reich and Stanton Peale develops the theory of the peculiar resonances that have recently been discovered in the rotation periods of Mercury and Venus. It is now observationally established that Mercury's rotation is locked to its orbital motion, the rotation period being two thirds of the orbital period. Also the rotation of Venus appears to be locked to the orbital motion of itself and the earth, the rotation rate of Venus being equal to four times its revolution rate minus five times the earth's revolution rate. These relationships can be understood on the basis of Newtonian mechanics, when tidal interactions are properly taken into account. The theory is an exercise in analytical dynamics, which any of the great 19th-century mathematicians from Lagrange to Poincaré would have enjoyed working out. What a demonstration of the poverty of human imagination it is that nobody considered the possibility of such resonances in the dynamics of the solar system until the radar astronomers observed them!

I have described just a few of the contributions in this volume. My advice to the reader is to begin reading the article that you think will interest you least. The chances are that you will be pleasantly surprised.

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Fundamentals of Electricity and Magnetism

By Arthur F. Kip
(2nd edition) 630 pp. McGraw-Hill, New York, 1969. $9.50

There are several interesting features about this excellent text by Arthur F. Kip, physics professor at Berkeley. For one thing, a description of the chapter contents precedes the table of contents. This, with the table, forms a clear and easy sketch of what material the book covers and how it is covered. A second feature is a fine last chapter on units of measurement. The third feature is the relegating of mathematics to the appendixes. It is thus convenient to instructor and student, but is not a part of the regular text.

Although the inclusion of alternating-current circuits is not too unusual in electricity and magnetism books, Kip's chapter is exceptionally well done. There are sections on complex-number concepts, generators and motors, which may be omitted if desired.

The book includes two other features less frequently found in books at this level—a first course in electricity and magnetism. One is on electric and magnetic quantum effects and the other on vacuum tubes and semiconductor devices. Both chapters are "starred," meaning they may be omitted.

The rest of the material is usually found in other books at this level. This book appears to cover the material well, has good illustrations and has enough detailed examples to give the student an insight into the solution and handling of electricity and magnetism problems.

I am sure this is a good teaching book with certain touches, for example, the explanation of the galvanometer principles, that should make it of special interest and use to the student who wants a little more for his time and effort.

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Lecons sur la Theorie des Groupes et les Symétries Des Particules Elementaires

By H. Bacry
449 pp. Gordon & Breach, Paris, 1967. Paper 91.50 F, cloth 109 F

Group Theory and Its Applications

Ernest M. Loebl, ed.
696 pp. Academic Press, New York, 1968. $19.50

Because group theory is a natural framework for the study of symmetries, theoretical physicists have always been interested in this branch of mathematics to fulfill their cherished desire to discover and understand symmetries in our natural systems.

This interest, however, remained only in permutation groups or some compact groups like the three-dimensional rotation group. The age of relativity brought with it serious study of the noncompact Lorentz group and simple generalizations, like the de Sitter group. A recent boost in this interest is perhaps a result of the discovery of SU(3) as a possible broken higher symmetry group for the elementary constituents of matter.

This has resulted in attempts by the theoretical physicists to rewrite the great work done by the mathematicians on the theory of compact and noncompact continuous groups (Lie groups) and to communicate it to their colleagues in a language they can comprehend. They have also been able to contribute a great deal to this far-from-complete, although ever expanding, storehouse of knowledge.

These two excellent books are written to bring this expanding knowledge to its potential users. The appeal of the two books is, however, to somewhat different audiences. Henri Bacry's book is intended mainly for graduate students, but the contributions in the book edited by Ernest M. Loebl aim very much beyond and are meant for serious researchers and those who would like to acquaint themselves with the contribution that group theory is making in branches of theoretical physics.

Bacry's book, which is unfortunately in French, resulted from a series of lectures delivered at l'Université de Marseille (1962–63 and 1965–66) and l'Istituto di Fisica dell'Università di Bologna (spring 1965). Its aim is to bring students studying symmetries to the threshold of group theory without involving them in complicated proofs. The mathematical jargon is not avoided, so that the student will be able to face the literature later. The book is full of many nice problems containing useful results. Leaving them to the students to answer has also helped a great deal in keeping the book to a handy size. The book concludes with two chapters on elementary particles oriented towards a brief description of their internal and external symmetries.

Group Theory and its Applications contains contributions from authors who are masters of the application of group-theory techniques to a wide range of theoretical physics. I believe that this book will prove very useful in widening the scope and outlook of many of its users.

