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Sinopsis

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This invaluable textbook presents the basic elements needed to understand and research into semiconductor physics. It deals with elementary excitations in bulk and low-dimensional semiconductors, including quantum wells, quantum wires and quantum dots. The basic principles underlying optical nonlinearities are developed, including excitonic and many-body plasma effects. Fundamentals of optical bistability, semiconductor lasers, femtosecond excitation, the optical Stark effect, the semiconductor photon echo, magneto-optic effects, as well as bulk and quantum-confined Franz-Keldysh effects, are covered. The material is presented in sufficient detail for graduate students and researchers with a general background in quantum mechanics.

This fifth edition includes an additional chapter on 'Quantum Optical Effects' where the theory of quantum optical effects in semiconductors is detailed. Besides deriving the 'semiconductor luminescence equations' and the expression for the stationary luminescence spectrum, results are presented to show the importance of Coulombic effects on the semiconductor luminescence and to elucidate the role of excitonic populations.

Contents:
Oscillator Model
Atoms in a Classical Light Field
Periodic Lattice of Atoms
Mesoscopic Semiconductor Structures
Free Carrier Transitions
Ideal Quantum Gases
Interacting Electron Gas
Plasmons and Plasma Screening
Retarded Green's Function for Electrons
Excitons
Polaritons
Semiconductor Bloch Equations

Excitonic Optical Stark Effect
Wave-Mixing Spectroscopy
Optical Properties of a Quasi-Equilibrium Electron-Hole Plasma
Optical Bistability
Semiconductor Laser
Electroabsorption
Magneto-Optics
Quantum Dots
Coulomb Quantum Kinetics
Quantum Optical Effects