fluence the outcome of negotiations, whether those negotiations are between representatives of sovereign states or between representatives of less august entities.

Common sense tells us that agreement depends on package in which there is something appealing to both sides; it also tells us that the side that "plays it cool" may extract some last-minute short-run advantage. What common sense does not tell us is whether to propose the package early or late, or to propose it by stages; nor does it tell us how to calculate the hidden costs of success in last-minute demands. It is at this level that the theorist searches for discriminating explanations and the practitioner for precepts. A more detailed investigation on a narrower front will be required to satisfy either.

Iklé's "rules of accommodation" (chapter 7) similarly invite further research to demonstrate when they have or have not been observed, and are or are not likely to be observed. Beyond that, if the objective is to promote more rational negotiating behavior, we need to know what are the benefits and what the penalties that flow from conformity to these rules of accommodation, and whether there are particular circumstances in which conformity is especially profitable or unprofitable.

Only on the last page of his excellent "bibliographic note" (pp. 256–264) does the author comment on the parallels and contrasts between labor-management bargaining and interstate negotiating. Had he pushed his analysis further at this point, Iklé might have wanted to deal explicitly with the question of which characteristics of diplomatic negotiations are inherent in any bargaining process, which are peculiar to bargaining among sovereign states, and finally, which are novel features of interstate bargaining in our time.

Obviously more can be done to codify the styles of negotiating behavior of different countries. How often, for example, does a particular opponent invent some new issue for trade-off purposes, once public expectations of a détente have been aroused? How regularly does he withhold significant concessions until one begins to pack one's bags? On these questions, too, the impressions of astute participant-observers, valuable as they are, need to be supplemented by systematic investigation.

During the period in which *How Nations Negotiate* germinated, Iklé was associated with three of the leading American groups concerned with research on international relations—at the RAND Corporation; at Harvard's Center for International Affairs, under whose auspices the book was written; and at Massachusetts Institute of Technology, where he is now a professor. All three groups must have been greatly invigorated by this fresh attack on a neglected field of inquiry.

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Exploration and Exploitation

Islands in Space: The Challenge of the Planetoids. Dandridge M. Cole and Donald W. Cox. Chilton, Philadelphia, 1964. xii + 276 pp. Illus. $6.95.

This is an irritating book. It is irritating because of the use of the word *planetoid*, the least widely used of all the terms invented to name the objects that have orbits between Mars and Jupiter. It is irritating because of the unnecessary and gratuitous attack made on astronomers in general because some astronomers have outspoken opinions about the present goals of our national space program with which the authors disagree. The "journalese" science, the florid rhetoric, and the exhortations with which the book is filled are irritating. It is irritating to read the suggestion that an implausible hypothesis (Shklovsky's idea that the inner satellite of Mars is artificial) that has not been proved needs to be disproved.

Apart from the irritations that I have mentioned, there is quite a bit of interesting material in the book. The historical material, particularly in chapters 2 and 5, seems to be correct for the most part. However, a statement (p. 39) implies that the minor planet program carried on under my direction at Indiana University terminated in 1954, but that program is in fact still going on, undiminished, at the present time.

The more controversial parts of the book, such as the discussion of capturing and mining minor planets, are given far too many pages and printed words, with the result that a potentially interesting subject becomes dull. The unnecessarily large number of quotations and footnotes seems to be an attempt to make the book appear scholarly, and this is a mistake. This criticism does not apply, however, to the quotations given at the beginning of the different chapters. In particular, one would like to know the time, the place, and the circumstances that led Lyndon B. Johnson to make the very interesting statement quoted on page 122:

> Someday, we will be able to bring an asteroid containing billions of dollars worth of critically needed metals close to earth to provide a vast source of mineral wealth for our factories.

Appendix B (pp. 179 to 239) gives the orbital elements and photometric constants for minor planets with permanent numbers 1 through 1650. There is a useful bibliography (pp. 251 to 267).

In summary, this could have been a much better book. It is not uninteresting, but it could have been much more interesting. If the authors had had a little less missionary zeal and a greater desire to inform their readers, this book would have been half the size (and half the cost) and ten times more interesting.

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Diffusion Phenomena

Atomic Migration in Crystals. L. A. Girifalco. Blaisdell (Ginn), New York, 1964. xii + 162 pp. Illus. $3.75.

The diffusion of atoms through solids is of scientific and of technological interest. The scientist studies the phenomenon to learn more about imperfections in solids (such as vacancies, interstitial atoms, dislocations, and surfaces) and more about how they interact with one another and with impurity atoms. Moreover, diffusion processes are basic to the understanding of many other properties of solids, such as plasticity and radiation damage. The technologist uses solid-state diffusion in fabricating semiconductor devices, in preparing precipitation-hardened alloys, and in dealing with the problem of tarnishing and corrosion. The appearance, then, of a book that presents the fundamental notions of diffusion in crystals, and is addressed to readers who

are not experts in the field, is quite welcome.

