of stability and examines them in detail for certain important forms of the function $X(x,t)$ such as $Px + q$, where P is a matrix which is either constant or a function of t only, and q is a vector, depending on x and t, which is, in some sense or other, small compared with x. If P is a constant matrix, and q is ignored to get a first approximation, the set of equations is a linear set with constant coefficients, and we may hope that the solution of this simple set will indicate the dominant stability features of the more general set. Much of the content of this section stems from Liapunov's classical monograph on the general problem of stability (1892), but Lefschetz brings the development right up to date by collecting all the salient points from recent research work.

In the latter half of the book, the n-space is specialized to two dimensions. When X is independent of t the equations are said to be autonomous, and in Cartesian form are :

$$\mathrm{d}x/\mathrm{d}t = f(x,y), \quad \mathrm{d}y/\mathrm{d}t = g(x,y)$$

The trajectories, which in the autonomous case are called paths by Lefschetz, are studied in considerable detail and much geometrical information about them is obtained, for various special forms of f and g. Then second-order non-linear equations, including the famous van der Pol equation for triode oscillations, are discussed with emphasis on the phase-plane representations : they are reduced to a pair of first-order equations, which may be autonomous, or, as in the case of the Cartwright–Littlewood equation, may contain a function of t on the right-hand side. Finally, there is a chapter on oscillations in a quasi-harmonic system, differing from the simple harmonic equation by a small, variable, perturbation term : Poincaré's perturbation method, and the time-averaging method originated by van der Pol, are described.

Lefschetz's exposition is, as always, vivid and stimulating, and does not demand a great deal of specialized equipment ; although some previous acquaintance with matrix notation and the idea of a compact space is desirable, the book itself contains an excellent summary of what is wanted on these topics. In the main sections, the reader will find that he is expected to be quick in grasping new ideas, and should allow himself frequent pauses for assimilation. For the young research student wishing to begin work in this wide and important field, the volume will prove invaluable.

<div align="right">T. A. A. Broadbent</div>

STRUCTURE OF ATOMIC NUCLEI

Handbuch der Physik
Herausgegeben von S. Flügge. Band 39 : Bau der Atomkerne. Pp. vi + 566. (Berlin : Springer-Verlag, 1957.). 125 D.M.

THIS volume comprises chapters on the two-nucleon problem by Prof. Lamek Hulthén (Stockholm), and Prof. Masao Sugawara (Hokkaido) ; on the three-body problem in nuclear physics by Prof. Mario Verde (Torino) ; on the distribution of matter and charge within atomic nuclei by Dr. D. L. Hill (Los Alamos) ; on the nuclear shell-model by Dr. J. P. Elliott, and Dr. A. M. Lane (Harwell) ; and on models of nuclear structure by Prof. Steven A. Moszkowski (University of California, Los Angeles).

Profs. Hulthén and Sugawara's contribution, in Chapter 2, gives a complete and compact summary of the experimental data on the two-nucleon problem available up to 1956. The treatment of theoretical questions required for the interpretation of the experimental observations is based on static nuclear potentials as derived from the pseudoscalar field theory. The main merit of this review lies in the careful analysis of the observational data (mostly in the low-energy region) in terms of central forces and the effects achieved when a tensor force is introduced. Sections on high-energy scattering and photoeffect and a mathematical appendix (by Prof. Sugawara) conclude an exemplary piece of scientific reporting. Unfortunately, the recent observations of the polarization of p and n on scattering, of importance in resolving ambiguities in the phase-shift analysis, could not be included. The section on three-body problems and that on matter and charge distribution in nuclei complete what one could call the first part of this volume. Dr. Hill's article illustrates in detail how a single property, such as the finite size of the nucleus and its charge distribution, sometimes has observable effects on a great many atomic and nuclear properties.

The experimental physicist who works in a high-voltage laboratory with a cyclotron and studies the unstable elements will certainly find the second part of the volume dealing with nuclear models particularly welcome. The two articles by Elliott and Lane and by Moszkowski contain everything that the research physicist needs for analysing his data in terms of the mechanism which underlies his observation. It also seems that the review of the shell model is complete in so far as theory is concerned, so that all tools for shell model calculations are at the reader's disposal within its 170 pages ; to ease readability, much formal mathematics is placed in eleven appendixes. Dr. Moszkowski's survey of nuclear models offers a lucid and most readable exposé of a mainly non-mathematical character. The general approach is nevertheless that of a theoretician, who ably supports his statements with experimental data. The whole is excellently organized, preventing confusion which could easily arise when one looks at Table 1 with its list of sixteen models. I drew considerable courage from this diversity, since we are not likely to run out of problems during the next five years (though we may do so within ten years), unless Brueckner's theory provides a sudden solution.

Of the total 550 pages in this book, 240 are used for the first three contributions and 310 are devoted to nuclear models. All the contributions are written, in English, by theoretical physicists, 42 per cent of the volume being written by authors working in government laboratories in Britain or the United States, though the topics covered are only remotely connected with the immediate interests of these institutions. They reveal a very high standard of scholarship indeed.

This volume should be within easy reach of all workers engaged on research in the fields covered ; it would be so, were it not that the price confines it to libraries, where it will mostly be out on loan. The printing, illustrations and accuracy are of the highest order.

<div align="right">E. Bretscher</div>