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   Titolo   A First Introduction to Quantum Physics / / by Pieter Kok

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   Collana   Undergraduate Lecture Notes in Physics, , 2192-4791

   Disciplina   530.12

   Soggetti   Quantum theory
                    Physics
                    Quantum field theory
                    String models
                    Mathematical physics
                    Quantum Physics
                    Mathematical Methods in Physics
                    Quantum Field Theories, String Theory
                    Mathematical Applications in the Physical Sciences

   Lingua di pubblicazione   Inglese

   Formato   Materiale a stampa

   Livello bibliografico   Monografia

   Nota di contenuto   Chapter 1: Three simple experiments -- The purpose of physical theories -- A laser and a detector -- A laser and a beam splitter -- A Mach-Zehnder interferometer -- The breakdown of classical concepts -- Chapter 2: Photons and Interference -- Photon paths and superpositions -- The beam splitter as a matrix -- The phase in an interferometer -- How to calculate probabilities -- Gravitational wave detection -- Chapter 3: Electrons with Spin -- The Stern-Gerlach experiment -- The spin observable -- The Bloch sphere -- The uncertainty principle -- Magnetic resonance imaging -- Chapter 4: Atoms and Energy -- The energy spectrum of atoms -- Changes over time -- The Hamiltonian -- Interactions -- Atomic clocks -- Chapter 5: Operators -- Eigenvalue problems -- Observables -- Evolution -- The commutator -- Projectors -- Chapter 6: Entanglement -- The state of two electrons -- Entanglement -- Quantum teleportation -- Quantum computers -- Chapter 7: Decoherence -- Classical and quantum

uncertainty -- The density matrix -- Interactions with the environment -- Entropy and Landauer's principle -- Chapter 8: The Motion of Particles -- A particle in a box -- The momentum of a particle -- The energy of a particle -- The scanning tunneling microscope -- Chemistry -- Chapter 9: Uncertainty Relations -- Quantum uncertainty revisited -- Position-momentum uncertainty -- The energy-time uncertainty relation -- The quantum mechanical pendulum -- Precision measurements -- Chapter 10: The Nature of Reality -- The emergent classical world -- The quantum state revisited -- Nonlocality -- Contextuality -- A compendium of interpretations.

| Sommario/riassunto | In this undergraduate textbook, the author develops the quantum theory from first principles based on very simple experiments: a photon travelling through beam splitters to detectors, an electron moving through a Stern-Gerlach machine, and an atom emitting radiation. From the physical description of these experiments follows a natural mathematical description in terms of matrices and complex numbers. The first part of the book examines how experimental facts force us to let go of some deeply held preconceptions and develops this idea into a mathematical description of states, probabilities, observables, and time evolution using physical applications. The second part of the book explores more advanced topics, including the concept of entanglement, the process of decoherence, and extension of the quantum theory to the situation of a particle in a one-dimensional box. Here, the text makes contact with more traditional treatments of quantum mechanics. The remaining chapters delve deeply into the idea of uncertainty relations and explore what the quantum theory says about the nature of reality. The book is an ideal and accessible introduction to quantum physics, with modern examples and helpful end-of-chapter exercises. |