1. Record Nr. UNINA9910254616103321

Autore	DICK RAINER
Titolo	Advanced Quantum Mechanics : Materials and Photons / / by RAINER DICK
Pubbl/distr/stampa	Cham : , : Springer International Publishing : , : Imprint : Springer, , 2016
ISBN	3-319-25675-0
Edizione	[2nd ed. 2016.]
Descrizione fisica	1 online resource (XIX, 692 p. 63 illus., 36 illus. in color.)
Collana	Graduate Texts in Physics, , 1868-4513
Disciplina	530.12
Soggetti	Quantum physics Quantum optics Optical materials Electronic materials Nanoscale science Nanoscience Nanostructures Nanotechnology Quantum Physics Quantum Optics Optical and Electronic Materials Nanoscale Science and Technology
Lingua di pubblicazione	Inglese
Formato	Materiale a stampa
Livello bibliografico	Monografia
Nota di contenuto	The Need for Quantum Mechanics -- Self-adjoint Operators and Eigenfunction Expansions -- Simple Model Systems -- Notions from Linear Algebra and Bra-Ket Formalism -- Formal Developments -- Harmonic Oscillators and Coherent States -- Central Forces in Quantum Mechanics -- Spin and Addition of Angular Momentum Type Operators -- Stationary Perturbations in Quantum Mechanics -- Quantum Aspects of Materials I -- Scattering Off Potentials -- The Density of States -- Time-Dependent Perturbations in Quantum Mechanics -- Path Integrals in Quantum Mechanics -- Coupling to Electromagnetic Fields -- Principles of Lagrangian Field Theory -- Non-relativistic Quantum Field

Sommario/riassunto

In this updated and expanded second edition of a well-received and invaluable textbook, Prof. Dick emphasizes the importance of advanced quantum mechanics for materials science and all experimental techniques which employ photon absorption, emission, or scattering. Important aspects of introductory quantum mechanics are covered in the first seven chapters to make the subject self-contained and accessible for a wide audience. Advanced Quantum Mechanics, Materials and Photons can therefore be used for advanced undergraduate courses and introductory graduate courses which are targeted towards students with diverse academic backgrounds from the Natural Sciences or Engineering. To enhance this inclusive aspect of making the subject as accessible as possible Appendices A and B also provide introductions to Lagrangian mechanics and the covariant formulation of electrodynamics. This second edition includes an additional 62 new problems as well as expanded sections on relativistic quantum fields and applications of quantum electrodynamics. Other special features include an introduction to Lagrangian field theory and an integrated discussion of transition amplitudes with discrete or continuous initial or final states. Once students have acquired an understanding of basic quantum mechanics and classical field theory, canonical field quantization is easy. Furthermore, the integrated discussion of transition amplitudes naturally leads to the notions of tr ansition probabilities, decay rates, absorption cross sections and scattering cross sections, which are important for all experimental techniques that use photon probes. Quantization is first discussed for the Schrödinger field before the relativistic Maxwell, Klein-Gordon and Dirac fields are quantized. Quantized Schrödinger field theory is not only important for condensed matter physics and materials science, but also provides the easiest avenue to general field quantization and is therefore also useful for students with an interest in nuclear and particle physics. The quantization of the Maxwell field is performed in Coulomb gauge. This is the appropriate and practically most useful quantization procedure in condensed matter physics, chemistry, and materials science because it naturally separates the effects of Coulomb interactions, exchange interactions, and photon scattering. The appendices contain additional material that is usually not found in standard quantum mechanics textbooks, including a completeness proof for Eigen functions of one-dimensional Sturm-Liouville problems, logarithms of matrices, and Green’s functions in different dimensions.