

and the theoretical interpretation of experiments is stressed. The fourth chapter considers nuclear structure from the independent particle point of view. This topic is amplified for the light nuclei ($A \leq 25$) in the next lecture, where the measured magnetic moments of the ground states are employed to deduce information on the shell structure. The degree of detail in this chapter is somewhat out of keeping with the spirit of the other lectures, and some of the conclusions reached are oversimplified. The sixth lecture discusses nonspherical heavier nuclei in terms of the Bohr-Mottelson model. The seventh and eighth chapters bring out the description of nuclear reactions in terms of the statistical (compound nucleus) and optical models. The latter is illustrated for the elastic scattering of high-energy neutrons; the deuteron stripping reaction is also discussed qualitatively. The last two lectures are concerned with π mesons; their properties, including behavior under parity, charge conjugation, and time reversal, are given first. This is followed by an examination of their interactions with nucleons and of the (multiple) production mechanism.

In summary, this series of articles on diversified topics in nuclear physics is very stimulating, even 4 years after the original lectures were given. The translation from the Russian is clear and fluid, and except for minor errors, is well done.

Science and the Creative Spirit: Essays on Humanistic Aspects of Science. By Karl W. Deutsch, F. E. L. Priestley, Harcourt Brown, David Hawkins. Edited by H. Brown for the American Council of Learned Societies. 165 pp. U. of Toronto Press, Toronto, Canada, 1958. \$4.50. *Reviewed by Lawrence H. Bennett, National Bureau of Standards.*

The authors of the four essays which comprise this book are scholars in the humanities who, meeting together under the auspices of the American Council of Learned Societies, have explored the subject of the interactions between the sciences and the humanities. The essays represent the individual views of the authors, but each essay was critically reviewed by the entire Committee on the Humanistic Aspects of Science, which consisted of the authors and six other scholars. The editor is careful to stress that this volume is to be considered only as a progress report, not as a completed study. Criticism of the book should be seen in the light of this self-imposed limitation.

In discussing the interactions between the sciences and the humanities, the authors realize the difficulty of attempting to consider science as constituting one unit and the humanities as another unit. In fact, there are several attempts made in this volume to define the range of activities of the sciences and the humanities. That their classification is open to debate is seen, for example, in the use of modern advertising writing as a branch of science. The justification here is that advertising writers use the science of information theory in their work.

The editor asks to be excused for making no distinction between basic science and technology; this reviewer believes some distinction must be made if the study of the interactions between the sciences and the humanities is to be meaningful. The editor does make the important point, however, that many scientists attempt to justify increased support for basic research in terms of the improved technology resulting.

Except for an excellent discussion by one of the authors on the creative aspects of science, the book implies that the use of creative imagination is the characteristic most clearly separating the activities of the humanist from the search for facts of the scientist. This lack of appreciation of the essential nature of ideas and imagination in basic science portrays the need for more emphasis to be placed on the creative aspects of science in popular and semi-popular scientific publications.

In spite of the foregoing objections, this book has made a contribution in presenting a fresh approach to a difficult subject.

The Theory of Functions of a Real Variable and the Theory of Fourier's Series. (Reprint of latest edition.) By E. W. Hobson. Vol. 1, 736 pp. Vol. 2, 780 pp. Dover Publications, Inc., New York, 1958. Paperbound \$3.00 each. *Reviewed by George Weiss, University of Maryland.*

These volumes are the classic account of the theory of real variables as it was known in the first quarter of the twentieth century. Although these books do not contain the modern function theory which deals with abstract spaces, both the mathematician and the physicist will find many valuable discussions which are not contained in modern treatises. For example there is a chapter on the representation of functions as limits of integrals that contains much of interest with regard to representations of the delta function. The range of topics is quite wide, and includes point set theory, the theory of Lebesgue integration with several extensions such as Denjoy and Hellinger integration, the theory of series in general and Fourier series in particular. This set is well worth owning, particularly at the price quoted.

