

with and without excitation states, between electrodes which are combinations of semiconductors, metals and superconductors. The achievements of both theory and experiment are critically examined, but the author's own interest has led to a greater emphasis on theory and rather less understanding is shown towards experiments. For example, he says that all systems claimed to be tunnelling should be proved to be so by the observation of the gap characteristic if one of the electrodes becomes superconducting, whereas this, of course, only indicates tunnelling over a small fraction of the energy range that is of interest.

The book is divided into two. The first half is concerned with independent electron effects which are usually large and can be understood quite well with relatively simple theory. The theory is presented first and then the measurements are critically compared with it. The second half deals with many body effects, and the author adopts the more cautious approach of describing the experiments and their interpretation before the detailed theory.

An admirable attempt has been made throughout the book to unify the diverse studies in tunnelling. The treatment and emphasis throughout are clearly personal, but this is the price of coherence. An honest effort has been made to present the arguments clearly and failures are emphasized as much as successes. I am sure people will find parts controversial, but on the whole it is, nevertheless, a very useful review. A. F. G. WYATT

## PHYSICS OF SCATTERING

### Scattering Theory

New Methods and Problems in Atomic, Nuclear and Particle Physics. Edited by A. O. Barut. Pp. viii + 431. (Gordon and Breach: New York and London, 1969.) n.p.

THIS book consists of a collection of articles presented by theoretical physicists well known in their respective fields on aspects of quantum scattering theory and its applications to atomic, nuclear and elementary particle physics. Because quantum scattering theory is the chief underlying theme in the description of the various processes in atomic, nuclear and particle physics, an exposition of certain of its basic ideas and their relevance and use in these branches of physics could hopefully serve to bring out the unifying features of these different physical processes. This, together with a hope that such an effort may lead to a cross-fertilization of ideas between atomic, nuclear and particle physicists, forms, as the editor points out in the introduction, the chief objectives of this book. Given the enormous growth in these branches of physics in the past decade or so and their ever continuing expansion at an even faster pace, any significant accomplishment of these objectives is, in my opinion, quite impossible within the confines of a modest sized volume. Even a small contribution towards these objectives is, however, a praiseworthy venture and I think that this book does indeed make such a contribution.

The book consists of five parts. Most of the first part consists of a lucid article by F. Calogero on the variable phase approach to potential scattering. There is also a useful section by A. Degasperis on the inverse problem—that of obtaining the potential from the experimental scattering data.

The second part, which has the slightly misleading title of "General Scattering Theory", consists of three topics in quantum scattering theory. The first, written by G. C. Ghirardi, deals with the evaluation of upper and lower bounds for the number of bound states of a physical system. An elementary knowledge of the spectral theory of linear operators in a Hilbert space should prove useful in acquiring a deeper understanding of this material. The second topic, presented by J. Werle,

is on relativistic polarization and angular correlation which is essentially a small portion of our up to date knowledge of the non-dynamical theory of relativistic particle reactions. Finally, the third topic, by L. Fonda, is on many-channel collision processes. Its relevance to the theory of nuclear reactions is obvious.

Parts three, four and five deal with the applications of scattering theory to atomic, nuclear and particle physics respectively. M. H. CHOUDHURY

## CRITICAL PATH CALCULATIONS

### The Critical Path Method

Application of the PERT Method and its Variants to Production and Study Programs. By A. Kaufman and G. Desbazeille. Pp. x + 167. (Gordon and Breach: New York and London, August 1969.) 195s.

THIS book should be entitled "Theory of the PERT Method and its Variants". It is an account of the mathematical theory of critical path calculations, starting from an assumed knowledge of set theory, and extending to methods of parametric linear programming in the optimization of cost functions. It is well printed and laid out, with a consistent scheme of chapter, paragraph, table and figure numbers. As a result, it is possible to treat with amusement the occasionally quaint wording resulting from its translation from the French. But care is needed in following the terminology, as, for example, "float" becomes "margin", and "precedence diagrams" are variously called "method of potentials" or "tasks and constraints". Although the authors do take care to define all their terms as they come to them, there is no glossary or index to facilitate subsequent reference to definitions.

According to the foreword, this book is aimed at engineers, organizers, entrepreneurs and all who are responsible for the elaboration and control of programs. The first half of the first sentence reads "Without stretching the theoretical aspects relative to the search for ordinal relations in a graph, this concept, as will be seen, being nothing else but a set of elements among which oriented relations exist . . .". If the reader survives the first chapter, which is a revision of the theory of graphs, he will find an impressive and well illustrated mathematical text, but one into which any really practical examples seem to have been introduced very grudgingly. The two mapping examples in section two are both borrowed from other authors, and Fig. 11.1, which is intended to explain the first of these, seems to be both irrelevant and inconsistent. The example in section thirty used to illustrate the Fulkerson algorithm is commended to the reader in the preface, where it is admitted that the algorithm itself is somewhat forbidding. But to work through the example requires the reader to have studied most of the rest of the book in any case.

For a dedicated operational research specialist who cares about the theory of critical path calculations, this book might well prove valuable. P. L. CLOOT

## POISONS INTRODUCED

### Essays in Toxicology

Vol. 1. Edited by Frank R. Blood. Pp. xi + 169. (Academic Press: New York and London, September 1969.) 70s.

THE increased use of chemical substances such as drugs, food additives, pesticides, fertilizers, and the like, and the fear of environmental pollution have stimulated the development of toxicology in its widest sense. Toxicology, the study of poisons, is today a multidisciplinary system of knowledge which acquires and interrelates information from many sciences including chemistry, physics, bio-