex): Dominates strong interactions; in electrons, it is a color singlet state
* C-field (Higgs vortex): Couples with the mass generation mechanism, determining particle inertia

**2.2 C-Field Background Phase Transition in Superconductivity**

In the normal state, the C-field background in the conductor is in a phase-disordered state. During the superconducting phase transition, the system undergoes a macroscopic reorganization of the C-field background:

where the phase remains coherent throughout the entire space, and the order parameter

1. **Field Theory Reconstruction of Electron-Phonon Interaction**

Within the ABC theory framework, the electron-phonon interaction can be expressed as:

where is the B-field component of phonons.

**3.1 Scattering Mechanism in the Normal State**

In the normal state, the C-field background is disordered, and the interaction manifests as random scattering:

**3.2 Synergistic Reorganization in the Superconducting State**

When the C-field background enters a coherent state, the interaction is reorganized as:

where is the momentum matching function ensured by C-field coherence.

1. **Field Combination Representation of Cooper Pairs and Zero-Resistance Mechanism**

Cooper pairs as composite field combination states:

**4.1 Ultra-Low-Energy Diffuse State Characteristics**

The energy scale of Cooper pairs is determined by the superconducting gap which is much lower than the Fermi energy:

The wave function is uniformly distributed on a macroscopic scale, forming a low-energy diffuse state with infinite wavelength.

**4.2 Scattering Matrix Element Vanishing Mechanism**

The matrix element with the local scattering potential is:

because the local potential cannot induce momentum transfer to a uniform state.

1. **Conclusion**

Based on the ABC field combination theory, we have established a new paradigm for the superconducting mechanism:  
1. The superconducting phase transition is a macroscopic quantum phase transition of the C-field background.  
2. The electron-phonon interaction is reorganized into a constructive force under a coherent C-field background.  
3. The low-energy diffuse state characteristics of Cooper pairs fundamentally eliminate resistance.

This theory provides a new theoretical framework and mathematical description for the superconducting mechanism, offering new directions for high-temperature superconductivity research.

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