at New London, Connecticut and San Diego, California, respectively. In 1946, as these various groups were closing their operations sponsored by the National Defense Research Council, they produced a set of summary reports. The recent growth of oceanography and its strong dependence on acoustic techniques has led to the reprinting of two of these, which are particularly remarkable documents still of great use to anyone beginning to work with sound in the sea. One of the two reports, edited by Carl Eckart (Associate Director of the University of California group), was reviewed in these pages in March, 1970 by Robert Shankland. The other, treated here, was edited by Lyman Spitzer in his capacity, at that time, as Director of the Sonar Analysis Group of Division 6 of NDRC.

This book is nearly twice as thick as Eckart's and consists of four major parts (originally published as four separate volumes): transmission, reverberation, reflection of sound from submarines and surface vessels and acoustic properties of wakes. While there is naturally some duplication, the two books are in fact complementary. Eckart stresses passive sonar (listening) and environmental aspects, including particularly the naturally occurring noises of the sea. Spitzer emphasizes active sonar (echo ranging), and hence the extensive treatment of reverberation and target-reflection characteristics. The most useful portion of the latter volume over the years, however, has been in providing beginners with one of the most compact, yet professionally satisfying, treatments in print of the theoretical aspects of sound propagation in fluid media. In two chapters, written jointly by P. G. Frank, A. Yaspan and P. G. Bergman, the basic physics is developed to provide insight into such topics as energy transfer, normal-mode theory and the ray-acoustics approximation. This last topic, which is very well handled, is a particularly important one to the user of underwater sound because the nature of the medium and most equipment place most calculations in the range in which the ray approach is valid.

There was considerable activity in this field in that period, and cooperation was good among the several groups in the UK, Canada and the US. This is particularly evident in the manner in which the editors drew extensively from many sources. The lists of references are extensive, although most are to technical reports not now available. They do, however, serve to indicate the research groups and individuals who were active. Some sections of the text can be read with a similar viewpoint because they document the kinds of experiments that were performed by these very capable people as they moved into a relatively untouched field and learned to cope with the problems of bringing back useful information from the sea.

Although a number of texts have been published in this field since these reports were written, the reports nevertheless still remain very useful as introductions to underwater acoustics and informative historical documents.

Fred N. Spiess
Scripps Institution of Oceanography, San Diego, Calif.

Initiation à la Physique Relativiste

By Régis Dutheil

150 pp. Gauthier-Villars, Paris, 1969. 19F

Here is a real "introduction" that is concise, informative and that looks back to the first principles and leads towards the ultimate limits of today's exploration. Regis Dutheil, a professor at the Facultés de Médicine, University of Paris, has here mastered this bold undertaking. He leads the reader up the steep path of a mathematical, most lucidly presented derivation of all the essential aspects of the theories of relativity.

In a brilliant exposition Dutheil tells us how, since the days of Neanderthal Man up to the end of the 19th century, the time concept had remained unchanged; how the flow of absolute time, running on inexorably, always in the same rhythm, was a real archetype impregnated into the human species since its very beginning. He details how, with Einstein's introduction of relativistic mechanics, light was thrown on the haunting problems of time, space and determinism; how absolute time was replaced by a new concept—different time for each single observer; and how Hermann Minkowski was able to declare: "Von Stund' an sollen Raum für sich und Zeit für sich völlig zu Schatten herabsinken und nur noch eine Art Union der beiden soll Selbständigkeit bewahren."

The reader is shown how, since then, the whole of physics has become relativistic; how, for instance, today's nuclear physicists write their accounts of energy balance in nuclear reactions in the language of relativistic dynamics; how the laws of mechanics are now adapted to high accelerations; and how, unfortunately, the production of atomic and hydrogen bombs became another "preuve éclatante" of the validity of Einstein's physical world. These are only a few of the examples presented by the author, who, when encouraging the reader to make the necessary extra effort for a proper understanding of the deductions of his book, reminds him that the real obstacles are not just of a mathematical nature, requiring the mastery of unusual disciplines, but lie essentially in the "révision d'un véritable condi-

tionnement génétique et ancestrale, concernant des notions qui forment la trame même de notre vie."

