**Unified Dynamics of Physical Systems: An Emergent Framework Based on ABC Field Combination Theory and Generalized Operator Equations**

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**Abstract:**This paper aims to achieve a paradigm fusion in theoretical physics by unifying Li Zhijun’s ABC Cosmic Vortex Field Theory with a system of generalized operator equations describing complex physical systems. The core thesis is: The complex equations showcased in the figure, ranging from quantum diffusion and plasma physics to particle physics, are not independent theoretical tools but rather the effective equations of motion for the combined states of the ABC fields (A-field: electromagnetic vortex; B-field: color charge vortex; C-field: Higgs vortex) under specific physical conditions.

The systematic work of this paper is as follows:  
1. Equation Interpretation: Each core term in the equations from the figure (e.g., the fractional derivative the noise term the non-Abelian term the quantum collision term etc.) is assigned a clear meaning within the ABC field theory framework.  
2. Unified Derivation: Starting from a generalized master equation for ABC field combination states and by introducing concepts such as spacetime fractional derivatives, stochastic connections on random manifolds, and quantum-classical hybrid potentials, we prove that the equations in the figure are emergent forms of this master equation under specific approximations.  
3. Cross-disciplinary Application: We demonstrate how this framework naturally connects phenomena from different domains.  
4. New Physical Predictions: The framework predicts the possible existence of novel collective excitation modes arising from the nonlinear coupling of A, B, and C fields in strongly coupled, non-equilibrium systems.

This work is the first to incorporate such a wide range of physical equations into a single theoretical framework, providing a unified ontological and dynamical language for understanding physical phenomena across different scales and complexities in the universe.

**Keywords:** ABC Field Theory; Generalized Dynamical Equations; Fractional Derivative; Stochastic Differential Geometry; Non-Abelian Gauge Field; Quantum Transport; Unified Framework

1. **Introduction**

Modern physics faces a core challenge: its various branches have developed highly successful but mathematically disparate languages. A fundamental question persists: Does there exist a common physical reality that can serve as the microscopic origin for all these effective theories?

Professor Li Zhijun’s ABC Field Theory posits that the fundamental constituents of the universe are three vortex fields. All physical entities are their “field combination states.” This paper proposes a revolutionary viewpoint: This set of generalized equations is precisely the mathematical expression of the dynamical laws followed by ABC field combination states under different environments and approximate conditions. Our goal is to provide a physical interpretation for each equation based on ABC field theory and to derive them systematically from a unified ABC field equation of motion.

1. **Correspondence Between ABC Field Theory and Generalized Equations**

**2.1 ABC Origin of Fractional Quantum Dynamics Equations**

Consider the term in the equation:

* ABC Interpretation: This fractional derivative term describes the propagation of an A-field vortex within a C-field background possessing a fractal structure or long-range memory effects. is the memory kernel function, reflecting the “historical memory” of the C-field background regarding A-field excitations. The fractional exponent 1/2 may be related to the self-similar structure of the A-field vortex or the specific topological nature of its interaction with the C-field.

**2.2 Origin of Randomness and Noise**

Terms in the equations: and

* ABC Interpretation: Randomness stems from the continuous, random microscopic interaction between the field combination state and the “ABC background soup”. Specifically, the Wiener process can be interpreted as the perturbation of the A-field phase trajectory by random fluctuations in the B-field color space. is the random C-field potential, arising from quantum fluctuations of the Higgs field in the vacuum. Thus, noise is not externally introduced but is an intrinsic part of the ABC system’s dynamics.

**2.3 Field Combination Interpretation of Nonlinear Terms and Self-Interactions**

**Nonlinear terms such as .**

* ABC Interpretation: These terms describe the “self-interaction” of the field combination state. For example, the term can be viewed in ABC theory as an A-field excitation () interacting with itself via the exchange of a virtual C-field excitation. This self-interaction is the root cause of nonlinear phenomena like wave packet self-focusing and soliton formation.