Our Nuclear Future: Facts, Dangers and Opportunities. By Edward Teller and Albert L. Latter. 184 pp. Criterion Books, New York, 1958. \$3.50. *Reviewed by Freeman J. Dyson, Institute for Advanced Study.*

When a book has been serialized in *Life* magazine and boosted with the heavy weapons of Henry Luce's publicity machine, readers of *Physics Today* probably do not need to be told what it is about. In these circumstances, a reviewer is expected not so much to describe the book as to give vent to his personal opinions on the subject of bomb testing. Previous reviewers have expressed their opinions with varying degrees of heat and eloquence; I shall follow their example.

Two main questions arise in the discussion of agreements to stop testing, first, whether such agreements can be easily policed, and second, whether an end of testing is anyway desirable. I would answer both questions in the negative.

Unhappily I do not live in the state of uncontaminated innocence which enables Professor Orear to assure us with complete sincerity that policing by remote inspection is adequate. I am a Los Alamos consultant. Still I have never taken part in any classified discussion of the problem of evading test inspection, and I therefore feel free to make a few elementary remarks on the technical aspects of this problem. Russians who work in Siberia are no doubt well aware that sound does not travel well through forests. Like the American Indian, the Yakut hunter probably has learned to put his ear to the ground to listen for distant footsteps. The principle he uses is that sound travels well through a homogeneous medium but is rapidly broken up and damped out by an inhomogeneous mixture of air and trees. Now the spectacular effects of nuclear explosions, brought vividly to mind by the published pictures of the early tests at Alamogordo and Bikini, were produced by bombs in homogeneous surroundings. It is my impression, based on no secret information but on a very rough estimate of the orders of magnitude, that a 20-kiloton explosion could be effectively damped out by a million tons of water mixed with air in a suitably lumpy and irregular way. Of course, an outer shell or roof would be necessary in order to contain the radioactivity. All this would be expensive and inconvenient but not impossible. It appears that a facility for conducting significant military tests in secret would be about as expensive and about as conspicuous as other major atomic facilities such as diffusion plants and production reactors. I conclude that an agreement to stop tests could be policed effectively by an "open-sky" system, or by a ground inspection system with unrestricted right of travel, but not otherwise.

There are several aspects to the question of the desirability of further testing. First there is the fall-out. This is the main subject of Teller and Latter's book. I am no expert and cannot judge the detailed accuracy of their presentation. All I can say is that they seem to me to have done an honest job in explaining what is known and what is unknown. Their story is no soothing syrup; I found it considerably more frightening than the official report of the National Academy of Sciences on radiation hazards. They conclude by saying that the risks from fall-out are acceptable, but this is not said without a good hard look at the magnitude and nature of the risks.

The fall-out is acceptable, of course, only if one has strong arguments in favor of continued testing. The arguments here are of two kinds, short-range and long-range. The short-range argument revolves around the question of disarmament. Opponents of testing hope that an agreement to stop tests could be the beginning of an end to the armaments race and a step in the direction of peace. Teller considers this hope illusory. He

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argues that existing nuclear weapons are adequate for an all-out attack but unsuited for defensive use; future development will lead to improvement in the possibilities of defense, and will therefore make war less likely. Both sides in the dispute believe that they are fighting for peace, and both are sincere. I consider the arguments on both sides slightly irrelevant. To fight for peace means to me to fight for an effective international control of national armaments. Insofar as a test-ban agreement would distract attention from this objective, I am against it.

To my mind the overriding argument in favor of bomb experiments is the long-range one. The handling of nuclear explosions is a new technology, and attempts to stifle a new technology can neither be fruitful nor ultimately even successful. The dominating fact of our technological situation is that thermonuclear explosions give us energy at something like one ten-thousandth of the cost of all other sources of energy. Professor Orear recently proposed a scheme for the direct harnessing of this energy. Sooner or later, by us or by others, the job will be done.

Books Received

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