It can be considered to have a virtual division into three parts. The first part consists of well written mathematical articles, including a particularly interesting one on induced representations by A. J. Coleman. The technique of inducing representations for finite groups from representations of their subgroups was known quite early to the mathematicians. Their techniques have only recently been

extended to noncompact groups following the now classical work of Eugene P. Wigner (incidentally, the book contains contributions from this great master). Coleman's article carefully elucidates the present knowledge on this subject.

The second part contains applications of group theory to such "classical" subjects as atomic spectroscopy (by J. R. Judd), solid-state physics (by Stig Flodmark), nuclear structure (by P. Kramer and M. Moshinsky) and to the "modern" subject of SU(3) symmetry of elementary particles by L. O'Raifeartaigh and R. G. Behrends.

The last part, consisting of an article on "De Sitter Space and Positive Energy" by J. O. Phillips and Eugene P. Wigner, is an attempt to elucidate the physical interpretation of the de Sitter group and in particular to understand how the energy's positive nature can be incorporated in this interpretation.

In praising this book I would like to mention specifically an attempt at using uniform notation. This is very essential in any effort to create interest in other fields. In fact, the very reason that books on group theory by theoretical physicists are bound to be much more popular among followers of this discipline is that the language used by mathematicians is not so readily and widely understood. These two books go a long way in bridging such gaps.

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The Collected Works of Count Rumford, Vol. 1: The Nature of Heat

Sanborn C. Brown, *ed.*
507 pp. Harvard U. P., Cambridge, Mass., 1968. $10.00

This is the first volume of a new five-volume edition of the technical papers of Benjamin Thompson (1753–1814), later Count Rumford. It was published under the auspices of the American Academy of Arts and Sciences and paid for in part by Rumford's own legacy to that organization. The work is edited by Sanborn C. Brown, professer at MIT and a life-long student of Rumford's activities.

It is a major improvement over the edition published nearly a century ago, as the new edition reproduces the original papers almost exactly as written with only a minimum of editorial changes made in the interest of clarity. Volume one of the set, titled *The Nature of Heat*, will be of greatest interest to physicists, as it deals with Rumford's basic studies on that subject. The additional four volumes are concerned principally with technical applications, especially those made while Rumford was employed by the Elector of Bavaria as his chief advisor on military applications of science, housing, and what would now be termed "inner-city problems."

Benjamin Thompson had spent his early years in intrigue as a Tory spy against the American colonies in Massachusetts and then in London as personal adviser to Lord George Germain, helping him to suppress the independence movement in the British–North-American colonies. Throughout his highly romantic life, Rumford was a very successful opportunist and, on the personal side, an aggressive and unattractive character.

When he returned from Bavaria to England with his title of Count of the Holy Roman Empire, he was not again accepted by the British sovereign and so was forced to return to scientific pursuits. He was the leading influence in the founding and development of the Royal Institution in London, and was responsible for the employment there of Thomas Young and Humphrey Davy. However, he felt snubbed in London and so transferred his activities to Paris for his final years of political and social climbing. These years were also unsuccessful for although he gained the salons of Paris society by marrying the widow of Lavoisier, he never won Napolean's confidence. Probably as a result of his disappointments in London and Paris, he left his principal legacy to the American Academy of Arts and Sciences in Boston.

The papers recorded in this book were first published during 1798–1805 and report work done in Munich, London and Paris. They expound pioneer contributions to our understanding of the science of heat. A person who could produce work of this caliber amid all his political, military, and social intrigues must have been near to genius. His experiments and their interpretation, on the nature of heat as a mode of motion, its generation by friction, its propagation in

AN EARLY HEAT EXPERIMENT. With this apparatus, Rumford found that an undisturbed vessel of water remains liquid at the bottom when surrounded by a freezing mixture and frozen at the top.

solids and liquids, thermal expansion and radiation, are all illustrated with direct and crucial quantitative experiments made with great skill and constitute an impressive achievement.

Although this edition is most welcome, many physicists will find the 1967 Pergamon Press paperback of selected readings from the works of Rumford (also edited by Brown) to be more useful for their personal libraries. The earlier book is not only considerably more reasonable in price, but also in many ways more attractive for the general reader, not least because Brown's own commentaries on some of Rumford's work are included. However, this new book is an important addition to physics literature, although the subsequent volumes will be of special value not only for their scientific content, but also for the early technical applications of heat that they reveal. These books should have general appeal, although it is probable that interest in Count Rumford diminishes rapidly with the reader's distance from Massachusetts Bay.

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The Game of Science

By Garvin McCain, Erwin Segal
171 pp. Brooks-Cole, Belmont, Calif. 1969.

In the preface Garvin McCain and Erwin M. Segal hope their book will ". . . lead the reader to a broader per-