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Nota di contenuto	EXPLORING QUANTUM PHYSICS THROUGH HANDS-ON PROJECTS; Introduction; Prologue; Important Disclaimer and Warnings; Acknowledgments; About the Authors; 1 LIGHT AS AWAVE; Newton's View: Light Consists of Particles; Young's Interference of Light; Automatic Scanning of Interference Patterns; The Final Nail in the Coffin for Newton's Theory of Light; Light as an Electromagnetic Wave; Polarization; Optics with 3-cm Wavelength "Light"; Real-World Behaviors; Double-Slit Interference with Microwaves; The Doppler Effect; Experiments and Questions; 2 LIGHT AS PARTICLES The Seed of Quantum Physics: Planck's FormulaThe Photoelectric Effect; Can we Detect Individual Photons?; Low-Cost PMT Power Supplies; Listening to Individual Photons; Where does this Leave Us?; Experiments and Questions; 3 ATOMS AND RADIOACTIVITY; The Need for Vacuum; The Mechanical Vacuum Pump; The Vacuum Gauge; A Very-High-Voltage Power Supply; A Vacuum Tube Lego® Set; Phosphor Screens; The Electron Gun; The Discovery of the Electron; Cathode-Ray Tubes; Thomson's First 1897 Experiment-Negative Charge and Rays are Joined Together

Thomson's Second Experiment-Electrostatic Deflection of Cathode Rays; Thomson and the Modern CRT; Thomson's Third Experiment-Mass-to-Charge Ratio of the Electron; Measuring  $e/m$  with our CRT; A Magical Measurement of  $e/m$ ; Thomson's "Plum Pudding" Model of the Atom; Geiger-Muller Counter;  $\alpha$ ,  $\beta$ , and  $\gamma$ ; The Nature of Beta Radiation; The Ionizing Power of Alpha; What are Alpha Particles?; Rutherford's Alpha-Scattering Experiment; Rutherford's Planetary Model of the Atom; Experiments and Questions; 4 THE PRINCIPLE OF QUANTUM PHYSICS; Emission Spectroscopy; Bohr's Spark of Genius Orbitals and Not Orbits; Quantization-The Core of Quantum Physics; Experiments and Questions; 5 WAVE-PARTICLE DUALITY; Gamma-Ray Spectrum Analysis; What is the Nature of Light?; Two-Slit Interference with Single Photons; Imaging Single Photons; The Answer: Complementarity; Matter Waves; Matter Waves and the Bohr Atom; Experimental Confirmation of De Broglie's Matter Waves; Two-Slit Interference with Single Electrons; A Simple TEM; Blurring the Line Between Quantum and Classical; Particle-Wave Duality in the Macroscopic World; Experiments and Questions; 6 THE UNCERTAINTY PRINCIPLE; Wavefunctions The Uncertainty Principle; Experimental Demonstration of the Uncertainty Principle; Time-Energy Uncertainty; Fourier Analysis; Bye, Bye Clockwork Universe; Experiments and Questions; 7 SCHRÖDINGER (AND HIS ZOMBIE CAT); Real-World Particle in a Box; Quantum Tunneling; Quantum Tunneling Time; Many-Worlds Interpretation; Schrödinger's Cat in the Lab; Beam Splitters; Who Rolls the Dice?; The Mach-Zehnder Interferometer; "Which-Way" Experiments; The Quantum Eraser; Experiments and Questions; 8 ENTANGLEMENT; Bell's Inequalities; An Entangled-Photon Source; Detecting Entangled Photons High-Purity Single-Photon Source

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## Sommario/riassunto

Build an intuitive understanding of the principles behind quantum mechanics through practical construction and replication of original experiments With easy-to-acquire, low-cost materials and basic knowledge of algebra and trigonometry, Exploring Quantum Physics through Hands-on Projects takes readers step by step through the process of re-creating scientific experiments that played an essential role in the creation and development of quantum mechanics. Presented in near chronological order-from discoveries of the early twentieth century to new material on entanglement-th

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