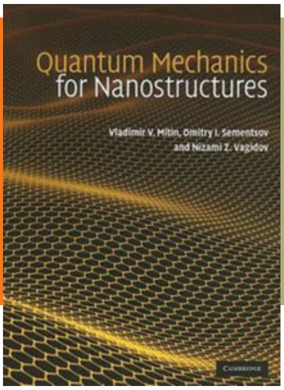

Quantum mechanics for nanostructures

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Quantum Mechanics for Nanostructures is a book geared to provide a sufficient background in quantum mechanics so that the reader may properly understand the operation of nanostructures. It also will serve as a ready reference for physics and engineering students at the graduate or advanced undergraduate level who should find this to be an excellent introduction to the application of quantum mechanics to materials and structures with particle dimensions less than or on the order of the de Broglie wavelength.

There are eight chapters in the text. While Chapters 2–7 form the core of the volume, developing the quantum mechanics of nanostructures, Chapters 1 and 8 bound these chapters with an introduction to nanostructures that includes their history and a lengthy conclusion that covers fabrication, characterization, and application of very relevant nanostructures. One of the strengths of the book is the discussion of nanomaterials and nanodevices of contemporary interest, such as graphene, carbon nanotubes, quantum cascade lasers, quantum dots for cellular automata, fullerenes, spintronic devices, and nanoelectromechanical systems—an extension of microelectromechanical systems to the nanoscale.

Chapter 2 is a nice primer on introductory quantum mechanics, with useful contrasts between classical and quantum regimes. Throughout the text, the consequences of quantum mechanics are shown, including examples where the lowest energy state is not the state of rest. The core of the book builds in a natural manner. After starting with the infinite square well potential in one dimension, the authors develop the semi-infinite well before moving on to the finite square well. The discussion is not limited to square wells, but extends to triangular barriers, parabolic wells, and other potential profiles. The authors extend quantum confinement beyond one dimension and consider the energy in three-dimensional structures, even if the confinement only occurs in one or two dimensions. In particular, in Chapter 7, the authors break convention and begin with a treatment of quantum dots rather than starting with quantum wells. Approximation methods such as perturbation theory and the quasiclassical approximation are developed for cases where the Schrödinger equation cannot be solved exactly. Bands and minibands are introduced through the coupling of nanostructures.

The authors have included summaries, an extensive group of worked examples in each chapter and a substantial set of problems, for many of which the answers are given. This strengthens the usefulness of the book for either self-study or use in a formal course. Three substantial appendices include summaries and problems in classical dynamics, electricity and magnetism, and introductory solid-state physics. Tables of units and a list of symbols also contribute to making this a self-contained text.

This excellent volume by Mitin, Sementsov, and Vagidov is a succinct and thorough introduction to the quantum mechanical principles necessary to understand individual and coupled nanostructures. This book contrasts with Mitin, Kochelap, and Stroscio's *Quantum Heterostructures*, which is an extensive and lengthy volume that provides more detail on specific optoelectronic devices. *Quantum Mechanics for Nanostructures* is a well-written, self-contained introduction that describes nanomaterials of recent interest.

Reviewer: Linda Olafsen *of the Department of Physics at Baylor University.*