a change of pace, the paper by Anderson, Andres and Fenn of Princeton University gives a welcome detailed discussion of the problems and promises (so far, alas, not yet fulfilled) of supersonic nozzle beams. Finally, for dessert, we have the thorough and critical review of D. Herschbach of Harvard on reactive scattering in molecular beams, including methods, results and interpretations with a useful table of chemical reactions studied so far in molecular beams and many references to the literature.

The reviewer recommends this volume most highly to his brethren in the chemical physics fraternity, as a valuable and thorough review of molecular beams and molecular scattering. It is also recommended to the physics tong (atomic and nuclear scattering subdivision) to show them that us chemists are finally catching up.

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The reviewer, who is a Senior Research Fellow at the National Bureau of Standards, has for years acted as a self-appointed missionary preaching the gospel of molecular beams in the study of chemical kinetics.

Thermodynamical instruction

METHODS OF THERMODYNAMICS. By Howard Reiss. 217 pp. Blaisdell, New York, 1965. $8.50.

PRINCIPLES OF GENERAL THERMODYNAMICS. By George N. Hatsopoulos and Joseph H. Keenan. 788 pp. Wiley, New York, 1965. $15.00.

by Stuart A. Rice

Despite the enormous number of textbooks dealing with thermodynamics, new books continuously come onto the market. In this process many very ordinary books are published, and only rarely does an outstanding work appear. It is my opinion that *Methods of Thermodynamics* by Howard Reiss is one of these outstanding contributions. The author has managed to treat the fundamental theorems of thermodynamics with a precision and vigor that is remarkable for its clarity and ease of comprehension. While there has been no compromise with accuracy, the text can be easily read by an undergraduate student. In this sense I disagree with the publisher's blurb, namely, I believe this book should be the primary text in a first course and not merely an auxiliary text for first year graduate students.

The subject matter of the book is conventional: The laws of thermodynamics, thermodynamic potentials, phase equilibria, surface phenomena and elastic phenomena, systems in gravitational and centrifugal fields, and stability theory. What is perhaps the finest feature of the text is the transparent manner in which the fundamentals are exposed and the careful attention paid to the avoidance of conceptual errors (for example, the treatment of virtual variations, of constraints, of the nature of the entropy function). I intend to recommend Reiss' book to all of my students and sincerely hope that it will be very widely used in the teaching of elementary thermodynamics.

Principles of General Thermodynamics by Hatsopoulos and Keenan is also a valuable contribution to the literature, but in a very different sense. This massive text attempts a rigorous formulation of thermodynamics using very careful definitions and with much greater than usual emphasis on the nature of work processes, the meaning of stable states, etc. The treatment is very extensive (there are 52 chapters) and includes discussions of flow phenomena, some statistical mechanics, some relativistic thermodynamics, and many other topics. There are two large subdivisions: Elementary Thermodynamics (chapters 1-30) and General Thermodynamics (chapters 31-52), with a division of material roughly in accord with the titles given. Since many of the arguments and definitions used are new, I cannot claim to have completely digested and appreciated all the material in the text. There are, of course, very strong links between the formulation given and the classical representations of thermodynamic theory, but there are also a number of significant differences in emphasis. In this sense the Hatsopoulos-Keenan monograph differs from that of Reiss. Whereas the great strength of the Reiss text is in the precise treatment of the conventional formalism of thermodynamics, the major virtue of the book by Hatsopoulos and Keenan is in the careful consideration of alternative and generalized fundamental concepts (for example, a different definition of heat) thereby demonstrating that despite its age, thermodynamics still serves as a stimulus to creative thinking.

