# Books

**Proceedings of the Symposium on Operations Research in Business and Industry.** Sponsored by Midwest Research Institute. Edited by David Hughes. 185 pp. Midwest Research Institute, Kansas City, Mo., 1954. $5.00. *Reviewed by Philip M. Morse, Massachusetts Institute of Technology.*

Almost every month, now, one hears of another conference on operations research. This is mildly heartening to persons interested in the field, for it evidences a widespread interest. But it also has its disquieting aspects and, to anyone attending more than one of them, the end effect is close to boredom. The chief trouble seems to be that most of the time of most such conferences is taken up with attempts to define operations research and to persuade others to try it. I am not sure that physicists would care to attend many conferences where most of the time is spent in defining physics research and in showing that physics research is a Good Thing.

Of course operations research has two (at least!) handicaps compared to physics research. It is a new field, and therefore its aims must be explained from time to time in order to obtain support and to attract new workers. Also the subject matter of the research, the operation, is not the inorganic phenomenon studied by the physicist or chemist. An operation is a team of men and machines doing an assigned (and usually a repetitive) job. To study such a phenomenon, particularly to carry out controlled experiments on it, requires the consent of the human participants and particularly of its "boss", the director of the operation. The feed-back between the observer and the observed is thus much greater and much more complex than in quantum physics. So, unfortunately, there is a need for exposition even before research. One can only hope that, as industry becomes aware of the aims and the successes of operations research, these conferences can become more and more true scientific meetings, where results are reported rather than definitions proclaimed.

The *Proceedings* reviewed here are typical of recent conferences. A paper by Ackoff on production and inventory control in a chemical process, one by Orchard-Hays on some aspects of linear programming and one by Prager on some transportation problems, are interesting reports of research in progress or completed; the rest is less rewarding. For the physicist who wishes to learn about actual research in the field, the *Proceedings* of the Case Conference on Operations Research in Production and Inventory Control (Case Institute, Cleveland, 1954) would provide more real meat. Even better, however, would be any of the issues of the *Journal of the Operations Research Society of America.*

**Annual Review of Nuclear Science.** Volume 4. James G. Beckerley, editor, and Martin D. Kamen, and Leonard I. Schiff, associate editors. 483 pp. Annual Reviews, Inc., Stanford, Calif., 1954. $7.00. *Reviewed by Bernard T. Feld, Massachusetts Institute of Technology.*

This volume is perhaps the most impressive to date of the series. The articles are uniformly thorough and critical. The subjects covered are timely in interest and, for the most part, progress has been sufficient to warrant critical review and summary at this stage.

The main emphasis of this volume is on recent progress in techniques, theory, and information in the field of elementary particle and high-energy physics. Articles which fall, partially or wholly, in this category are (this list is not in the order in which they appear in the volume): (1) Penetration of Heavy Charged Particles in Matter, by E. A. Uehling, a summary of recent theoretical developments. (2) Nuclear Particle Detection (Fast Electronics), by R. E. Bell. (3) Nuclear Particle Detection (Characteristics of Scintillators), by R. K. Swank. (4) Nuclear Particle Detection (Characteristics of Cerenkov Counters), by J. Marshall. These three articles form an excellent comprehensive review and discussion of the present status of the techniques of high energy particle counting. (5) Recent Developments in Proton Synchrotrons, by J. P. Blewett, a brief survey of existing, imminent, and contemplated ultra-high-energy accelerators. (6) Positronium, by S. De Benedetti and H. C. Corben, a brief, clear and complete summary of the theory of positronium and of the (excellent) status of its experimental verification. (7) The Interactions Between $\pi$-Mesons and Nucleons, by M. Gell-Mann and K. M. Watson, a review of the status of the phenomenological approach to the pion-nucleon interaction, with emphasis on the success and usefulness of the concept of a "resonance" in the state of isotopic spin 3/2, angular momentum 3/2, positive parity. Also included is a short discussion of the possible bearing of this approach on meson field theories. (8) Heavy Mesons, by C. Dilworth, G. P. S. Occhialini, and L. Scarsi, an admirably critical review of a situation about which it may be aptly quoted: "It's always darkest just before the dawn."

Articles involving low- and intermediate-energy nuclear physics include: (9) Radiofrequency and Microwave Spectroscopy of Nuclei, by G. E. Pake, mainly a summary of recent developments in universal detection schemes (that of Hin Lew) and in the polarization of nuclei by the Overhauser effect. (10) Alpha Radioactivity, by I. Perlman and F. Asaro, describing the remarkable recent elucidation of $\alpha$-decay systematics and the understanding of the energy levels of

heavy nuclei in terms of the "collective" model of Bohr and Mottelson. (11) Fission Radiochemistry (Low Energy Fission), by L. E. Glendenin and E. P. Steinberg, containing the experimental results since 1949 on problems relating to the mass distribution in low energy fission. (12) Theories of Photonuclear Reactions, by J. S. Levinger, a review and comparison of various models, all more or less successful (even though they are based on rather different and even contradictory assumptions) in describing the main features of the observations.

