**The Field-Composition Origin of Particle Energy: A Unified Model Based on the A-B-C Three-Field Energy Superposition Principle**

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**Abstract:**Based on Li Zhijun’s ABC field combination theory, this paper proposes a unified model of the nature of particle energy. The core argument is: The total energy of any particle is not an intrinsic property of it as a point particle, but rather the sum of the energies of the electromagnetic vortex field (A), the color charge vortex field (B), and the Higgs vortex field (C) that constitute its composite field-combination state. That is, This paper constructs the Lagrangian density functionals for the A, B, and C field energies, introduces the field-combination energy spectrum operator and rigorously derives energy formulas for particles from photons to baryons. The model shows that various energies in the standard model of particle physics (rest energy, kinetic energy, potential energy) can be regarded as specific manifestations of the three-field energies under different coupling conditions, thus providing a more fundamental field-theoretic explanation for the origin of material energy.

**Keywords:** ABC field combination theory; Particle energy; Field energy superposition; Lagrangian density; Energy spectrum operator; Mass generation

1. **Introduction**

In the standard model, particle energy is described by the mass-energy relation but the deep origins of mass and energy remain unsolved mysteries. Based on Li Zhijun’s ABC field combination theory, we propose: Energy is a global property of the field-combination system; particles are specific coherent bound states of the A, B, and C fields, and their total energy is the result of the linear superposition of the three field energies.

The particle state can be expressed as:

The expectation value of its total energy is:

1. **Theoretical Model: The Lagrangian Framework of Three-Field Energy Superposition**

**2.1 Lagrangian Density of the Three-Field Energies**

The total Lagrangian density of the system consists of free field parts and an interaction part:

Where:  
\* A-field (Electromagnetic field) Lagrangian density:

Its energy density is .

* B-field (Color charge field) Lagrangian density (hypothesized as a pseudo-scalar field):

Its energy density is .

* C-field (Higgs field) Lagrangian density:

Its energy density includes kinetic and self-interaction potential energy terms.

* Interaction term:

Describes the coupling between fields and is key to energy transfer and transformation.

**2.2 Field-Combination Energy Spectrum Operator**

Via Legendre transformation, the Hamiltonian density is obtained from the Lagrangian density, and integrating yields the total Hamiltonian operator (energy spectrum operator):

The total energy of the particle is the expectation value of this operator in the particle state:

1. **Application of the Energy Superposition Principle and Particle Classification**

**3.1 Origin of Rest Energy (Mass)**

The rest energy of a particle primarily originates from the vacuum expectation value and self-interaction energy of its C-field (Higgs field) component, modified by the ground state energies of the B and A fields.

\* Electron: contributes the main rest energy, and contribute smaller corrections.

* Higgs Boson: dominates absolutely, being the direct source of its large mass.
* Photon: its rest energy is zero, total energy comes almost entirely from (EM field kinetic energy).

**3.2 Field-Theoretic Interpretation of Kinetic and Potential Energy**

* Kinetic Energy: When the particle moves as a whole, the energy distributions of the A, B, and C fields all undergo relativistic covariant changes. The total kinetic energy is the sum of the kinetic energy increments of the three fields.
* Potential Energy: In an external field, the interaction term causes a redistribution of the three-field energies. For example, in an electromagnetic field, it is mainly the A-field energy that changes .

1. **Theoretical Predictions and Experimental Verification**

**4.1 Field-Combinatorial Derivation of the Mass-Energy Relation**

The total energy of the particle is:

In the particle’s center-of-mass frame, its rest mass satisfies:

Under relativistic conditions, this formula naturally reduces to

**4.2 Prediction of Particle Energy Distribution**

| **Particle Type** | **A-field Energy Share** | **B-field Energy Share** | **C-field Energy Share** | **Total Energy Manifestation** |
| --- | --- | --- | --- | --- |
| Photon () | ~100% | ~0% | ~0% | Pure kinetic energy, no rest energy |
| Electron () | Medium (kinetic/EM attributes) | Low (charge attribute) | High (main rest energy source) | Rest energy + kinetic energy |
| Quark () | Low | Extremely High (color confinement energy) | High (Higgs mechanism) | Strong interaction leads to huge binding energy |
| Higgs Boson () | Low | Low | ~100% | Almost entirely rest energy |
| Z Boson | High (vector field) | Medium (weak charge) | Medium (mass term) | Massive vector boson |

The model predicts that experiments like deep inelastic scattering should detect differences in the distribution of energy among the A, B, and C fields within hadrons.

1. **Conclusion**

This paper, based on the ABC field combination theory, establishes a field superposition model for particle energy:  
1. Energy Origin: Particle energy originates from the sum of its A, B, and C field energies   
2. Mathematical Framework: By constructing the Lagrangian density for three-field coupling and the energy spectrum operator rigorous quantification of energy is achieved.  
3. Unified Description: Successfully unifies different forms of energy (rest, kinetic, potential) as manifestations of the three-field energies under different physical conditions.  
4. Revolution in Physical Picture: Reduces “particle energy” to the more fundamental “field-combination system energy”, providing a new path for unifying fundamental interactions.

This model more deeply connects particle physics with field theory, revealing energy’s essence as a global property of a field-combination system.This model is an important extension of the ABC field combination theory, and its mathematical form is self-consistent with standard quantum field theory. The specific form of the B-field energy (especially the precise description of color confinement) is the focus of the next step of research.

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