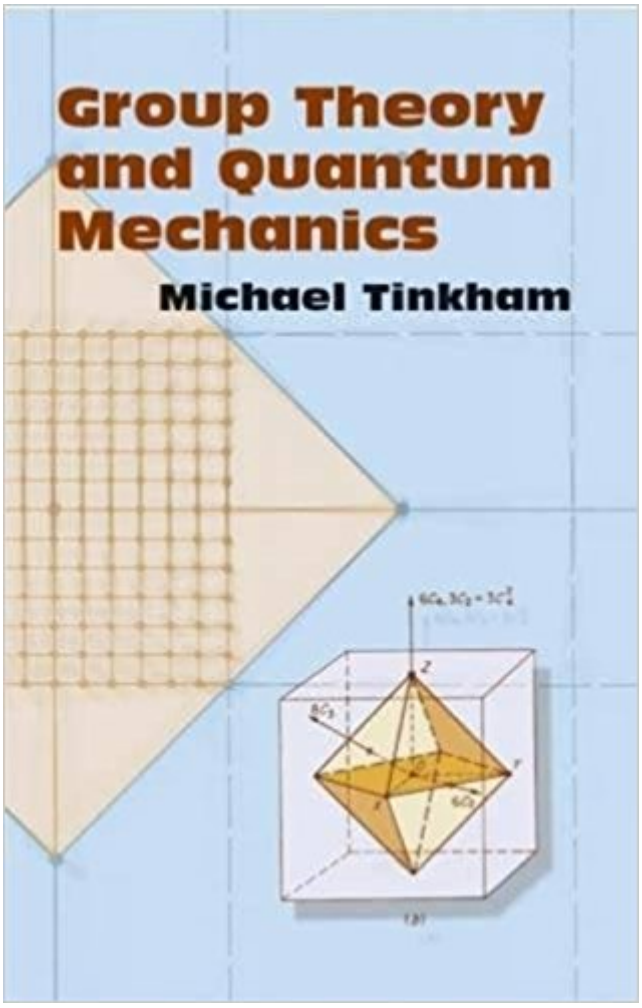
Group Theory And Quantum Mechanics (Dover Books On Chemistry)



Synopsis

This graduate-level text develops the aspects of group theory most relevant to physics and chemistry (such as the theory of representations) and illustrates their applications to quantum mechanics. The first five chapters focus chiefly on the introduction of methods, illustrated by physical examples, and the final three chapters offer a systematic treatment of the quantum theory of atoms, molecules, and solids.The formal theory of finite groups and their representation is developed in Chapters 1 through 4 and illustrated by examples from the crystallographic point groups basic to solid-state and molecular theory. Chapter 5 is devoted to the theory of systems with full rotational symmetry, Chapter 6 to the systematic presentation of atomic structure, and Chapter 7 to molecular quantum mechanics. Chapter 8, which deals with solid-state physics, treats electronic energy band theory and magnetic crystal symmetry. A compact and worthwhile compilation of the scattered material on standard methods, this volume presumes a basic understanding of quantum theory.

Book Information

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Customer Reviews

I have attempted to read other books on group theory, especially those intended for physicists, including Weyl's bookÂ The Theory of Groups and Quantum Mechanics. Tinkham's book, however, is the only one that I have been able to understand relatively well. Tinkham gently takes you by the hand and starts you out on a tutorial that addresses the symmetry of a simple example from plane

geometry, and then gradually builds up to more sophisticated problems. Character tables and the various orthogonality and normalization relations that make them useful are developed and used for both simple (e.g. plane geometry) and more sophisticated problems. Lie Groups, Schur's Lemma, angular momentum, crystal symmetry, and nature's inability to conserve parity are among the topics addressed.The treatment of Lorentz and Poincare groups required for a more sophisticated understanding of quantum field theory, however, is not included in this book--for those topics Weinberg's (The Quantum Theory of Fields, Volume 1: Foundations) suggestion of Tung'sÂ Group Theory in PhysicsÂ would seem to be reasonable. I was also not able to understand Tinkham's proof of the Vector Addition Theorem for angular momentum. I found a version of the proof that I could understand, however, in Wigner's bookÂ Group Theory and It's Application to the Quantum Mechanics of Atomic Spectra, and I display this proof along with my review of Wigner's book.

