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Nota di contenuto	Quantum Ring: A Unique Playground for the Quantum-Mechanical Paradigm and Topological Physics -- Optical Berry Phase in Micro/Nano-Rings -- The Inverse Faraday Effect as a Mechanism for Optical Control of Superconducting States -- Magnetic Lightning in Macroscopic Superconducting Ring Structures -- Self-Organized Quantum Rings: Physical Characterization and Theoretical Modeling -- Functionalization of Droplet Etching for Quantum Rings -- Self-Assembled Semiconductor Quantum Ring Complexes by Droplet Epitaxy: Growth and Physical Properties -- In(AsSbP) Graded Composition Quantum Dots, Quantum Rings and Quantum Dot Molecules -- Spin Waves in Magnetic Nanodisks, Nanorings, and 3D Nanovolcanos -- Light-Controlled Optical Aharonov-Bohm Oscillations in a Single GaAs/AlGaAs Quantum Ring -- Quantum Interference in

Transport Measurements of Superconducting Rings -- Spin Interference Effects in Rashba Quantum Rings -- Quantum Rings in Electromagnetic Fields -- Cyclocarbons in External Fields -- Electron-Phonon Interaction in Doubly-Connected Nanostructures -- Differential Geometry Applied to Rings and Möbius Nanostructures -- Theory of Superconductivity in Quantum Rings.

Sommario/riassunto

The book represents quantum rings as special class of modern high-tech materials structures at the nanoscale. It deals, in particular, with their formation by molecular beam epitaxy and droplet epitaxy of semiconductors, their topology-driven electronic, optical and magnetic properties. Highly complex theoretical models are developed to adequately explain the specific features of quantum rings. The results presented in the book serve to develop low-cost high-performance electronic, spintronic, magnetic, optoelectronic and information processing devices based on various doubly-connected structures. The third edition contains new chapters and significantly updated and extended chapters from the second edition. It provides an ample presentation of the recent advancements in the physics of quantum rings related to spin dynamics and the spin-orbit interaction (spin interference in Rashba rings, tunable exciton topology on type II InAs/GaAsSb quantum nanostructures), the electron-phonon interaction in ring-like structures, quantum-interference manifestations in novel materials (e.g., graphene cylinders, cyclocarbons, MoS2), effects of electric field and THz radiation on optical properties of quantum rings and quantum-ring molecules. Special emphasis is made on fascinating novel effects emerging due to double-connectedness in various physical systems, ranging from the occurrence of the continuous geometric phase provoking formation of non-integer mode numbers in Möbius microring light cavities—through the inverse Faraday effect on the generation of current states in an array of superconductor nanorings—to the emergence of lightning-like magnetic flux bursts into a macroscopic superconductor ring. The new edition gives insight into the properties of various novel architectures, including coupled semiconductor quantum ring-quantum dot chains and concentric quantum rings, In(AsSbP) graded-composition quantum rings, topologic states of light in self-assembled and direct-printed ring-like cavities, optical and plasmon modes in Möbius-band-shaped resonators, the ferromagnetic resonance in various magnetic elements ranging from arrays of magnetic nanorings to individual 3D nanovolcanoes. It includes novel theoretical solutions to long-standing problems in the physics of quantum rings: interpretation of the observed magnetoresistance oscillations by a transmission model for superconductor quantum rings and adaptation of the Bardeen-Cooper-Schrieffer theory of superconductivity for metallic quantum rings with due account for the effects of double-connectedness on the electron properties.