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A NOVEL POTENTIAL ENERGY SURFACE OBTAINED BY NONPERTUBRATIVE QUANTUM ELECTRODYNAMICS

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This work presents a novel approach to quantum electrodynamics (QED) through a nonperturbative framework. By employing a generalized saddle-point approximation technique inspired by Fadeev-Popov methods, we construct a potential energy surface (PES) that captures quantum fluctuations beyond traditional perturbative or Gaussian methods. The resulting formulation demonstrates a tree-structured set of effective actions, each contributing to a multi-force field landscape experienced by classical nuclei. Such a quantum-theoretic extension has implications for understanding complex chemical reactions and may even contribute to emergent biological morphogenesis and rare phenomena like ectoplasmic materialization. This model provides a bridge between high-energy QED formulations and emergent macroscopic behaviors in soft matter and biosystems.

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Keywords: Fadeev-Popov method, nonperturbative quantum electrodynamics, potential energy surface (PES), quantum electrodynamics (QED), saddle point approximation

1. Introduction

Quantum electrodynamics (QED) is widely regarded as the most successful theory in modern physics, providing extraordinarily precise predictions for phenomena involving the interaction of light and matter. Originating in the early 20th century and formalized through the works of Dirac, Feynman, Schwinger, and Tomonaga, QED has evolved into a cornerstone of the standard model of particle physics [5,6]. Within QED, the interactions of electrons, positrons, and photons are typically treated perturbatively, via series expansions in the coupling constant α. While this approach yields excellent agreement with experiments in many regimes, it can fail in systems characterized by strong fields or significant quantum fluctuations [4].

To overcome these limitations, the nonperturbative methods have been developed, ranging from lattice gauge theory to functional renormalization and saddle-point approximations [10, 11]. These techniques are especially useful in the regimes

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