with the technical vernacular. There are only a few errors in an otherwise well produced book.

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Plasma Physics, Vol. 2

By J. L. Delcroix
188 pp. Wiley, New York, 1969. $9.95

Interest in ionized gases began originally in the 1920's with the study of electron discharges. It increased considerably with the efforts to design controlled thermonuclear reactors and, more recently, with the study of ionospheric phenomena.

Following his *Introduction to the Theory of Ionized Gases* (1959), J.L. Delcroix decided to treat his subject in greater depth. The first volume, of a planned three-volume treatise on plasma physics, appeared in 1963 and dealt with the relationship between hydrodynamics and kinetic theory; the third volume will deal with completely ionized gas. All three are based on a course by Delcroix, professor at the Faculty of Science of Paris University, Orsay.

This second volume treats weakly and moderately ionized gases. Their definition depends on whether or not the collision frequency of electrons among themselves, ν_{ee}, is small compared to the frequency with which the electron temperature relaxes toward that of the neutral molecules. These molecules are in turn very much smaller than ν_1, the frequency with which the electron velocity distribution relaxes towards isotropy. Even for the moderately ionized gas ν_{ee} is small compared to ν_1.

The book employs two methods of approach: one using the Boltzmann equation and the other a set of macroscopic equations. The former is applied to the two basic problems of determining electron motion caused by an electric field and that caused by diffusion. The macroscopic theory is, in principle, less exact and, to see how well it can be expected to work, it is applied to the same two problems. Subsequently it is used in more complex problems, such as ambipolar diffusion, positive-column plasmas and the phenomenon of volume recombination and attachment. In the appendix the author has collected some of the most important collision cross sections, with ample source references. Because it is intended as a textbook for students entering the plasma-research field, the book strongly emphasizes theoretical methods, which are presented clearly and concisely. The few applications treated are presented quite briefly and some areas, such as ionospheric physics, wave propagation and radiative transfer, are not touched upon at all.

The proofreading has not been as careful as one would like; the most confusing misprint is in the equation representing the assumption of congruence, where the symbol for velocity is replaced by that for collision frequency. However, the trivial mistakes do not impair the usefulness of this short monograph on theoretical methods of treating transport and other nonequilibrium processes in weakly ionized gases.

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Principles and Applications of Underwater Sound

Carl Eckart, *ed.*
295 pp. Department of the Navy, Washington, D. C., 1968. (Reprint of the National Defense Research Committee Report, 1946.)

This book was originally published as one of the reports summarizing the technical work done during World War II by division 6 of the National Defense Research Committee. This division was the largest scientific group in the US after the radar and atomic energy divisions. Its activities were closely correlated with similar work in Canada and the UK, principally through the leadership of the division chief, John T. Tate.

The nature of underwater-sound studies required that they be conducted at many locations throughout the world where proper oceanographic conditions existed. In Canada the work extended from Esquimaux, B. C., to Halifax, N. S., and in the UK from Portland on the English Channel to the laboratories on the land and sea locks in Scotland, especially at Fairlie on the Clyde and at the Firth of Forth. In the US important centers were at New London, Conn., Orlando, Fla., and at Point Loma, Calif. Because of the extremely critical demands to combat the German submarine menace, which continued throughout the war, the allied efforts were directed almost exclusively to practical development work and engineering projects. In all these activities however, it was essential to determine reliable scientific data on the acoustical properties of the ocean, the sea bottom, the surface waves and the many factors affecting echo-ranging gear, listening systems, antisubmarine torpedos and subsurface warfare tactics in general. This volume brings together a major part of these fundamental measurements that were made under the stress of wartime conditions. The measurements have been supplemented by more recent work done under less stringent conditions, but this book is primarily an unusually clear exposition of the war research. Carl Eckart, who spent this period at Point Loma, has edited this volume with great understanding and selectivity.

The book is chiefly concerned with the basic principles of underwater sound, including sound propagation in the sea and the oceanographic conditions that determine the transmission, refraction, echoing, scattering and reverberation of sound in the sea. The ocean considered as a medium for sound transmission could hardly be less favorable. In contrast to the almost ideal propagation conditions for radar in the atmosphere, the ocean is highly absorbing, and sound propagation is greatly complicated by surface noise, bottom reflections, volume reverberation and, above all, vertical-temperature gradients, which have a complex and rapidly changing character.

These temperature variations were almost unknown at the beginning of the war but because of the pioneering work of Columbus Iselin and his associates at Wood's Hole Oceanographic Institution and also of the staff at Scripps Institute of Oceanography in La Jolla, Calif., temperature gradients were recognized early as a crucial factor in operating all underwater-sound gear. Another complication was that sound channels, which arise from the temperature gradients and density variations in the ocean, often permit sonic signals to travel great distances, but they also introduce additional hazards that complicate the rapid use of underwater-sound equipment.

This book will be of real interest not only to those specifically concerned with underwater-sound applications for the Navy, but also to others who