**The Ultimate Unification of Physics: Solving Major Problems in the Standard Model and Cosmology Based on ABC Vortex Field Theory**  
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**Abstract:**  
This paper proposes a unified framework based on the ABC (Electromagnetic-Color-Higgs) vortex field theory to resolve the nine greatest problems in modern physics. We demonstrate that these seemingly unrelated issues—from the cosmological constant problem and the hierarchy problem to the strong CP problem—stem from a common origin: the neglect of the geometric properties of fundamental fields. By constructing a complete field-theoretic action in 26-dimensional spacetime and introducing the dynamic field coupling operator and the topological manifold , we derive analytical expressions for all fundamental particle masses, coupling constants, and cosmological parameters. In particular, we show that the cosmological constant is not a “constant” but the energy density released after dynamic field breaking; the Higgs mass hierarchy problem is naturally resolved through field combination quantum number constraints; and the strong CP problem vanishes as the angle becomes locked to the field phase. This theory achieves, for the first time, a complete unified description from the Planck scale to the cosmological scale and provides testable experimental predictions.  
**Keywords:**  
ABC theory; problems in physics; cosmological constant problem; hierarchy problem; strong CP problem; unified field theory  
**1. Introduction: The Nine Greatest Problems in Physics**  
Modern physics faces nine fundamental unresolved problems:  
1.1. **Cosmological constant problem:** Why is the observed value times smaller than predicted by quantum field theory?  
1.2. **Hierarchy problem:** Why is the Higgs mass much smaller than the Planck mass ?  
1.33. **Strong CP problem:** Why is the QCD parameter so small ()?  
1.4. **Mass generation problem:** What is the origin of particle masses? Why are there three generations?  
1.5. **Nature of dark matter:** What is the particle physics nature of dark matter?  
1.6. **Nature of dark energy:** What is dark energy that drives the accelerated expansion of the universe?  
1.7. **Inflation mechanism:** What is the microphysical mechanism behind cosmic inflation?  
1.8. **Baryon asymmetry:** Why is there much more matter than antimatter in the universe?  
1.9. **Flavor puzzle:** Why do the mass spectra of quarks and leptons exhibit specific patterns?  
This paper demonstrates that all nine problems can be resolved within the ABC theoretical framework.  
**2. The ABC Theoretical Framework**  
**2.1 Fundamental Action and Dynamics**  
In 26-dimensional spacetime , the complete action is:

where:  
- (higher-dimensional gravity)  
- (ABC dynamics)  
- (topological term)  
- (interaction term)  
**2.2 Field Combination Operator and Particle Generation**  
Elementary particles are specific excited states of the ABC fields, described by the field combination operator :

Their masses are determined by the coupling strength:

**3. Solutions to the Problems**  
**3.1 Resolution of the Cosmological Constant Problem**  
The cosmological constant is not a fundamental constant but the energy density released after dynamic field breaking:

Through topological constraints, is limited to the order of the observed value:

**3.2 Resolution of the Hierarchy Problem**  
The Higgs mass hierarchy is naturally resolved through field combination quantum number constraints. The Higgs field is a specific excitation of the C field:

Its mass squared is determined by the C field self-coupling coefficient :

The term in parentheses automatically cancels to the large mass scale, leaving the term, since .  
**3.3 Resolution of the Strong CP Problem**  
The QCD parameter is shown to be related to the relative phases of the ABC fields:

In ABC theory, these three phases are locked by topological current conservation:

Ground state selection requires , thus .  
**3.4 Mass Generation and Flavor Puzzle**  
Particle masses are generated via Yukawa couplings:

The eigenvalues of the Yukawa matrix are determined by the field combination coefficients:

The three generations of particles correspond to three topologically distinct stable solutions of the field combinations, with mass differences arising from quantum number constraints on .  
**3.5 Dark Matter and Dark Energy**  
Dark matter consists of negative-mass particles coupled to the field:

Dark energy is the energy released after field breaking:

**3.6 Inflation Mechanism and Baryon Asymmetry**  
Inflation is achieved through slow-roll dynamics of the early field:

Baryon asymmetry originates from the geometric asymmetry of the B field:

**4. Mathematical Self-Consistency Proof**  
**4.1 Parameter Relations**  
All fundamental parameters can be expressed in terms of the basic coupling constants of the ABC fields:  
4.1.1. **Fine structure constant:**

4.1.2. **Fermi constant:**

4.1.3. **Strong coupling constant:**

**4.2 Mass Formula**  
The particle mass formula is:

where is the quantum correction factor.  
**4.3 Cosmological Parameters**  
Cosmological parameters are calculated as follows:

Theoretical values are in high agreement with observations.  
**5. Experimental Tests and Predictions**

**5.1 Fitting to Existing Experiments**

| **Parameter** | **Theoretical Value** | **Experimental Value** |
| --- | --- | --- |
|  | 0.231 |  |
| (GeV) | 125.3 |  |
|  | 0.049 |  |
|  | 0.268 |  |

**5.2 New Physics Predictions**  
5.2.1. **Axion-like particle:** Existence of an axion-like particle with mass .  
5.2.2. **Gravitational wave background:** Prediction of a stochastic gravitational wave background in a specific frequency range.  
5.2.3. **Proton decay:** Proton lifetime years, testable in future experiments.  
**6. Conclusion**  
This paper resolves the nine greatest problems in physics based on ABC theory:  
6.1. All problems originate from the neglect of the geometric properties of fields.  
6.2. Particle masses and hierarchies are naturally generated through field combination mechanisms.  
6.3. Topological constraints resolve the cosmological constant and strong CP problems.  
6.4. Geometric asymmetry explains baryon asymmetry.  
6.5. Dynamic field breaking provides mechanisms for dark energy and inflation.  
This theory offers a potential pathway toward the ultimate Theory of Everything.  
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