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Partial differential equations

DIFFERENTIAL EQUATIONS OF APPLIED MATHEMATICS. By G. F. D. Duff and D. Naylor. 423 pp. Wiley, New York, 1966. $11.95

by George Weiss

Books on partial differential equations appear to be divided into two groups. The first includes recipe manuals which give the solution to a certain number of problems but allow little insight into the general theory. The second category includes books heavily loaded with classificatory properties of partial differential equations and existence proofs with few applications to provide any physical motivation. Neither type of book really suffices as an introduction to the subject for a beginning course in mathematical physics. It is a pleasure to report a text which comes close to being ideal from the pedagogic point of view, avoiding the recipe approach yet not slipping into unmotivated abstract complexities.

Considerable attention in this book is given to the three principal equations of mathematical physics—the heat and wave equations, and Laplace's equation. Nevertheless, the treatment of these special cases is given in enough generality so that extension to other problems should not be difficult. Liberal use is made of the delta function, introduced by the authors in a careful mathematical manner which does not obscure any of the techniques in its application. Worthy of particular mention is the chapter on spherical eigenfunctions which has the clearest exposition of the subject that I have seen, and the chapter on wave propagation in space which contains a good discussion of

Huyghen's Principle (curiously called Huyghen's Premise). There is a short section on finite difference schemes for numerical solutions of partial differential equations. If there is any criticism to be made of this book, it is that more could have been done with that important topic. The treatment of Green's functions is exemplary, as is the chapter on the general theory of eigenvalues and eigenfunctions problems. All told, this book can be unreservedly recommended as an introduction to partial differential equations.

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Nuclear excited states

ANGULAR CORRELATION METHODS IN GAMMA-RAY SPECTROSCOPY. By A. J. Ferguson. 214 pp. (North-Holland, Amsterdam) Wiley, New York, 1965. $8.50.

by G. K. Wertheim

Our knowledge of nuclear excited states is derived from the observation of radiation resulting from the transition between nuclear levels. The fundamental attributes of a nuclear state—its energy, spin, and parity—are obtainable from measurements some of which require considerable experimental sophistication. To interpret these measurements, it is necessary to apply a theory which, while simple in concept, presents computational complexities.

In his book A. J. Ferguson gives a concise summary of the pertinent theory, treating first the general case of successive nuclear radiation and then specific cases such as particle-gamma reactions, gamma-gamma angular correlations, and Coulomb excitation. A particularly valuable feature of the book is his treatment of the whole field of angular correlations according to a consistent set of conventions. Early in the volume he discusses the problem of the relative phases of reduced matrix elements and explains his choice of sign. He also chooses to use emission matrix elements for all gamma transitions. These conventions run counter to those of the standard reference in the field of angular correlations—Biedenharn and Rose's 1953 article. His reasons for this controversial choice (as well as a rebuttal by Biedenharn and Rose) are included in the text.

The rest of the volume includes chapters on apparatus and numerical methods as well as on the coefficients and functions used in angular correlation analysis. The final part contains tables of Z, G_γ, and α coefficients which permit the evaluation of angular correlation functions up to spin 6 for dipole and quadrupole radiations. Tabulations of the more fundamental Clebsch.-Gordon, Racah, and 9-j coefficients are not given but, as the author points out, these are readily available elsewhere. In any case, since data analysis is usually carried out by computers which can rapidly calculate the needed coefficients, such tables are no longer essential.

It is perhaps worth noting that the author's point of view is that of a nuclear physicist. That angular correlations may be perturbed is mentioned but excluded from further discussions. As a result, such topics as time-dependent correlations (currently gaining importance in solid state physics) and the attenuation of the correlation by fluctuating fields are not mentioned.

The level of treatment is such that anyone familiar with the quantum theory of angular momentum should have no difficulty in working through the book. It should prove useful to anyone who plans to enter the field of angular correlations.

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Measuring plasmas

PLASMA DIAGNOSTIC TECHNIQUES. Richard H. Huddlestone and Stanley L. Leonard, eds. 627 pp. Academic Press, New York, 1965. $19.50

by Harold P. Furth

In his introduction, Richard Huddlestone makes an interesting point about the recent development of plasma physics. As a mere "application" of classical mechanics and electromagnetic theory, plasma physics might