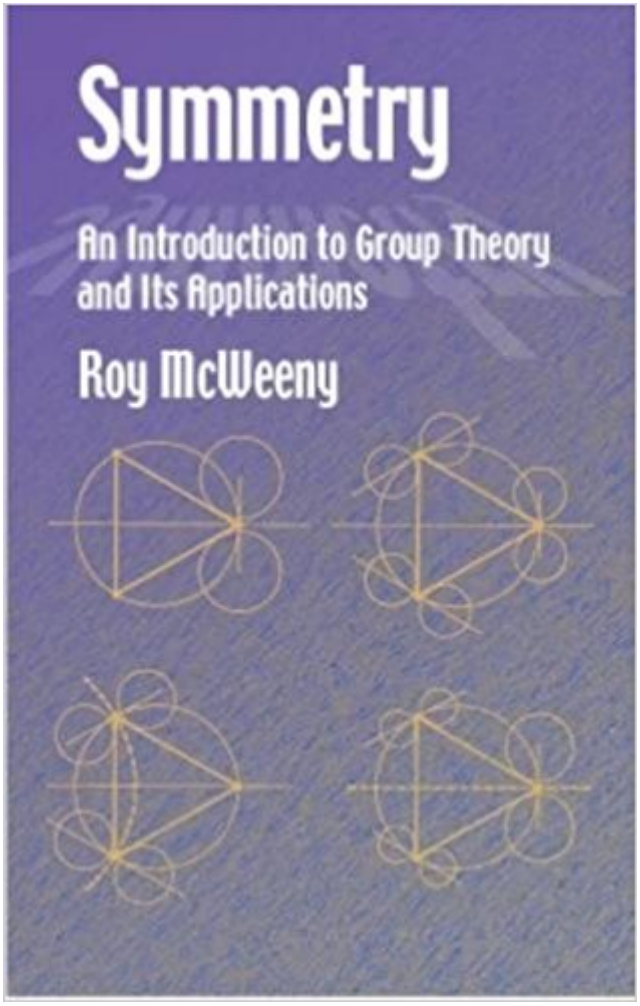
# Symmetry: An Introduction To Group Theory And Its Applications (Dover Books On Physics)



## Synopsis

The crucial significance of symmetry to the development of group theory and in the fields of physics and chemistry cannot be overstated, and this well-organized volume provides an excellent introduction to the topic.The text develops the elementary ideas of both group theory and representation theory in a progressive and thorough fashion, leading students to a point from which they can proceed easily to more elaborate applications. The finite groups describing the symmetry of regular polyhedral and of repeating patterns are emphasized, and geometric illustrations of all main processes appear here â ” including more than 100 fully worked examples.Designed to be read at a variety of levels and to allow students to focus on any of the main fields of application, this volume is geared toward advanced undergraduate and graduate physics and chemistry students with the requisite mathematical background.

## Book Information

Series: Dover Books on Physics
Paperback: 256 pages
Publisher: Dover Publications; Unabridged edition (June 12, 2002)
Language: English
ISBN-10: 0486421821
ISBN-13: 978-0486421827
Product Dimensions: 0.8 x 5.5 x 8.8 inches
Shipping Weight: 8 ounces (View shipping rates and policies)
Average Customer Review: 4.4 out of 5 stars 12 customer reviews
Best Sellers Rank: #162,355 in Books (See Top 100 in Books) #13 inÂ Books > Science & Math > Mathematics > Pure Mathematics > Group Theory #622 inÂ Books > Textbooks > Science & Mathematics > Physics #703 inÂ Books > Science & Math > Chemistry > General & Reference

## Customer Reviews

Peter Bernath was born in Ottawa, Ontario, Canada and was educated at the University of Waterloo (B. Sc. in chemistry 1976) and Massachusetts Institute of Technology (Ph. D. in physical chemistry 1980). After a post-doctoral stint at the Herzberg Institute of Astrophysics of the National Research Council of Canada, he began his academic career at the University of Arizona in 1982. In 1991, he moved to the University of Waterloo as Professor of Chemistry and of Physics and now holds an Industrial Research Chair in Fourier Transform Spectroscopy. Prof. Bernath has interests in high resolution spectroscopy of molecules with applications in astronomy and atmospheric science. He is

the author of the textbook Spectra of Atoms and Molecules.  Roy McWeeny's academic career spans five decades. After a first degree in Physics (Leeds University) and a D.Phil. from Oxford University (where he worked with C.A. Coulson), he was appointed Lecturer in Physical Chemistry, University of Durham. In the mid-1950s he was an invited member of J.C. Slater's famous Solid-State and Molecular Theory Group at MIT; and in 1960 spent a year as Associate Director of P.-O. Lowdin's Quantum Theory Group at Uppsala University. His other University appointments include a Lectureship in Mathematics, Physics and Chemistry (University of Keele, UK); a Readership in Quantum Theory, a personal Chair of Theoretical Physics and Theoretical Chemistry, and a Chair of Chemistry (University of Sheffield, UK). In 1982 he became the first foreign scholar (following a Ministerial Decree) to be called to an Italian University Chair, taking up the position of Professore Ordinario di Chimica Teorica, UniversitA di Pisa, where hebecame Professore Emerito in 1998. He is a Member of the International Academy of Quantum Molecular Science (elected 1973); and a Member of the European Academy of Arts, Sciences and the Humanities (elected 1986). In 1996 a Special Issue of the International Journal of Quantum Chemistry (Volume 60) was published in his honour: it contains sixty scientific papers, contributed by authors from many countries. Stephen Wilson has published over 300 scientific papers and reviews, principally in theoretical and computational chemistry and molecular physics, but also in computing science and numerical analysis. He has authored two books - Electron correlation in molecules, Clarendon Press, Oxford, 1984, and Chemistry by Computer: An overview of the applications of computers in chemistry, Plenum Press, New York, 1986, and has edited some 21 volumes. He is an Editor-in-Chief of Progress in Theoretical Chemistry and Physics and Series Editor of Methods in Computational Chemistry. Dr. Wilson holds a D.Sc. from the University of Bristol.

