

book as a specialized text for those working on the receiver or amplifier side of system design and analysis.

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Quantum Theory of Matter: A Novel Introduction

Antonis Modinos
Wiley, New York, 1996.
356 pp. \$79.95 hc (\$32.95 pb)
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(0-471-96364-X pb)

Many of us, myself included, have taught one-semester physics courses for engineers (subsequent to the introductory sequence) in which we have tried to cover all of "modern physics." Typically, one spends a substantial part of the course on basics of quantum mechanics, then applies it to atomic, nuclear and elementary-particle topics, leaving little time for condensed matter physics, which is arguably of greatest interest to these students. The novelty of the approach taken by Antonis Modinos in *Quantum Theory of Matter* is to bury most of the formal development of quantum theory in his appendix B, thereby allowing him to reach chapter 2, "Atoms," after just 45 pages. Chapter 3, "Molecules," serves as a modest bridge to chapter 4, "Solids," which contains nearly half the body of the text. He mentions neither nuclei nor quarks.

The unusual flavor of the text stems from the author's experiences teaching related courses at the University of Salford in the UK and the National Technical University of Athens, Greece. Modinos comments with pride, in the preface, that the book's four chapters contain no differential equations and can be read with just "rudiments of calculus." Appendix B, which supplies the "mathematical backbone of the theory," is longer than chapter 1! We are left, then, with a spineless treatment of quantum physics in which important ideas and solutions to standard potentials are dished up to the reader one after the other. While the preface suggests that readers will thus gain a better overall view of the quantum world, their understanding of these ideas will be superficial and ill-grounded if they have failed to master appendix B. In fact, over half of the dozen-plus problems at the end of chapter 1 require appendix B (though in subsequent chapters, this fraction decreases).

Some ideas that might have been exciting when the author was developing his course now seem rather dated.

An example is John Slater's $X\alpha$ method for computing the electronic structure of atoms or clusters. While Modinos mentions different ways to pick α , he does not explore the physics behind the various choices. Band structure and self-consistency are described in nice detail (although—not surprisingly by now—Bloch's theorem is just handed to the reader); however, there is no mention of current total-energy calculations. To suggest an up-to-date outlook, Modinos includes sections on surfaces, amorphous materials and superconductors, but he does not mention such Nobel Prize-winning topics as the quantum Hall effect or scanning tunneling microscopy, both of which relate readily to elementary quantum mechanics. The grudgingly short paragraph on high-temperature superconductors is strikingly unstimulating.

A book of this sort should provide a good qualitative discussion of fundamental ideas, but Modinos often glosses over them. Holes in semiconductors are simply defined in passing as empty states in the valence band. There is a nice discussion of vibrations and phonons, but zero-point motion is never mentioned. Modinos poses the intriguing question of why 4s states fill before the 3d band is completely occupied, then answers, basically, that this is what emerges from the full calculation.

The book's physical layout is pleasant enough, with few typos and ample, helpful figures. (However, the figure on bonding and antibonding states in dimers misses the point that their normalization factors are different.) The text notes appear at the end of the chapters rather than at the bottom of the pages; some are worthwhile, some minor, and it soon becomes annoying to hunt for them. The energy unit changes from eV to Hartree to Rydberg with no explanation of why one might favor a particular choice.

In conclusion, a more accurate title would be "Quantum Description of Non-Subatomic Matter." The back cover (presumably penned by Wiley's marketing arm) preposterously boasts that this text is "essential for all undergraduate physics courses" and "a most valuable supplementary text for postgraduate courses on quantum mechanics." In the preface, the author himself is appropriately modest: He hopes the book can serve as a complement in a beginning course on quantum mechanics and as part of a subsequent course on atomic, molecular and solid-state physics, and he describes it as suitable as a textbook only for "students of applied physics"; having no experience with such students, I cannot fairly judge the benefits they would derive from this book. As for

graduate students, some might gain from skimming this book before a qualifying exam; for those interested in condensed matter, their time and money would much better be spent on Neil Ashcroft and N. David Mermin's admittedly more advanced *Solid State Physics* (Holt, Rinehart and Winston, 1976).

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