This book has the advantage of applying group theory directly to solvable physical problems. In most areas of applied physics it isvery important to know the basics concepts of group theory, butthere is no need to have a deep knowledge as well as to know how toproof all the main theorems. As an introductory course for undergradstudents this book is well recommended.

Great book great price

My background is that of theoretically inclined inorganic chemist and this review is intended for those with interests in inorganic and physical chemistry or solid-state chemistry/physics.Tinkham's text is the first textbook one should go to for a reasonably rigorous introduction to the theory and use of group representations in physics and theoretical chemistry. Modern theoretical chemists should become familiar with all of this book, with the possible exception of the some of the material in Chapter 5 that will be applicable only to physicists (and not a lot of that, actually). The pervasiveness of band theory, even in general inorganic chemistry journals now, should convince chemists who teach this subject to include a lot of Chapter 8 (Solid-State Theory) and chemical theorists will even have to go beyond the symmorphic groups treated here. The purely mathematical aspects of the subject are treated briefly, but much more completely, than "chemical group theory books" like Cotton's, for example. Naturally, this comes at a price of more mathematical abstractness, but that is unavoidable. These sections, like the rest of the book, are very well written. Chapter 7, on applications to molecular quantum mechanics, is now quite dated. It was quite incomplete even when written, since it did not include any discussion of ligand-field theory. The

effects of antisymmetric wavefunctions for electrons are touched on briefly in Chapter 5 (atoms), but are not adequately accounted for in discussion of molecules. (Incidentally, the failure to use Mulliken notation in molecular QM is an unfortunate annoyance.) These objections aside, this book is an excellent buy for the price of a Dover edition. Indeed, if I'd included price in my rating, it would be 5 stars - easily!

I began reading this book having just finished a course on Abstract Algebra through my school's math department, and the semester before I took a graduate course on the exact subject.After taking the math course, I was presented with group theory as if it were some muddled mix of facts, and the course came across as a poorly taught class on number theory. After reading just the first chapter of Tinkham's book, I developed a new, deeper understanding of group theory as a whole. For example, the way that Tinkham presents normal subgroups makes vastly more intuitive sense than the presentation I received in my math course.The first two chapters alone are probably worth 80% of the book's sale price. The rest is made up entirely of the fact that the book does not piddle around with trivial examples, but genuinely frames quantum mechanics in the language of group theory, and the most important part is that Tinkham does it well.This book, along with his book on superconductivity, are must-haves for any serious condensed matter person, and this book should be at least read (if not owned) by any physics grad student.

A LOT of quantum theory results from symmetry. This book encapsulates a huge amount of results that come directly from group theory. Heavy on actual applied examples. Extremely close to chemistry use, but good for physicists too.

(Dover Books on Chemistry) Computational Chemistry: Introduction to the Theory and Applications of Molecular and Quantum Mechanics Quantum Ontology: A Guide to the Metaphysics of Quantum Mechanics Recent Advances in the Theory of Chemical and Physical Systems: Proceedings of the 9th European Workshop on Quantum Systems in Chemistry and Physics ... in Theoretical Chemistry and Physics) Mathematics for Quantum Mechanics: An Introductory Survey of Operators, Eigenvalues, and Linear Vector Spaces (Dover Books on Mathematics) Joining Together: Group Theory and Group Skills (11th Edition) Covariant Loop Quantum Gravity: An Elementary Introduction to Quantum Gravity and Spinfoam Theory (Cambridge Monographs on Mathematical Physics) Physical Chemistry: Quantum Chemistry and Molecular Interactions, Books a la Carte Plus MasteringChemistry with eText -- Access Card Package Principles of Quantum Mechanics: As Applied to Chemistry and Chemical Physics Introduction to Quantum Mechanics: in Chemistry, Materials Science, and Biology (Complementary Science) Quantum Mechanics In Chemistry Edition