functional dependence may be determined by the addition of general postulates such as relativistic invariance and conservation of probability. The most powerful additional hypothesis seems to be one about the singularities of the S-matrix elements considered as analytic functions of their variables, which is suggested by the examination of certain models. When supplemented by the Regge pole description of scattering processes at high energies, these assumptions lead, at the least, to relations between S-matrix elements which can be tested against experiment and may furnish the basis of a complete dynamical theory.

The purpose of this book is to give a development of these topics in the detail suitable for the graduate student intending to do theoretical research in the field. A particular feature is the treatment of the kinematics of the one, two, or more, free particle states in terms of which the S-matrix elements are defined. Because the concepts of quantum field theory do not enter into the scheme outlined earlier, the description of free relativistic particles using field equations has been omitted in favour of an equivalent one, which is based on the notion that a complete set of states for a free elementary particle should form the basis for an irreducible representation of the inhomogeneous Lorentz group. The necessary group representation theory is developed without assuming previous knowledge of the subject in the first half of the book, although, occasionally, objects such as the tensor product symbol have slipped in without a precise definition. Isospin and the discrete symmetries P, C, and T are discussed and applied, but not SU(3).

In the second half of the book, the analytic properties of two particle scattering amplitudes and partial wave amplitudes are discussed. Building on the material of the first half, a detailed treatment of the analyticity and crossing properties of helicity amplitudes for arbitrary spin is given, following the approach of Trueman. An excellent final chapter on Regge poles motivates their introduction and brings the reader to within sight of recent activity on the Veneziano representation and its generalizations. The absence of any field theory means assumptions about analyticity, crossing symmetry and kinematic singularities are not motivated by an examination of Feynman graphs. The beginner must look elsewhere for these.

Sets of useful exercises with hints for their solution are provided at the end of each chapter. Students who master this material will be well equipped to undertake research in this field. The presentation in a uniform notation of the topics covered should also make the book a convenient reference for practising theorists. B. R. POLLARD

REACTOR KINETICS

Space-time Nuclear Reactor Kinetics

By Weston M. Stacey, jun. (Nuclear Science and Technology: a Series of Monographs and Textbooks, Vol. 5.) Pp. vii+186. (Academic Press: New York and London, December 1969.) 121*s*.

DURING recent years there has been a considerable amount of technical literature on the subject of spatial reactor kinetics, due largely to the inability of the older point kinetic models to describe the transient behaviour of large power reactors, where spatial effects are of considerable importance. This book provides a useful text that bridges the gaps between the older point kinetic models and the more modern spatial approaches.

The reader is expected to have had a basic grounding in reactor kinetics and physics. A basic knowledge of matrix arrays would be an advantage.

The text begins with the now familiar time dependent group diffusion equations and deals with the spatial finite difference approximations. Modal expansion approximations utilizing matrix methods are evaluated, proceeding through natural modes, Green's function and synthesis modes. Nodal approximations are then considered in detail. The various methods are compared and their respective advantages and disadvantages are discussed for particular applications.

Numerical integration methods are covered in some detail; these will provide the reader with a good foundation to build on, because many subsequent variations lie in the hands of the user. A good discussion is given of stability truncation errors and computation time.

Variational synthesis methods are introduced to allow the general space-kinetics problem to be approached systematically. This leads to multichannel space-time synthesis which makes more efficient use of a given set of expansion functions, a good example being given to illustrate this technique.

Up to this point the book deals with computational methods for solving the spatially dependent kinetic equations and provides the reader with a good broad introduction. The neutron process is stochastic in nature and chapter 4 covers the use of a forward stochastic model which leads to the use of correlation functions. A theory for backwards stochastic model is given and the Langevin technique is discussed in some detail. This chapter is mathematical, and some knowledge of stochastic functions would assist the reader.

There is a good study of xenon spatial oscillations using linear and non-linear techniques. Control induced xenon spatial oscillations are introduced and their control is illustrated. The last two chapters serve to present a basic theory with which to treat the stability and control of spatial reactor models.

To summarize, the book gives an excellent, though mathematical, approach to the subject of space and time dependent reactor kinetics. It contains numerous useful references which will enable the reader to probe more deeply into the subject and, in general, it fulfils its object of bridging the gap between new and old texts.

ALAN JEBB

KINETIC THEORY OF GASES

The Mathematical Theory of Non-Uniform Gases

An Account of the Kinetic Theory of Viscosity, Thermal Conduction and Diffusion in Gases. By Sydney Chapman and T. G. Cowling. Third edition prepared with the co-operation of D. Burnett. Pp. xxiv+423. (Cambridge University Press: London, May 1970.) 100*s*; $16.

THE first edition of this book appeared in 1939 and immediately established itself as an authoritative work on the kinetic theory of gases. This is the third edition of the book in which the already concise and elegant presentation of the equations and text has been improved by printing in a modern format and adopting a new layout of the text. The work has been the basis for the development of the subject matter since the initial publication of the book. The authors, renowned for their contributions in their respective fields, have been aided by Professor D. Burnett in incorporating the most recent developments in the theory.

The chapter dealing with molecular models with internal energy has been completely rewritten to take into account recent advances. The theory of multiple gas mixtures is dealt with for the first time and warrants a chapter of its own. The discussion of the electromagnetic phenomena of gases has been greatly extended to include major contributions that have taken place in this rapidly changing field since 1952, and includes the Fokker-Planck approach to the Boltzmann equation and the subject of collisionless plasmas. The authors have deemed it necessary to omit some of the subject matter that was in the previous edition, but nothing of substance has been left out.