Unification of Forces: A Four-Force Emergence Model Based on ABC Vortex Field Coupling and Negative Mass Background  
**Author:** Li Zhijun zhaoguangyao  
**Abstract:** This paper proposes a novel unified theory of the four fundamental forces by introducing an extended ABC field theory model incorporating a negative mass background field, unifying gravitation, electromagnetism, the weak force, and the strong force within a single mathematical framework. The core postulate is that all fundamental forces originate from the coupling interactions of the electromagnetic vortex field (A-field), color charge vortex field (B-field), Higgs vortex field (C⁺-field), and its associated negative mass Higgs field (C⁻-field) in 26-dimensional spacetime. Gravitation does not arise from spacetime curvature but emerges as an equivalent interaction induced by the repulsive effect between the negative mass dark matter background (NMDMS) excited by the C⁻-field and ordinary matter (excited by the C⁺-field). This paper constructs a unified field-theoretic action, derives the four-force unification equations including gravity, and demonstrates their natural reduction to known forms of the four fundamental forces in the low-energy limit.  
**Keywords:** Force unification; ABC mechanism; Negative mass Higgs field; Background field theory; Unified action; Emergent gravity  
 1. Introduction: A New Paradigm for Unification  
Existing unification theories predominantly attempt to incorporate gravity into the quantum field theory framework but encounter fundamental challenges such as non-renormalizability. This paper reverses this approach by extending quantum field theory to include gravity. We argue that gravity differs intrinsically from the other three forces: it is a background-dependent global effect, whereas the other three are local gauge interactions.  
The key to unification lies in introducing a global negative mass Higgs field background—the Negative Mass Dark Matter Particle Soup (NMDMS). Gravitation arises from the interaction between matter and this background, while the other three forces stem from direct interactions among matter fields. Both originate from a more fundamental principle.  
 2. Unified Field Theory Model: Extended ABC Field Theory  
We introduce a unified action on a 26-dimensional manifold :

2.1 Kinetic Terms

Here, and denote the positive and negative mass Higgs vortex fields, respectively. The potential triggers spontaneous symmetry breaking:

2.2 Interaction Term—Core Unification Formula

This topological term describes the coupling of A, B, C⁺, and C⁻ fields under the highest-rank antisymmetric tensor in 26 dimensions, serving as the origin of four-force unification. is the unified coupling constant.  
 2.3 Background Field Term

This term represents the global background current provided by the negative mass Higgs field . Its vacuum expectation value permeates the universe, constituting the NMDMS.  
 3. Unified Emergence Mechanism of the Four Forces  
 3.1 Unified Force Equations  
Varying the action yields the unified field equations:

The current terms include contributions from both matter fields and couplings to other fields. Notably, the gravitational current directly correlates with the negative mass background:

3.2 Force Differentiation and Low-Energy Limit  
Through dimensional reduction and low-energy effective theory, we recover the four forces from the unified equations:  
1. **Electromagnetism (U(1)ₑₘ):** When only the A-field is active in , the equations reduce to Maxwell’s equations, with as the electromagnetic current.  
2. **Strong and Weak Forces (SU(3)꜀ × SU(2)ₗ):** When the B-field and C⁺-field are active, the equations reduce to Yang-Mills equations, with and yielding color and weak currents, respectively.  
3. **Gravitation (Emergent):** When the global effect of the background is considered, the gravitational current becomes non-zero. Its substitution into the A-field and C⁺-field equations generates additional interaction terms.  
 3.3 Rigorous Derivation of Gravity as a Background Field Effect  
Consider a test particle moving in the background . Its action is influenced by :

Since is a constant background, varies only on cosmological scales and is locally approximated as a constant . For the test particle, the effective action becomes:

where is the current of positive mass matter. This is equivalent to introducing a background field coupled to the matter current at each spacetime point. The force exerted by this field on matter is:

where is the gravitational coupling strength. This force reproduces Newtonian gravitation in the low-energy non-relativistic limit:

Newton’s constant thus emerges from the unified coupling constant and the gradient of the negative mass background.  
4. Unified Coupling Relations  
At the unification scale (assumed to be the 26-dimensional Planck scale), all four forces share a single coupling constant .  
In the low-energy regime, dimensional reduction differentiates them as:

where is the compactification mass scale. Gravity’s weakness arises because is a cosmologically large number. The strength disparity among the four forces stems from distinct symmetry-breaking patterns and dimensional reduction, yet they share a common origin.  
 5. Conclusions and Outlook  
This paper constructs a true four-force unification model by introducing a negative mass Higgs background field. The model:  
1. **Mathematically Unifies:** Describes all interactions via a single action .  
2. **Clarifies Mechanisms:** Distinguishes gravity’s background dependence from the locality of the other three forces.  
3. **Offers Testable Predictions:** Predicts that may evolve slowly with cosmic evolution (as may evolve).  
4. **Resolves Challenges:** Avoids divergences in graviton self-interactions, as gravity is renormalizable in perturbation theory (originating from a background field).  
**Future Work:** Precisely compute parameters after dimensional reduction; investigate cosmological solutions under this theory; identify observable differences from general relativity (e.g., additional gravitational wave polarization modes).