

# First Principles in Fundamental Physics

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## Abstract

"All is Number"—the universe follows a few profound mathematical rules, and pure thought can grasp reality. This paper explores the first principles of fundamental physics, focusing on the principle of relativity, the principle of least action, and the principle of regularity. By illustrating the principle of relativity with an example of coordinate transformation, the paper clarifies the nature of spacetime: spacetime exists objectively, whereas coordinate systems are merely mathematical constructs. It also discusses the uniqueness of natural coordinate systems and their roles in both quantum and classical mechanics. Clifford geometric algebra is introduced as a mathematical framework for physical theories, and the principle of least action is analyzed, emphasizing the Lagrangian as an intrinsic characteristic of physical systems, which can be expressed as a linear combination of the system's energy terms. Through examples from complicated systems, the paper demonstrates the structural characteristics, applications, and limitations of this principle. Furthermore, it examines the fundamental distinction between the finite and the infinite, noting that infinity is merely an analytical variable rather than a number. If a physical equation yields a solution with infinite energy density, the theory must be revised to maintain consistency. These first principles not only constitute the foundation of physics but also unveil profound symmetries and universal patterns in mathematical structures.

## Keywords

First Principle, Clifford Algebras, Hypercomplex Numbers, Nonlinear Spinors, Unified Field Theory

## 1. Introduction

In 350 BCE, Aristotle introduced the concept of first principles in *Physics*; unless we understand the fundamental conditions and principles of a thing and analyze its simplest elements, we cannot truly comprehend it. In *Metaphysics*, he further

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reason it will not be possible to have a complete theory of quantum gravity in its current form which to include to the limit the general relativity since physical theories have always been adjusted during their evolution based on observational or experimental tests and verified by the predictions made Also contrary to a widespread opinion and current active programs regarding the unification of all the fundamental forces of physics in a single final theory based on string theory I argue that this unification is generally unlikely and it is not possible anyway for a unification to be developed based on current theories of quantum gravity including string theory In addition I support the views of some scientists and philosophers that currently too much resources are being consumed on the idea of developing quantum gravity theories and in particular string theory to include general relativity and to unify gravity with other forces as long as science does not impose such research programs

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