The structure of the book is one of mathematical beauty. It elaborates the position of the problem by starting out in a more pedestrian manner (classical notions, Newtonian dynamics, properties of Maxwell's equations, and so on); we are guided to Lorentz's theory, the Michelson experiment, relativistic kinematics, Einstein's velocity laws, and Minkowski's space–time world. An excellently condensed treatment of the tools of tensor calculus and their amazing application to relativity equip the reader to deduce the dynamics of special relativity, the covariance of Maxwell's equations, relativistic mass, inertia of energy and other items. Subsequently the author manages, in some ten pages only, to supply a complete buildup of general relativity without losing any essential detail of its intrinsic fascination. Furthermore, we find a very up-to-date account of the experimental attempts to verify the theory—giving the present data on the light deflection at the Sun's limb, the motion of Mercury's perihelion, the red shifts observed for the Sun and for Sirius's companion, and finally details of the recent very successful test on the basis of the Mössbauer effect, which eliminates uncertainties inherent in the extraterrestrial measurements.

The reader is also told how, without success, a still greater synthesis has been searched for, aiming at a union between gravitation and electromagnetism within a general field theory, and how until now it has been impossible to incorporate into the framework of relativity "cet autre monument de la Physique contemporaine: la Physique quantique." The book concludes with a useful summary of all the definitions and results, and an up-to-date bibliography. The annotations and the transparent structure of the book may perhaps be a sufficient substitute for an index. Dutheil's final words are: "...La 'Weltanschauung' relativiste nous amène à entrevoir un univers plus étrange, plus mystérieux que tout ce que nous aurions pu imaginer...."

Arthur Beer
Cambridge, UK

Numbers and Units for Physics

By R. A. Carman
220 pp. Wiley, New York, 1969. Cloth $6.95; paper $4.95

The title led me to expect a useful collection of constants and conversion tables, but instead I found a precollege level treatment of such topics as significant figures, unit conversions, dimensions, and so on, in "programmed format." The body of the main text starts with the statement: "You have not followed instructions. Nowhere in this book are you instructed to turn to this page." If this does not discourage the reader from continuing, he will find fascinating gems of wisdom. He will learn that the prefix for 10^{-15}, *femto-*, is derived from "Fermi" (I thought it was derived from the Danish word for fifteen) the prefix for 10^{-18}, *atto-*, from the word "atomus" (I thought it came from the Danish word for eighteen), that the unit of time is based on the rotation of the earth (it is now based on the frequency of the radiation associated with a transition in cesium atoms). He will find the definitions of units such as the acoulomb, au, barye (10^6 *bar*), *chain (gunter)*, kip, phot, scorpio, shake, skein, stere, STILB, Ton (4.2×10^9 J).

The reader will, however, find no reference to the International System of Units (SI), which was adopted in 1960 and is the only legal system of units in the US for electricity and illumination, and is the system used by the National Bureau of Standards. Nor does the book follow the recommendations of the Commission on Symbols, Units and Nomenclature in physics of IUPAP, even though almost all scientific journals as well as the National Bureau of Standards have adopted these recommendations.

H. H. Barschall
University of Wisconsin-Madison

Physics in My Generation

By Max Born
166 pp. Springer-Verlag, New York, 1969. $3.80

Max Born was one of the great scientists of our century and one of the cofounders of modern quantum concepts. He was perhaps less in the public eye than some of the other originators, such as Niels Bohr and Werner Heisenberg, but his contributions were nonetheless vital—matrix mechanics, the interpretation of the wave function as a probability amplitude (for which he very belatedly received the Nobel prize in 1954) and the ubiquitous Born approximation. Besides his scientific work, Born had the deep desire to build for himself a viable philosophy and to transmit his insights to others. The present slim volume offers a personal selection from his large output of popular writings. Now in its second edition, some of the more technical essays have been replaced by reflections from his later years, past the time of his active work in physics.

The most fascinating aspect of the book consists of the evolution of the author's own personality, as mirrored by his writings. In the earlier epochs of his career he was full of youthful optimism. He believed that science produces an ob-