

Quantum Mechanics: From Foundational Principles to Emerging Technologies

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A B S T R A C T

Quantum mechanics, from its origin, altered our comprehension of the microscopic world during the 1900s. This paper explores quantum theory's foundational principles, such as wave-particle duality, superposition, and uncertainty, and traces quantum theory's evolution into modern-day applications like quantum computing, quantum sensing, and quantum communication, quantum metrology. The study highlights present research directions and technological breakthroughs connecting theoretical physics with actual quantum technologies. These advancements have promising transformative impacts across the social, industrial, and scientific domains.

Keywords:

Quantum Mechanics, Superposition, Quantum Computing, Quantum Communication, Foundational Principles, Emerging Technologies