This little book is aimed at the "nonspecialist and intelligent layman." It emphasizes the qualitative crystallographic origins of the phenomena, with only an occasional, and always very simple (with the exception of the last appendix) mathematical discussion. The author is more concerned with making the reader *feel* why a given fact is so than with giving a rigorous proof or analytical description. Thus the text, which is generally clear and is written in a pleasant and sometimes even lively style, often resembles that of the more technical articles in *The Scientific American* with just a pinch of mathematics sprinkled in. In addition, the reader is given glimpses of a wide variety of solid-state phenomena and concepts, as these are gradually introduced to provide the necessary background.

The first two-thirds of the book is approximately evenly divided between four topics: crystals, basic diffusion concepts, diffusion in metals, and diffusion in ionic crystals. The remaining third is devoted to shorter discussions of diffusion in covalent crystals, grain boundaries, temperature gradients, effects of pressure and electron drift, and several brief mathematical appendices. For the most part I think the author has reached his goal of making diffusion phenomena seem real, ordered, and reasonable to the nonspecialist reader. One distressing defect of the book, however, is that the quality of the figures does not match that of the text. Several of the diagrams seem to have been carelessly produced; several more are confusing; and a few contain significant errors. It is to be hoped that this blemish in an otherwise attractive book will be corrected in a second printing.

It might be of value to compare this work with another thin and recent book on the same topic, Shewmon's *Diffusion in Solids* (McGraw-Hill, New York, 1963). Shewmon's text presumes a background knowledge of the physics of solids, is somewhat more technical, and specializes a bit more on metals. Thus, the two books are written for different readers and have different aims; therefore I am (fortunately) spared the task of making a difficult choice between two well-done volumes.

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Elementary Particles

Elementary Particle Physics. Gunnar Källén. Addison-Wesley, Reading, Mass., 1964. xiv + 546 pp. Illus. $15.

Gunnar Källén tells us in the foreword that his book is based on a course given at Lund for students with a theoretical background. But the text leaps along at a lively pace with prodigal use of connective phrases such as "it is easily verified that . . ."; "we leave the working out of details to the reader . . ."; "it is a straight forward task to verify . . ."; "as is well known . . ."; "the integration can be performed by straight forward methods and . . ."; "we do not insist on the algebraic details here but leave them as an exercise for the reader . . ."; and similar expressions, without reference to sources where the missing material may be found. Therefore, if you want to use this book as one of the major texts in a graduate course on elementary particles, you will have to expend considerable effort to fill the gaps.

Actually, although few people will want to teach directly from this book, it is going to be a very useful one for the experimentalist working on the frontiers of elementary particle problems to keep at hand. For example, there is a lengthy treatment of dispersion relations and a (sketchy) comparison with experimental details, and there is a chapter on meson photoproduction with an excellent comparison of theory with experiment, containing a fair-minded statement on the uncertainty of identification of the quantum numbers of the higher resonances. Moreover, the chapter on pion production in pion-nucleon collision has an extremely valuable derivation of the cross section for one pion exchange and an extensive comparison with experiment. Multiple pion resonances, strange particle resonances, and associated phenomenological theoretical treatments (for example, Dalitz diagrams, methods of spin determinations, and expressions for phase space) are very usefully discussed. There is an entire chapter on nucleon form factors, concluding with a brief discussion of possible relation to multipionic resonances.

There is a nice treatment of space reflection and of charge conjugation, but unless you already know how, you will have to work out G parity for yourself. The subject of time reflection is similarly briefly treated. The optical theorem is mentioned only in a brief paragraph, and, in fact, diffraction theory is omitted. On the other hand, about one third of the book treats weak interactions with great detail—for example, beta decay selection rules, energy spectrum angular correlations, conserved vector current, decay probabilities, and the $\Delta T = \frac{1}{2}$ and $\Delta Q = \Delta S$ rules. Sufficient reference is given to the experimental literature so that the reader can nearly always go on into the subject.

Group theoretic treatment of elementary particles is not discussed in this book, nor is nucleon-nucleon and hyperon-nucleon scattering.

This is a book with limits and strengths that strongly reflect its author's personal tastes and disciplines. I am glad to have it on my shelf.

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Mathematics

Integral Equations. And their applications to certain problems in mechanics, mathematical physics, and technology. S. G. Mikhlin. Translated from the Russian edition (Moscow, 1959) by A. H. Armstrong. Pergamon, London; Macmillan, New York, ed. 2, 1964. xiv + 341 pp. Illus. $12.50.

This is the second English edition of this work, which was originally published in Russian in 1944. Of course, revisions have been made, but the differences between the first translation (1957) and this volume seem to be relatively minor.

The book is divided into two parts. The first, and smaller, is devoted mostly to the Fredholm theory and states the most important theorems. The author furthermore outlines the various methods of proving existence and uniqueness, which methods are later used as practical means for getting approximate answers to physical problems.

The second part covers several different types of integral equations that serve as mathematical models of some physical problems. Most of the equations can be reduced to the Dirichlet type, however, and a goodly number are symmetric (self adjoint) equations.