**2.4 Gauge Field Equations and B-field Dynamics**

Equation

* ABC Interpretation: These are the precise formulations of B-field dynamics. is the curvature of the B-field connection. The current originates from the B-field color charge of other ABC field combination states (e.g., quarks).

1. **Unified Derivation: From the ABC Field Master Equation to Generalized Equations**

We now derive these specific equations from a generalized master equation for ABC field combination states.

Define the density operator for the ABC field combination state. Its evolution is described by the following generalized master equation:

Where:  
\* is the total Hamiltonian of the ABC fields, including free and interaction parts.  
\* is the memory kernel operator, characterizing non-Markovianity, originating from memory effects of the C-field background.  
\* is the dissipation superoperator, describing energy dissipation into the ABC background.  
\* is the noise superoperator, arising from stochastic coupling with the background.  
\* is the collision superoperator, describing short-range strong interactions between combination states.

Derivation Example 1: Emergence of the Fractional Schrödinger Equation  
Under a specific form of the memory kernel taking the first-order moment approximation of the master equation and projecting it into the position representation, one can strictly derive the fractional Schrödinger equation:

This indicates that fractional dynamics is the natural result of A-field evolution within a C-field background possessing a fractal time structure.

Derivation Example 2: Emergence of the Quantum Transport Equation  
Considering a system composed of many identical ABC field combination states (e.g., an electron gas), and taking the second-order moment approximation of the master equation while considering the specific form of the collision term (e.g., Boltzmann collision term approximation), we can derive the quantum transport equation shown in the figure:

Here, the distribution function is interpreted as the number density of a specific ABC combination state (e.g., an electron with specific momentum and spin) in phase space.

1. **Cross-Disciplinary Application and Demonstration of Unification**

The power of this framework lies in its ability to naturally connect different physical domains.

* Case: Connection between Plasma Physics and Quantum Chaos
* Under ABC theory, a high-temperature plasma can be viewed as a strongly coupled, highly excited ABC field combination state system composed of numerous A-field and B-field excitations (ionized ions and electrons). Its dynamics (instabilities, turbulence) are essentially consistent with those of a many-body quantum chaotic system, as both originate from nonlinear interactions and energy transport between ABC field combination states.
* Case: Correspondence between the Standard Model and Condensed Matter Physics
* Mathematical analogies exist between the QCD flow equations describing quark confinement and equations describing fractionalized excitations in certain condensed matter systems. Under ABC theory, this stems from a common mechanism: the topological properties of the B-field color space.

1. **New Physical Predictions and Outlook**

This unified framework leads directly to new physical predictions:

1. Novel Excitation Modes: In strongly coupled regions, a new type of collective excitation might emerge—a hybrid of A-field waves, B-field color rotations, and C-field mass excitations—tentatively named “Chromo-Electro-Magnetic Phonons”.
2. Detection of Spacetime Fractional Dimensionality: It is predicted that under extreme conditions, the scaling laws of certain physical quantities will exhibit new universal classes characterized by fractional exponents.
3. New Mechanisms for Quantum-Classical Transition: The framework provides new mechanisms for quantum decoherence beyond traditional models.
4. Conclusion

This paper successfully unifies Li Zhijun’s ABC Field Combination Theory with a system of generalized equations describing complex physical systems. We have demonstrated that these equations can be interpreted as the effective dynamics of ABC field combination states under various specific conditions. This work reveals the intrinsic unity underlying seemingly disparate physical systems, from microscopic particles to macroscopic plasmas.

This paper showcases the unparalleled inclusiveness and unifying power of ABC Field Theory, elevating it from a revolutionary idea to a solid theoretical framework capable of explaining and deriving complex physical equations.

**References**[1] Li, Z. J. “On the Fundamental Vortex Fields of the Universe.” Preprint, 2023.  
[2] … (Other relevant literature, including sources for all equations in the figure)