Articles on applied radioactivity: (13) Stable Isotope Dilution as an Analytical Tool, by M. G. Inghram, concerning a new technique of great promise. (14) Standardization of Radioactive Sources, by G. G. Manov, a survey of available standards and of the progress and remaining problems in extending the range and number of standard sources. (15) Radioactivity in Geology and Cosmology, by T. P. Kohman and N. Saito, a complete and thoroughly documented summary of the various techniques of geological and anthropological dating. (16) Biochemical Effects of Radiation, by K. P. DuBois and D. F. Peterson; and (17) Vertebrate Radiobiology (Lethal Actions and Associated Effects), by J. F. Thomson, two views of a field in which there are now many data, often contradictory, but in which there are still lacking the guiding principles which can lead to the understanding of the data.

**The Development of the Concept of Electric Charge.** Electricity from the Greeks to Coulomb. By Duane Roller and Duane H. D. Roller. 97 pp. Harvard University Press, Cambridge, Mass., 1954. Paperbound $1.60. *Reviewed by P. Morrison, Cornell University.*

This little book, with nearly a dozen cuts of the instruments of the antique electric art, is good reading for any physicist, and should be at hand for students from high school to the institute. The present reviewer can claim no historiographic competence, but the many citations and the care of the exposition convince him that here is a succinct and accurate history of ideas during what we may call the prehistory of the study of electricity.

The method of the study is this: the authors present the work of a major author or two in each of their chapters, with a brief sketch of the historical background, and plenty of small-print citations from the work itself. Then they seek to elucidate the meaning of the observations and comments reported, writing from the point of view, not really of detailed modern knowledge, but from that of common-sense hindsight, from knowing how it all came out. The work is simple enough for young students, and will yet prove novel, if I am not much mistaken, to the most sophisticated physicist who has not read the cited works. The classical period, and indeed all the history up to the time of Gilbert and Galileo is perhaps slighted, but it can be complemented by the same authors' fine paper in the *American Journal of Physics*, in 1953.

It is certainly illuminating to read of the efforts of the men of the Renaissance and of the Enlightenment to make sense out of the still uncertain behavior of glass rod, cat fur, gold leaf, and silk thread in a humid climate. Stephen Gray established the transfer of "electric virtue" over a line of thread from the high window of a noble Kentish country house 650 feet into the fields, where he found that rubbing the glass tube at the low end of the line caused a brass leaf to be attracted to an ivory ball at the high end, fastened to the window by a silk insulating cord. "At length the dew began to fall . . . and the attraction ceased." But Gray rather thinks it was caused by his being very hot, and not the dew. Such was the first transmission line.

The doughty van Musschenbroek of Leyden recounted in 1746 how he drew a violent discharge from a flask filled with water, set on a metal stand, and charged from a spinning glass globe. ". . . in a word, I thought it was all up with me . . . ," he writes. Thus was capacitance discovered. Now, in the full flush of the Enlightenment, electricity was so much a cynosure that the people flocked to the regular college lectures, often "crowding the students out of their seats." And in colonial Philadelphia, a well-to-do-publisher, the ebullient Franklin, began his wonderful work with the "electrical fire".

The book ends with the account of the experiments of Charles Coulomb, who established his famous and fundamental law both statically, using a torsion balance consisting of two pith balls on a waxed thread, and dynamically, using a torsion pendulum whose period he measured. A metal sphere about baseball size served him to demonstrate that such a charged sphere behaved like a point of charge at its center, and that the inverse square law held both in attraction and in repulsion.

As a work of history, the book seems wholly satisfactory for its modest scope. But as a means of instruction (as a case history for the tactics and strategy of science) I must own to grave doubt. What will all this careful account of one and two fluids, of induction, of the effect of points, and the disproved hypothesis of an effect of the color of charged bodies tell the student of physics today? It is true and to the credit of the method that on this qualitative level he will be able with some effort to understand the novel ideas behind the halting experiments of those times, but he can gain no feeling for the actualities of our present theory, for its power, for its beauty and diversity, above all for the unified picture of the world which it provides. Key ideas, like potential or field lines, nowhere appear. The physics is lost in something a little like antiquarianism. The Enlightenment workers had as their guide the brilliant and quantitative success of Newton and Halley and Euler in mechanics. They worked with electricity, not to putter among glass tubes and thick sparks, but in the conviction that the same unity would here be found. Our present powers attest to the truth