The preface succinctly outlines aims and methods, and the first chapter is an excellent compact account of the chief acoustical properties of the ocean. Thereafter, mathematical description builds up step by step. Successive chapters treat basic theory; normal modes; shallow-water propagation; deep-water propagation; effects of irregularities; and measurements as problems in filter theory. A brief chapter of conclusions goes beyond a résumé by outlining the need for carefully planned combinations of theory, measurement and statistical analysis if much more progress is to be made.

The book can be highly recommended to neophytes, but also to experienced workers heretofore daunted by differing, widely scattered and often over-formal presentations. No one could make this subject easy, but the authors hold to essentials, develop them systematically, and discuss them in a physical context.

A. O. WILLIAMS, JUN.

DYNAMIC STARS

Dynamics of Stellar Systems

By K. F. Ogorodnikov. Translated from the Russian by J. B. Sykes. Translation edited by Arthur Beer. Pp. xii + 359 + 28 plates. (Oxford, London and New York: Pergamon Press, Ltd., 1965.) 100*s*. net.

TEN years after it was written this book can hardly read as a fully balanced account of the subject. In those years stellar dynamics has been re-enlivened by contacts with plasma physics, stellar element abundance work, celestial mechanics and ergodic theory, so it is no surprise to find little mention of those. The book's main emphasis, however, that stellar systems have settled to some form of detailed statistical quasi-equilibrium, is still well placed. No detailed theory of the relaxation process exists although it still seems likely that it is the large scale density fluctuations or star clouds that cause "irregular" gravitational fields and thus cause relaxation of stellar orbits. Even from the swarming workers on plasma physics no full theory of the relaxation of a collisionless medium has emerged. Recently computer experimenters and theorists have tackled this problem which lies at the basis of galactic dynamics. So far Ogorodnikov's assumption that the rotating self-gravitating Maxwellian distribution will be the outcome seems not too far from the truth; however, it appears that equipartition of kinetic energy will be replaced by an equality of the velocity dispersions of stars of different masses.

The book has other strong points. First, the emphasis that Schwarzschild's ellipsoidal hypothesis, though locally a good rough approximation, is actually false, so that theory based on its exact truth everywhere leads to nonsense. Second, there is the importance given to work on the third integral, a subject that has developed considerably since the book was written and which has even given rise to developments in celestial mechanics.

There are also weak points, however. The author has chosen to ignore work on evolution resulting from individual stellar encounters based on Chandrasekhar's dynamical friction. The Fokker–Planck equation and the difficult task of deriving the Fokker–Planck diffusion coefficients are hardly mentioned and the student is thus given few clues as to how to set up the mathematics necessary for a full discussion of the evolution of star clusters.

It is argued that apparent smoothness of the form of a galaxy must imply the presence of a dissipative visiosity. In fact such forms could be attained quite otherwise as a result of mere orbital propagation of the distribution function. These are perhaps matters of author's licence; the following error is not. In equations 4.44 and 4.45 approximate expressions for changes in velocity resulting from an encounter are compared and contrasted. Unfortunately in one ΔV is the change of relative velocity while in the other ΔV is the change of velocity of only one of the two interacting bodies. Had this been taken into account disagreement would have been avoided.

Physicists and astronomers who have not looked at graded exposures of galaxies should be warned against "theorem III" on page 306. "In any dynamically determinate galaxy the star density if sufficiently smooth is constant in a first approximation and . . ." In practice one of the outstanding characteristics of most galaxies is the density contrast as one proceeds outwards from the centre. This is so great that all the central regions are normally burnt out on exposures that show the outer parts. The words "sufficiently smooth" are thus included in theorem III to eliminate all galaxies save a very few.

In spite of these shortcomings Ogorodnikov's book is clearly written and translated and is likely to be a standard text for some courses on stellar dynamics. It is a pity that students must be warned against certain passages, and above all it is a pity that the book was not brought up to date before it was translated.

D. LYNDEN-BELL

GAS DYNAMICS

Elements of Magnetogasdynamics

By L. E. Kalikhman. Translated by Scripta Technica, Inc. Edited by A. G. W. Cameron. (Saunders Physics Books.) Pp. xvii + 366. (Philadelphia and London: W. B. Saunders Company, 1967.) 61*s*.

MAGNETOHYDRODYNAMICS is the study of the effects of electromagnetic body forces on a moving electrically conducting fluid. When the fluid is an ionized gas, when the processes are relatively slow, and when the energy of the magnetic field dominates that of the electric field a regime of the more general subject is defined by the title of this book. As such, it is of particular interest to astronautical engineers and those working in m.h.d. power generation.

The book is an American translation of a well known Russian text-book first published in 1964 and almost all of its references are to work from these two countries. It is basically a theoretical treatment, but is presented in a manner which the experimenter will find most useful. Russian authors have a good reputation for this engineering science approach and the translation has maintained the original spirit of the work.

This volume is to be recommended to the graduate engineer for the lucid manner in which the physical principles are introduced in the first two chapters; the physicist, generally unversed in fluid dynamics, will appreciate its treatment here. Aspects of steady state plasma flow without dissipation are followed by a discussion on shock waves in plasma. The sections on electrode-adjacent layers and the acrodynamic boundary layer in a plasma are the best collected accounts which I have seen. It is in the region between a solid surface and the body of a plasma that the majority of practical problems are to be found; for example, this region presents some of the critical problems in m.h.d. power generation.

More advanced chapters deal with two dimensional plasma flows in channels, unsteady state flows and hydrodynamic instabilities. A final chapter reviews, quite briefly, the practical applications of plasma propulsion, power generation and flight control, but references to experimental work appear throughout the book.

This book is a valuable contribution; unfortunately the subject has a more limited research effort in this country than it deserves.

J. PAIN