The author states in the preface that this book was written to serve readers at a variety of levels. In fact this rather short book is almost three books in one.The first two chapters provide an introduction to groups, vector spaces, and lattices. The material here is elementary, but the author is to be commended both for clear explanations as well as excellent notation. My only complaint is that the notation is useful to read, but not really to write as it relies on different typefaces.The next two chapters dig into translation groups, point groups, and space groups in three dimensions. Chapter 5 focuses on the theory of irreducible representations, and in many ways forms the core of the book. The material in these chapters is definitely more challenging than the material in the first two chapters.The final three chapters are devoted to applications. Chapter 6 covers applications to algebraic forms particularly as applied to vibrational modes as encountered in spectroscopy.

Chapter 7 focuses on applications to functions and operators. Finally, chapter 8 is devoted to tensors and tensor operators. These three chapters are the most advanced in the book, and each is successively more advanced than the preceding one. These chapters will serve more advanced readers.Early on the author introduces the group which comes to be known as C_3v. This groups is used as an example throughout the book and comes fully to life in chapter 6 where it is used to analyze the vibrational modes of the ammonia molecule. I really appreciated the continuity of and the elaboration on this one example as a unifying thread in the text.The entire book contains copious tables and figures which are extremely helpful. In particular, chapters 3 and 4 contain detailed tables of the groups considered as well as their representations. The book has no exercises, but does offer a nice collection of suggestions for further reading at the end of each chapter. Finally, this book has remarkably few errors which is actually somewhat surprising just given the level of detail in some sections such as the group tables mentioned above.Sure to be useful in particular to students of quantum chemistry and spectroscopy, this book is excellent and repays multiple readings, but I'd recommend the prospective reader bring a background in linear algebra and some quantum chemistry.

Really good reference book for the price. Well as tables he'd mathematics does not change over time.

Gives easy paced introduction to Group Theory. Author does good job explaining the reasoning behind concepts. Author makes subject materal easy enough for high school students to grasp.

I have a much more moderate view of this book than some other reviewers. The book was written in the early 1960s. Back then, physicists were assumed to be interested mainly in finite groups, and these take up a lot of the book. The symmetries involved tend to be geometric symmetries in 3-space, e.g. of molecules, crystals, rotation of light, etc. The more generalized notion of symmetry commonly spoken of in physics classes today, based on Noether's theorem and connected to conservation laws, is missing from this book. Most of the applications are in chemistry and crystallography (though not necessarily solid state physics -- e.g., Bloch's theorem is mentioned only in passing, more than 80% into the text). Classical mechanics, quantum field theory, and particle physics are all absent. So is much of the vocabulary that a student today might be interested in: Lie groups aren't mentioned by name, nor are orthogonal groups, linear groups, Galilean groups, Lorentz groups, SU(n), SO(n), etc. etc. So are some of the usual math text topics,

such as quotient groups and Sylow theorems.The book is written in straight exposition without definition/theorem/proof, and without exercises too. But it’s written in a more formal and pedantic style characteristic of the "Father Knows Best" era, when scientists smoked pipes and wore neckties under their lab coats -- very top-down, not the more eye-to-eye style of some textbooks today. Also typical for its time, the presentation is heavily reliant on all sorts of typographical tricks. On the plus side, the book has relatively many illustrations.I bought this book based on some of the reviews on this page. I teach in Japan, and was hoping to find something I could recommend as a first math/science book in English to some aspiring grad students who are interested in particle physics, but who aren’t yet so strong in groups or other algebraic structures. Sadly this didn’t fill the bill. Regardless of English ability, if you’re, say, a physics undergraduate who’s interested in elementary particles or cosmology, and you’re new to groups but allergic to pure math books, I think this could be a frustrating place to start. While the opening pages might have some useful information and visualizations, so do the early pages of some pdf introductions to group theory you can download for free, and those are written in a more contemporary style. If you’re interested in chemistry, the early chapters of "Symmetry and Spectroscopy" by Harris and Bertolucci (available in a Dover edition) provide a much more user-friendly way to learn about groups. That said, as other reviews evidence, the book might be useful for some audiences. Crystallographers and others who work with finite groups might be one, and very gifted high school students who are thirsty for knowledge but who lack the need and impatience to dive into the contemporary math or physics literature might be another.

This book is fantastic! We dont have any applied algebra text so clear like this book in portuguese. Good for algebra teachers who want to develop higher topics with students.

Wondering what a coset is? How axioms for lattices and groups generalize to vector spaces and linear algebra. Like an example of symmetry used as a theme for the whole book? This is the book for you.

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