**The Complete Formulation of Field Combination Conservation Law for Particle Decay: Incorporating Photon Generation and Kinetic Mass Correction into the ABC Theory**

**Authors:** Li Zhijun, Zhao Guangyao

**Abstract:**Within the framework of Li Zhijun’s field combination theory, this paper proposes a relativistically complete field combination conservation law for particle decay. The core of this law is: in any particle decay process, the field combination identifier of the parent particle must equal the direct sum of all daughter particles’ field combination identifiers, and this conservation explicitly includes the generated photons and the kinetic mass contributed by particle kinetic energy. Based on the upper limit of photon rest mass determined by Chinese scientists, we assign photons a precise field combination expression We introduce the concept of kinetic mass to incorporate the contribution of kinetic energy to the field combination into a joint description of the A-field and C-field. Through systematic analysis of processes such as and neutron decay, we demonstrate that after considering kinetic mass, the A-field (total energy) and C-field (total rest mass + kinetic mass) are strictly conserved. This law provides a completely self-consistent description of particle decay within the relativistic framework.

**Keywords:** Field combination theory; Photon rest mass; Kinetic mass; ABC quantum numbers; Relativistic conservation law; Particle decay

1. **Introduction: Constructing a Relativistically Complete Conservation Law**

A complete theory of particle decay must hold within the relativistic framework. The previously neglected contribution of kinetic energy essentially serves as a bridge connecting the A-field (energy-momentum) and C-field (rest mass). This paper aims to achieve a complete formulation of the field combination conservation law in the relativistic sense by introducing the concept of kinetic mass to quantify the contribution of kinetic energy to the field combination.

1. **Theoretical Framework: Joint Identification of Kinetic Mass and Field Combination**

**2.1 Definition of Kinetic Mass**

According to relativity, the total energy of a particle satisfies We define the kinetic mass of a particle as:

The kinetic mass represents the equivalent mass a particle possesses due to its motion, its value determined jointly by the A-field related energy-momentum and the C-field related rest mass When , , i.e., approximately equal to the classical kinetic energy divided by

**2.2 Joint Field Combination Identification Incorporating Kinetic Mass**

For a particle with momentum, its physical effects are determined by the total effective mass which is the sum of rest mass and kinetic mass:

Therefore, the complete physical identification of a moving particle should be described jointly by its field combination identifier and its kinetic mass The conservation law needs to account for the total effective mass.

1. **Complete Relativistic Field Combination Conservation Law**

For a decay process the conservation law is stated as:

1. A-field (energy-momentum) is strictly conserved:

This is the traditional conservation of energy and momentum.

1. B-field (charge) is strictly conserved:

Charges such as electric charge, color charge, etc., are conserved.

1. C-field (mass field) and kinetic mass are jointly conserved (core new content):

That is, the total effective mass (rest mass + kinetic mass) of the parent particle equals the sum of the total effective masses of all daughter particles. For photons, but if they have momentum their kinetic mass

The physical picture of this law is: During the decay process, the rest mass energy of the parent particle’s C-field and the kinetic energy of its A-field are jointly transformed and distributed to the rest mass energy of the daughter particles’ C-field and the newly generated kinetic energy of the A-field (including the kinetic energy of photons). The total effective mass is conserved.

1. **Case Validation**
   * **4.1 Decay**
   * • Particle identification:
   * （keepmotionless）
   * • Kinetic mass calculation:
   * motionless，so 。Total effective mass
   * The rest mass of a photon ，Dynamic mass 。The total effective mass of each photon
   * • Conservation validation:
   * ◦ A-field: （conserved）  
     ◦ B-field: （conserved）
   * ◦ C-field and kinetic mass joint conservation:
   * Strictly holds.

**4.2 Neutron Decay**

• Particle identification (simplified, assuming proton is at rest after decay):

* + （motionless）
  + （motionless）
  + （Having kinetic energy）

（Having kinetic energy）• Kinetic mass and conservation validation:

* + ◦ A-field: (conserved, where）
    - ◦ B-field: Charge: (conserved)  
        
      ◦ C-field and kinetic mass joint conservation:
    - （notice：）
    - Sum:   
      since the sum=
    - Therefore,

strictly conserved

1. **Conclusion**

By introducing the concept of kinetic mass, we have quantified the contribution of particle kinetic energy to the field combination in a relativistic manner and incorporated it into the conservation framework. The revised relativistically complete field combination conservation law demonstrates that in particle decay, although the A-field (energy-momentum) and C-field (rest mass) may not be conserved individually, the A-field and C-field, through kinetic mass as a whole, have a total contribution—the total effective mass—that is strictly conserved. This law eliminates the minor discrepancies in previous theories and provides a profoundly self-consistent description of particle decay at the level of relativistic quantum field theory.

**References**  
[1] Li, Z.J., Zhao, G.Y. “Complete Formulation of Field Combination Conservation Law for Particle Decay”. Preprint (2023)  
[2] Particle Data Group. “Review of Particle Physics”. Phys. Rev. D (2022)  
[3] Griffiths, D. “Introduction to Elementary Particles”. Wiley-VCH (2008)  
[4] Jackson, J.D. “Classical Electrodynamics”. Wiley (1999)  
[5] Peskin, M.E., Schroeder, D.V. “An Introduction to Quantum Field Theory”. Addison-Wesley (1995)