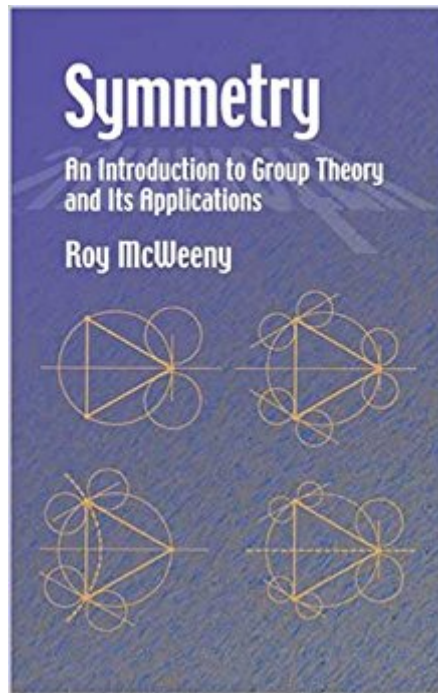# Symmetry: An Introduction To Group Theory And Its Applications (Dover Books On Physics)

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

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Customer Reviews

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.

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.

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