

Einstein's Physics: Atoms, Quanta, and Relativity - Derived, Explained, and Appraised

By Ta-Pei Cheng

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Many regard Albert Einstein as the greatest physicist since Newton. What exactly did he do that is so important in physics? *Einstein's Physics* provides an introduction to his physics at a level accessible to an undergraduate physics student. All equations are worked out in detail from the beginning.

Einstein's doctoral thesis and his Brownian motion paper were decisive contributions to our understanding of matter as composed of molecules and atoms. Einstein was one of the founding fathers of quantum theory: his photon proposal through the investigation of blackbody radiation, his quantum theory of photoelectric effect and specific heat, his calculation of radiation fluctuation giving the first statement of wave-particle duality, his introduction of probability in the description of quantum radiative transitions, and finally the quantum statistics and Bose-Einstein condensation. Einstein's special theory of relativity gave us the famous E=mc2 relation and the new kinematics leading to the idea of the 4-dimensional spacetime as the arena in which physical events take place. Einstein's geometric theory of gravity, general relativity, extends Newton's theory to time-dependent and strong gravitational fields. It laid the ground work for the study of black holes and cosmology.

This is a physics book with material presented in the historical context. It does not stop at Einstein's discovery, but carries the discussion onto some of the later advances: Bell's theorem, quantum field theory, gauge theories and Kaluza-Klein unification in a spacetime with an extra spatial dimension.

Accessibility of the material to a modern-day reader is the goal of the presentation.

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Editorial Review

Review

"What a wonderful book! Cheng explains the monumental achievements of Einstein, and relates them to developments in physics since his time. All this is done in detail, yet with a minimum of pre-requisites. Physicists and physics students alike will appreciate this book: whereas most books about Einstein, whether popular or academic, make no attempt to properly explain his physics, Cheng succeeds admirably. The book brings the reader up to date with short but lucid accounts of more recent developments based on the great Albert's work, such as dark energy in modern cosmology, gauges in quantum theory, and Kaluza-Klein theory." -- Jeremy Butterfield, Trinity College, University of Cambridge

"This far-reaching and fascinating textbook covers Einstein's work in depth and in context. The conscientious reader will be amply rewarded." -- Alan Heavens, Institute for Astronomy, University of Edinburgh

"Einstein's contributions to modern theoretical physics are both profound and pervasive. Cheng takes a look at the full range of the famous physicist's work and sets out to explain Einstein's achievements from our modern understanding of the subject matter. The project succeeds. Cheng's explanations combine conceptual clarity with mathematical detail and historical sensitivity." -- Tilman Sauer, Einstein Papers Project, California Institute of Technology

About the Author

Ta-Pei Cheng is a particle physics theorist. He received a PhD from Rockefeller University with the noted physicist and Einstein biographer Abraham Pais. He is the author of *Relativity Gravitation and Cosmology - A Basic Introduction*, as well as the coauthor (with LF Li) of *Gauge Theory of Elementary Particle Physics*. Both were published by Oxford University Press. He is an elected Fellow of the American Physical Society.

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