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Nota di contenuto	to Simple Atoms -- to Simple Atoms -- Hydrogen and Helium -- Precision Spectroscopy of Atomic Hydrogen -- Ultracold Hydrogen -- Review of High Precision Theory and Experiment for Helium -- Positronium and Muonium -- Spectroscopy of the Muonium Atom -- Experimental Tests of QED in Positronium: Recent Advances -- Fundamental Constants and Frequency Metrology -- A New Type of Frequency Chain and Its Application to Fundamental Frequency Metrology -- Fundamental Constants and the Hydrogen Atom -- Present Status of $g - 2$ of Electron and Muon -- Few-Electron Highly-Charged Ions -- Laser Spectroscopy of Hydrogen-Like and Helium-Like Ions -- The $g$ Factor of Hydrogenic Ions: A Test of Bound State QED -- Exotic Atoms -- Elementary Relativistic Atoms -- Antiprotonic Helium -- An Exotic Hydrogenic Atom -- Hydrogen and Helium -- Towards a Precise Measurement of the $\text{He}^+$ 2S Lamb Shift -- High Precision Measurements on Helium at 1083 nm -- Absolute Frequency Measurement of the 1S-3S Transition in Hydrogen -- 2s Hyperfine Structure in Hydrogen Atom and Helium-3 Ion -- Three-Loop Slope of the Dirac Form Factor and the 1S Lamb Shift in Hydrogen -- Radiative Decay of Coupled States in an External dc Field -- Atomic Interferometer and Coherent Mixing of 2S and 2P States in the Hydrogen Atom -- Ground State Energy of the Helium Atom -- Muonium and Positronium -- Two-Loop Corrections to the Decay Rate of Orthopositronium -- Recent Results in Positronium Theory -- Test

of CPT and Lorentz Invariance from Muonium Spectroscopy -- Positronium: Theory Versus Experiment -- Highly Accurate Theoretical Simulation of the Resonant Multiphoton Ionization Processes With Simplest Atoms -- Muonic Atoms -- Time-of-Flight Spectroscopy of Muonic Hydrogen Atoms and Molecules -- Hyperfine Structure in Muonic Hydrogen -- Towards a Measurement of the Lamb Shift in Muonic Hydrogen -- Exotic Atoms -- Antihydrogen Production and Precision Spectroscopy with ATHENA/AD-1 -- Precision Spectroscopy of X-rays from Antiprotonic Hydrogen -- Charged Pion Mass Determination and Energy — Calibration Standards Based on Pionic X-ray Transitions -- Pionic Hydrogen: Status and Outlook -- Antiprotonic Helium "Atomcule": Relativistic and QED Effects -- Towards Laser Spectroscopy of Antihydrogen -- Hyperfine Structure Measurements of Antiprotonic Helium and Antihydrogen -- Precision Spectroscopy, Fundamental Constants and Fundamental Symmetry -- Indium Single-Ion Optical Frequency Standard -- Matter Neutrality Test Using a Mach-Zehnder Interferometer -- Relativistic Corrections in Atoms and Space-Time Variation of the Fine Structure Constant -- Frequency Comparison and Absolute Frequency Measurement of I<sub>2</sub>-stabilized Lasers at 532 nm -- Few-Electron Ions -- A QED Calculation of Electron Interaction for He-Like and Li-Like Highly Charged Ions -- The g<sub>J</sub> Factor of an Electron Bound in Hydrogen-Like Carbon: Status of the Theoretical Predictions -- Second-Order Self-Energy Calculations for Tightly Bound Electrons in Hydrogen-Like Ions -- Lamb Shift in Light Hydrogen-Like Atoms -- The g Factor of a Bound Electron in a Hydrogen-Like Atom -- Laser Spectroscopy of the 2S Lamb Shift in Hydrogenic Silicon -- Ground-State Hyperfine Structure of Heavy Hydrogen-Like Ions -- Measurement of the 1s<sub>2p</sub> 3P<sub>0</sub> - 3P<sub>1</sub> Fine Structure Interval in Helium-Like Magnesium -- Towards a Precision Measurement of the Lamb Shift in Hydrogen-Like Nitrogen -- Absolute Test of Quantum Electrodynamics for Helium-Like Vanadium -- Relativistic Recoil Corrections to the Atomic Energy Levels -- X-Ray Spectroscopy of Hydrogen-Like Ions in an Electron Beam Ion Trap -- Advanced Quantum Mechanics and QED -- CPT-Invariant Eight-Component Two-Fermion Equation -- The Two-Time Green's Function and Screened Self-Energy for Two-Electron Quasi-Degenerate States -- Higher-Order Stark Effect on Magnetic Fine Structure of the Helium Atom -- Radiation Properties of Diamagnetic Manifolds in Atomic Hydrogen: Line Intensity Dependence on a Magnetic Field -- Precise Evaluation of the Electron (g - 2) at 4 loops: The Algebraic Way -- Relativistic Dipole Dynamic Polarizabilities of Lowest n<sub>s</sub> 1/2-States in Hydrogen-Like Atoms -- Loop-After-Loop Contribution to the Second-Order Self-Energy in Hydrogen.

## Sommario/riassunto

For more than a century, studies of atomic hydrogen have been a rich source of scientific discoveries. These began with the Balmer series in 1885 and the early quantum theories of the atom, and later included the development of QED and the first successful gauge field theory. Today, hydrogen and its relatives continue to provide new fundamental information, as witnessed by the contributions to this book. The printed volume contains invited reviews on the spectroscopy of hydrogen, muonium, positronium, few-electron ions and frequency metrology and the determination of fundamental constants. The accompanying CD contains, in addition to these reviews, a further 40 contributed papers also presented at the conference "Hydrogen Atom 2" held in summer 2000. Finally, to facilitate a historical comparison, the CD also contains the proceedings of the first "Hydrogen Atom" conference of 1988. The book includes a foreword by Norman F. Ramsey.

