



The Quantum Vacuum: A Scientific and Philosophical Concept, from Electrodynamics to String Theory and the Geometry of the Microscopic World

Luciano Boi

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A vacuum, classically understood, contains nothing. The quantum vacuum, on the other hand, is a seething cauldron of nothingness: particle pairs going in and out of existence continuously and rapidly while exerting influence over an enormous range of scales. Acclaimed mathematical physicist and natural philosopher Luciano Boi expounds the quantum vacuum, exploring the meaning of nothingness and its relationship with physical reality.

Boi first provides a deep analysis of the interaction between geometry and physics at the quantum level. He next describes the relationship between the microscopic and macroscopic structures of the world. In so doing, Boi sheds light on the very nature of the universe, stressing in an original and profound way the relationship between quantum geometry and the internal symmetries underlying the behavior of matter and the interactions of forces.

Beyond the physics and mathematics of the quantum vacuum, Boi offers a profoundly philosophical interpretation of the concept. Plato and Aristotle did not believe a vacuum was possible. How could nothing be something, they asked? Boi traces the evolution of the quantum vacuum from an abstract concept in ancient Greece to its fundamental role in quantum field theory and string theory in modern times.

The quantum vacuum is a complex entity, one essential to understanding some of the most intriguing issues in twentieth-century physics, including cosmic singularity, dark matter and energy, and the existence of the Higgs boson particle. Boi explains with simple clarity the relevant theories and fundamental concepts of the quantum vacuum. Theoretical, mathematical, and particle physicists, as well as researchers and students of the history and philosophy of physics, will find *The Quantum Vacuum* to be a stimulating and engaging primer on the topic.

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