flow (page 125), because of outgassing effects. I doubt, too, that in practice mechanical-pump manufacturers can maintain 2-to-3-micron tolerances (pages 204 and 383). Although the references end in 1974, some subjects are not brought up to date—for example, the equipment descriptions for molecular pumps and diffusion pumps—while space is allocated to obsolete equipment such as evapor-ion pumps.

There are other minor faults: One is that references are unnumbered and not referred to chapters; thus, it is impossible to crosscheck from the alphabetical index back to the text.

Generally, the style is clear, the figures well made and chapters well organized. However, the book could profit from careful editing—it deserves it. (For example, on page 221 Roth informs us that pumps are made in sizes from two to 40 inches, but on page 227 a 48-inch pump is described.)

Roth's book has been advertised in relevant journals and through related engineering societies. It certainly deserves the exposure.

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Quantum Collision Theory

J. C. Joachain
710 pp. American Elsevier, New York, 1975. $89.95

The inevitable first questions about this book are: Is it necessary? and Is it worth the price?

The main competitors of this book are Marvin L. Goldberger and Kenneth M. Watson's *Collision Theory* (919 pp. Wiley, New York, 1964. $37.50), Roger G. Newton's *Scattering Theory of Waves and Particles* (681 pp. McGraw-Hill, New York, 1966. $26.00), C. S. Wu and Ohmura's *Quantum Theory of Scattering* (495 pp. 1962. $16.95) and Leonard S. Rodberg and Roy M. Thaler's *Introduction to the Quantum Theory of Scattering* (398 pp. Academic, New York, 1967. $18.00). Rodberg and Thaler's book covers only the basic essentials, so probably it should not be compared to the others. Wu and Ohmura's book is slightly more complete, but does not match the remaining books in completeness.

Of these remaining three, Joachain's is certainly the most complete. For example, Joachain and Newton both discuss the Fadeev equations extensively, whereas Goldberger and Watson do not; in fact, Joachain has a 63-page chapter on three-body problems. Joachain has a good 15-page treatment of dispersion relations while Newton spends about six pages on the subject, but Goldberger and Watson's book has an excellent chapter of over 100 pages on the subject. The most complete discussion of the Mandelstam double-dispersion relation is in Newton's book. Again, Joachain has a good 19-page discussion of complex angular momentum and Newton has a 15-page chapter, but Goldberger and Watson's book does not mention the subject. There are several other subjects where Joachain shares a good treatment with either Newton or Goldberger and Watson, but not both. However, if you combine Newton's and Goldberger and Watson's volumes, you have a 1600-page book that covers almost everything in Joachain's book, plus a lot of extra electromagnetic-scattering material in Newton's book—all for $26.45 *less* than the outrageous price of Joachain's book.

This brings us to the second question. Despite the fact that the first paragraph of the preface states "It is primarily aimed at graduate students . . .", my publishing and library friends tell me that the publisher is counting almost solely on the "captive" library buyers who have blanket orders with all major book companies. I cannot imagine a graduate student, or even a professor, buying this book at the listed price. Finally, on the subject of price, after being given a $90 book I find it hard to write the above seemingly ungrateful comments.

Joachain's book deals mainly with nonrelativistic potential scattering, but it includes relativistic topics at appropriate points. Occasionally the reading gets tedious as the author belabors the fine points of topics that are his speciality. The book is divided into four parts: Description of Collision Processes, Potential Scattering, General Scattering Theory, and Applications. The first part is followed by twenty problems for students, and the second part is followed by sixty problems, but there are no problems for parts three and four.

Joachain is certainly well qualified to write a treatise on scattering theory. As the numerous references in each chapter indicate, he has many papers on the subject and has written many other papers jointly with several of the major contributors to the subject. His work ranges from esoteric theoretical development to the comparison of numerical calculations with atomic-scattering experiments.

The book is, in technical publishing terms, of the highest quality. I found not more than ten errors of any type in reading it. A publishing device that I found to be very convenient is the inclusion at the bottom of each odd-numbered page the statement "References and notes on page—." This enables one to find references for a particular chapter easily, both while reading that chapter and while reading later chapters—the latter being facilitated by the references' presence at the end of the chapter.

This is an excellent book, but I feel that the combination of Newton's, Goldberger and Watson's books is a better buy.

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Quantum States of Atoms, Molecules and Solids

M. A. Morrison, T. L. Estle, N. F. Lane
575 pp. Prentice-Hall, Englewood Cliffs, N.J., 1976. $25.50

The subjects of atomic, molecular and solid-state physics have only rarely been treated at an advanced level in a single volume. The notable exception, of course, is John C. Slater's *Quantum Theory of Matter*. In the present book the three authors, Michael Morrison, Thomas Estle and Neal Lane, stress the unity among these fields by emphasizing the concept of electronic quantum states in atoms, diatomic molecules and crystalline solids. Such a combination should be of basic interest to students in a variety of scientific fields and also forms the basis for more advanced work in those three subjects themselves. This is a textbook of applied quantum mechanics directed to advanced undergraduate and graduate students in physics, chemistry and engineering; the authors assume a previous introduction to quantum mechanics.

After a review of basic quantum mechanics, the first part contains the solution to the one-electron atom, two chapters on approximation methods, two on spin and three on multi-electron atoms. In Part 2 the authors treat the diatomic molecule, first through the use of an exactly soluble one-dimensional model and then by approximation methods applied to a three-dimensional model. The emphasis is heavily on electronic states; vibrational and rotational motion are treated only very briefly at the end of the section.

In the third part, after a preliminary discussion of crystals, lattices and Brillouin zones, we get into a perturbation treatment of a one-dimensional model using the free-electron and the weak-binding approximations. Step by step, the authors then take us through two dimensions and finally to three, where concepts such as energy bands and the Fermi surface are introduced. As in Part 2, the principal focus is on electronic states, but a final chapter on vibrations in solids helps to round out the picture. The five short appendices include a welcome one on atomic units.

This carefully thought out and well written book should provide the student with a well paced introduction to each of the areas under consideration, at a somewhat lower level than Slater's book.