for this purpose was first made in the late nineteen-forties, but its implementation had to await the construction of reactors capable of producing the neutron fluxes required in such experiments. However, since the first successful experiments were carried out, in the middle of the last decade, a great deal of theoretical and experimental study has been devoted both to the experimental method itself and to the interpretation of the results it has provided.

The book under review is a good survey of what was achieved with the aid of this research tool in the first five years of its use. It contains fifty papers divided into seven categories: general theory; methods of neutron spectrometry; liquids and molecules (other than water); water; cold moderators; solids; neutron spectra. Most of the papers are in English, with a few in Russian and in French. Each paper is prefaced by abstracts in English, French, Russian, and Spanish, and the discussions connected with the papers presented are included. The scientific level of the papers is almost uniformly high, and a great deal of effort seems to have been devoted to presenting them in a useful and attractive setting. This is a book which will be of value not only to neutron physicists, but also to other experimentalists and theoreticians interested in the microscopic properties of solids and liquids.

Mathematical Statistics and Probability. Symp. Proc. (Berkeley, Summer 1960). Jerzy Neyman, ed. Vol. 1, Theory of Statistics, 767 pp., $16.00; Vol. 2, Probability Theory, 633 pp., $13.50; Vol. 3, Astronomy, Meteorology, and Physics, 335 pp., $7.00. U. of California Press, Berkeley, 1961. *Reviewed by Mark Kac, The Rockefeller Institute.*

THE first three volumes of the proceedings of the Fourth Berkeley Symposium on Mathematical Statistics and Probability cover the theory of statistics, probability theory, and astronomy, meteorology, and physics. There are two more volumes, devoted to biology, econometrics, industrial research, and psychometry, but these are not under review here.

Volumes 1, 2, and 3 are collections of papers bearing little relation to each other. An exception to this is a group of papers in Volume 3 by Hammersley, D. G. Kendall, Kerr, and Lyttleton on the statistical theory of the loss of long-period comets from the solar system. The reviewer's interest was particularly aroused by these contributions.

Because the proceedings are much more like a research journal than a book, it is impossible to give them any kind of a comprehensive review. Even listing the titles of individual contributions would require more space than this journal could easily spare. And yet these proceedings represent a sample of a five-years' effort in a large and important field of science, and as such they deserve some kind of general comment and appraisal.

There are three observations (one for each volume)

which the reviewer would like to pass on to the reader as a summary of his impressions.

(1) Information theory has now been officially subsumed under mathematical statistics. This beautiful and original theory was greeted with suspicion by fundamentalists of rigor and it is amusing to see how much belated interest has been generated in the mathematical community as soon as the ϵ's have fallen in proper places. The creator of the theory, Claude Shannon is, by the way, one of the contributors to Volume 1.

(2) Probability Theory (Volume 2) seems like an example of "more and more about less and less". While one must admire the occasional and even frequent flight of analytic imagination and power, one would not fail to see that the volume represents a kind of "mopping-up operation". Of the three volumes under review, Volume 2 came closest in form and spirit to a specialized professional journal.

(3) Perhaps the most striking feature of Volume 3 is an almost total absence of physics. In fact, not counting a stimulating, nontechnical, and speculative article by Ulam, with a comment on it by Hammersley, there are exactly three articles dealing with probabilistic problems suggested by physics.

One is by J. A. Crawford on the motion of charged particles in a random magnetic field, the second is by W. B. Fretter on problems in the measurement of ionization in tracks in a cloud chamber, and the third is by Laurent Schwartz on the density of probability of presence of elementary particles.

The first is an interesting adaptation of the Fokker-Planck technique, the second is practical statistics with a vengeance, and the third (which the reviewer could not fully understand) ends with the following remark: "Of course the formulas and equations given here are well known in physics; only the point of view and the method of exposition are new (and eventually, the mathematical rigor!)." The subject, moreover, has little to do with probability theory.

Perhaps this is neither the right occasion nor the right place to discuss the problem of symposia, meetings, and publications in our scientific life. But at the risk of losing friends and alienating people, the reviewer will venture here the following views:

It is an admirable idea to bring together from all corners of the earth people with common scientific interests. It is particularly satisfying to note that the Berkeley Symposia have been growing progressively more and more international and that the fourth one included participants from the Soviet Union, Poland, Czechoslovakia, and Hungary, as well as from the West. The energy, dedication, and zeal of the organizers, and especially of Professor Neyman, deserve praise and admiration.

But to require every participant to present a paper and, worse yet, to bring a manuscript for inclusion in the published proceedings, is a practice which should be abandoned, if not outlawed.

Unless one can find people who are capable and will-

ing to summarize critically wide and significant areas of endeavor, we may as well dispense with symposia and operate within the ordinary framework of our professional societies and journals. Not that this framework is particularly good. Far from it. But at least papers get refereed and ten-minute contributions last ten minutes ($\pm\epsilon$).

There are now too many good, competent, and even excellent practitioners of the art of probability and statistics to allow oneself the luxury of a "free" symposium. Unless something drastic is done, symposia will become simply additional meetings and their proceedings just supplements to existing journals.

Science and Information Theory (2nd ed.). By Léon Brillouin. 351 pp. Academic Press Inc., New York, 1962. $9.00. *Reviewed by Charles M. Gottschalk, Library of Congress.*

THE second edition of this outstanding primer by a distinguished physicist is a welcome addition to the rapidly growing literature on information theory. It arrives on the scene after a second printing in February 1957 followed, less than a year later, the well-received and highly commended first printing of April 1956.

The general structure of the first edition has been retained, with improvements, corrections, and explanations added to the first chapters, which provide a clear presentation of the standard results used in communication theory. Two completely new chapters, concerned with the line of research followed by the author during the last few years, some of which was first published in the journal *Information and Control,* of which the author is one of the editors, account for most of some thirty pages added to this edition. One of these chapters considers the inevitability of experimental errors and points out the impossibility of strict determinism in scientific prediction by exorcising Laplace's demon. Both the uncertainty principle and the negentropy principle of information render such demons completely unrealistic, and they prove that the smaller the experimental error, the greater the price that must be paid for the observation.

The problem of very small distances is briefly treated in the last chapter, and the author observes that their measurement requires an enormous expenditure of energy, in fact more than any big nation can afford to give. He consequently suggests that this practical limitation be introduced in the theory by means of a convenient probability coefficient that would represent the difficulty of obtaining too high amounts of energy.

All the chapters are eminently readable, even to one untrained in the terminology of the field. The assumptions and simplifications being made are explicitly stated as well as the author's viewpoint concerning the relationships among classical and modern physics and mathematics. One of the book's greater accomplishments lies in its attempt to make the reader aware of the multitude of problems yet to be investigated.