**ABC Field Combination Interpretation of the Pauli Exclusion Principle: Quantum Interference and Bose Condensation Suppression Mechanism Based on Three-Field Coupling**

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**Abstract:**  
Based on Li Zhijun’s ABC field combination theory, this paper proposes a complete field theory interpretation of the Pauli exclusion principle. The core argument is: The essence of the Pauli exclusion principle is that two electrons in the same quantum state cannot achieve Bose-Einstein condensation through ABC three-field synergy, while spin-antiparallel pairing is the only way for electrons to achieve “solidified” Bose condensation through three-field destructive interference. When two electrons attempt to occupy the same orbital with the same spin, their electromagnetic vortex field A, color charge vortex field B, and Higgs vortex field C will undergo quantum interference, causing the total field energy of the system to increase, thereby preventing BEC formation. This paper constructs a second quantization Hamiltonian containing three-field coupling, introduces the field interference operator and the Bose condensation operator and rigorously proves that spin-antiparallel pairing enables electron pairs to achieve “solidified” Bose condensation, reaching the lowest energy stable state.

**Keywords:** ABC field theory; Pauli exclusion principle; Bose-Einstein condensation; three-field synergy; solidification transformation

1. **Introduction**

The Pauli exclusion principle is a fundamental principle of quantum mechanics. Based on Li Zhijun’s ABC field combination theory, an electron is a specific coupling state of the electromagnetic vortex field A, color charge vortex field B, and Higgs vortex field C:

A single electron can be regarded as a “hollow-core” particle with quantum fluctuations in its field distribution. The essence of the Pauli principle is: two electrons in the same quantum state cannot form a stable boson condensate through ABC three-field synergistic fusion, and only spin-antiparallel pairing can achieve “solidified” Bose condensation.

1. **Theoretical Model: ABC Three-Field Coupling and Bose Condensation**

**2.1 Single Electron ABC Field Operator**

The creation operator for a single electron state can be expressed as:

where are the creation operators for the A, B, and C fields respectively, and are the weight coefficients for each field.

2.2 Electron Pair Bose Condensation Operator

Define the electron pair Bose condensation operator:

This operator describes the process of two electrons forming Bose condensation at the same point in space.

**2.3 Three-Field Coupling Hamiltonian**

The interaction Hamiltonian between two electrons is:

where is the inter-field coupling strength, and is the Bose condensation coupling constant.

1. **ABC Field Interference and Solidification Transformation**

**3.1 Three-Field Interference Operator**

Define the ABC three-field interference operator:

**3.2 Spin Orientation and Solidification Mechanism**

For two electrons:  
\* When spins are parallel, three-field interference is constructive:

System energy increases, preventing stable condensation:

* When spins are antiparallel, three-field interference is destructive:

The system achieves “solidified” Bose condensation:

1. **Solidification Proof of the Pauli Principle**

**4.1 Solidified Bose Condensation Condition**

The condition for the system to achieve stable Bose condensation is:

A real solution exists only when which requires three-field interference to be destructive.

**4.2 Field Theory Formulation of Quantum State Repulsion**

For two electrons in the same quantum state:

Causing strong constructive interference:

Solidified condensation cannot be achieved.

1. **Physical Picture of Solidified Condensation**

Spin-antiparallel electron pairs achieve solidification through three-field destructive interference:  
1. Hollow-core electrons: Single electrons have quantum fluctuations in their ABC field distribution  
2. Solidification process: The field distributions of two spin-antiparallel electrons superimpose and cancel fluctuations  
3. Bose condensation: Formation of stable solid bosons with deterministic field distribution

Mathematical formulation:

1. **Conclusion**

Based on the ABC field combination theory, this paper proves the physical essence of the Pauli exclusion principle:  
1. Solidification mechanism: Spin-antiparallel pairing enables electron pairs to achieve solidified Bose condensation  
2. Three-field synergy: ABC three-field destructive interference is necessary for solidification  
3. Energy optimization: The solidified condensate has the lowest energy and highest stability

This model provides a new microscopic image for multi-electron systems and reveals the deep physical connotation of the Pauli principle.

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