Group Theory and Physics

Shlomo Sternberg
Cambridge U. P., New York, 1994.
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My first impression of *Group Theory and Physics* was: "Finally a group theory book for physicists that is actually fun to read!" It is written in an almost informal style (not the dry "definition–theorem–proof" style so common today), and the physics and mathematics are nicely mingled so that there is seldom a lack of motivation for the concepts introduced. But this also makes it harder to find things in the book and may make it less suitable as a "stand-alone" text to be used in a course.

Shlomo Sternberg is well known in the mathematics and mathematical physics communities for his original research as well as his books on celestial mechanics, differential geometry and symplectic techniques in physics (the latter written jointly with Victor Guillemin). He is also the coauthor (with Paul Bamberg) of a very nice introductory textbook on mathematical methods for physicists.

This time Sternberg has devoted his attention to a subject on which many long textbooks have been written, most of which (in contrast to the present volume) I would not recommend as "bedside reading." Like many of his other books, this one is full of historical pointers, and it even has a fascinating appendix on the history of 19th-century spectroscopy.

The author eschews the traditional barriers between finite and continuous groups, and he adroitly exploits common techniques. Thus, right after discussing the discrete symmetries of the square, Sternberg introduces the concept of homomorphism—using the example of the homomorphism between the Lorentz group and SL(2, {**C**})—which gives the reader facts that will be used repeatedly later. Another example of this approach is his introduction of the Wigner–Mackey theory of induced representations (in a chapter with the somewhat misleading title "Molecular vibrations and vector bundles") before the general concepts related to continuous and Lie groups are introduced in the next chapter.

Other novel or distinguishing features of this book are: a discussion of the relation between the icosahedral group and the spectra of fullerenes (buckyballs); a very clear discussion of the symmetric group; a good introduction to the representations of SU(n), with particular emphasis on "flavor" SU(3); and a discussion of gauge theories and the nuclear shell model.

On the negative side, in addition to a large number of minor errors and sloppy typesetting of formulas (such as exponents in line and missing parentheses), one sees other fingerprints of bad copyediting: There are references to nonexistent bibliographical sources, some "leftover" numbering of propositions (obviously unrevised from previous incarnations of the manuscript as lecture notes) and a rather uneven index, where some important topics are not to be found. I have sent the author a list of these, and he assured me that they will be corrected in a soon-to-be-released second printing.

Overall, I can highly recommend this book to anyone teaching or studying the subject. It could serve as a text in a graduate course if supplemented with exercises and problems. But when you buy it, check whether it is the corrected second printing:

Look for the units of Planck's constant on page 393.

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Holographic Interferometry Principles and Methods

Edited by P. K. Rastogi
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Aside from the steady flow of conference proceedings, it has been a while since the publication of the last major book on holographic interferometry. As a codiscoverer of this field, I have had the good fortune to be asked to review or contribute to most of the books in this area, and my collection now includes at least eight books on the subject published between 1974 and 1990, including the timeless classic *Holographic Interferometry* by C.M. Vest (Wiley Interscience, 1979). Even if I haven't missed any, which I'm sure I have, you might not expect me to be enthusiastic about yet another book in this field, especially one that is a compilation of chapters by separate authors. If so, you would be wrong, because these six authors and their editor Pramod K. Rastogi (who contributes a seventh article) have made *Holographic Interferometry Principles and Methods* a worthwhile book.

P. Hariharan's chapter, Basic Principles, is a good discussion of the hologram and its function in holographic interferometry and includes a basic discussion of the interference phenomena that make up this field. Ryszard J. Pryputniewicz's chapter, Quantitative Determination of Displacements of Strains from Holograms, for me was *déjà vu* because of the large amount of work we have done together. The author presents an elaborate mathematical treatment of fringe formation in holographic interferometry, including solutions for displacements and strains formulated in matrix notation, and also includes a section on modern work in TV holography. René Dändliker's Two-Reference-Beam Holographic Interferometry is a solid treatment of heterodyne interferometry as applied to holographic interferometry and includes some remarkable applications. Katherine Creath's Phase-Shifting Holographic Interferometry is an excellent treatment of phase-step interferometry and electronic holography (also called electronic speckle-pattern interferometry). Thomas Kreis, in his Computer-Aided Evaluation of Holographic Interferograms, presents a very thorough treatment of computer methods for interferogram analysis. In his Techniques to Measure Displacement Derivations and Surface Shapes, Rastogi presents an extended potpourri of measurement techniques. And C.S. Vikram's Study of Vibrations closes the book with a comprehensive discussion of vibration measurement by holographic techniques.

As would be expected of a multiauthor book, this volume appears to be aimed at the prospective user and is less a potential college text than is Vest's *Holographic Interferometry*. What is surprising is the extent to which the chapters complement one another to present a comprehensive picture of the major developments in this field over the past 30 years.