**Field Combination Interpretation of the Uncertainty Principle: A Three-Field Coherence and Decoherence Model Based on ABC Theory**

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**Abstract:**Based on Li Zhijun’s ABC field combination theory, this paper proposes a fundamental physical interpretation of the Heisenberg uncertainty principle. The core argument is: The uncertainty relation is not caused by measurement disturbance, but rather is a dynamic manifestation of the intrinsic coherence and decoherence of the three fields in spacetime, where the electron is a composite field combination state composed of the electromagnetic vortex field (A), color charge vortex field (B), and Higgs vortex field (C). The dispersion of electron position () originates from the localized fluctuation mode of its C-field (Higgs field) component in the nuclear Coulomb potential well; while the dispersion of momentum () originates from the phase gradient distribution of its A-field (electromagnetic field) component. By constructing the coupled wave packet equations of the A, B, and C fields, and introducing the concepts of three-field coherence degree and intrinsic dispersion product this paper derives the uncertainty relation from first principles, proving that it is an inevitable result of composite field system dynamics.

**Keywords:** ABC field combination theory; Uncertainty principle; Quantum coherence; Wave packet dispersion; Field coupling; Intrinsic dispersion product

1. **Introduction: From the Measurement Problem to Ontological Attributes**

The Heisenberg uncertainty principle is a cornerstone of quantum mechanics. Traditional explanations attribute it to disturbances during the measurement process. However, based on Li Zhijun’s ABC field combination theory, we propose: The uncertainty relation is an intrinsic property of the electron itself as a non-point-like, dynamic field combination state, originating from the wave nature and coherence characteristics of its constituent fields (A, B, C).

The electron state can be expressed as:

Its wave function is not the trajectory of a point particle, but rather a complex amplitude distribution of three-field coupling:

where are the real amplitudes of the A, B, and C fields respectively, and is the composite phase.

1. **Theoretical Model: Three-Field Coupled Wave Packet Dynamics**

**2.1 Three-Field Coupled Wave Packet Equation**

The motion of the electron is described by the generalized Schrödinger equation with three-field coupling:

where is the equivalent mass of each field component, is the three-field coupling constant, and is the external potential field (such as the nuclear potential well).

**2.2 Field-Theoretic Definitions of Position and Momentum**

In ABC theory, the uncertainties of position and momentum originate from the distributions of field amplitudes and phases:

Position dispersion : Mainly determined by the distribution width of the C-field amplitude:

Momentum dispersion : Mainly determined by the gradient distribution of the A-field phase:

1. **Derivation of the Uncertainty Relation: Intrinsic Dispersion Product**

**3.1 Three-Field Coherence Degree**

Define the three-field coherence degree characterizing the vibrational synchronization of the A, B, and C fields in spacetime:

closer to 1 indicates complete coherence of the three fields; smaller indicates decoherence.

**3.2 Intrinsic Dispersion Product**

The product of position and momentum dispersion has a lower limit, the intrinsic dispersion product:

where is the geometric mean of the three-field vibration frequencies.

**3.3 General Form of the Uncertainty Relation**

The general form of the uncertainty relation is:

Under optimal coherence conditions, this reduces to the standard Heisenberg relation.

1. **Application: Reinterpretation of Electron Orbital Imagery in Atoms**

In atoms, the electron is a three-field coherent wave packet constrained by the nuclear potential well:  
\* Orbital radius: Corresponds to the average distance between the wave packet center (where C-field amplitude is maximum) and the atomic nucleus  
\* Orbital angular momentum: Corresponds to the vortex gradient of the A-field phase around the nucleus   
\* Energy level quantization: Originates from specific stable coherence patterns (eigenstates) formed by the three fields in the nuclear potential well

1. **Conclusion**

Based on the ABC field combination theory, this paper reveals the deep physical essence of the uncertainty principle:  
1. Intrinsic origin: The uncertainty relation originates from the intrinsic properties of electrons as field combination states  
2. Physical mechanism: Position uncertainty is associated with C-field amplitude distribution, momentum uncertainty is associated with A-field phase gradient  
3. Mathematical essence: The uncertainty relation is an inevitable result of three-field coupled wave packet dynamics  
4. Universality: The Heisenberg relation is a special case when the electron is in the optimal three-field coherent state

This model profoundly unifies the basic principles of quantum mechanics with field combination theory.

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