interactions of stopped μ mesons, have presented an admirable survey of the experimental facts and have emphasized the crucial role of nuclear structure theory in obtaining quantitative results from the interpretation. (Again, the past year has seen the completion of an experiment that ingeniously avoids most of the uncertainties that nuclear theory introduces.) The late E. G. Dymond contributed an authoritative chapter on the penetrating component of cosmic radiation in the upper atmosphere and succeeded in bringing some order and rational interpretation into a nearly chaotic experimental situation.

The long chapter by H. Messel on the development of a nucleon cascade is a progress report rather than a true review. Messel's principal results are collected here and compared with experiment in a rather offhand way. One hopes that some method may be found in the future to reduce his formidable mathematical structure to a more convenient size.

The final chapter, "Particle identification with photographic emulsions, and related problems," by L. Voyvodic, presents a detailed exposition of the *expertise* of nuclear emulsions. Its inclusion is eloquent testimony to the importance of this tool in cosmic-ray research and helps to make the book a reference work of permanent value for physicists working in the field of cosmic rays and elementary particles.

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Flow Properties of Disperse Systems. J. J. Hermans, Ed. vol. V of *Deformation and Flow.* Interscience, New York; North-Holland, Amsterdam, 1953. vi + 445 pp. Illus. + plates. $9.90.

The term *disperse system* is used in this volume to cover not only suspensions and emulsions but also colloidal solutions, even though, in the latter case, many protein and polymer solutions are now known to behave like the solutions of small molecules. There are 10 chapters contributed by seven authors—five are from England, the others from France and Holland.

The editor shows that there is no thermodynamic necessity for dividing suspensions and solutions. A distinction is one of convenience. Hence, here are to be found the flow properties of dilute solutions of rigid particles, concentrated polymer solutions and gels as well as the coarser dispersions that include such a variety of systems as suspensions, emulsions, liquid sprays, smoke, and powders. The pertinence of the treatment to everyday technical experience can be illustrated by a brief selection of topics included in the volume: thixotropy, false-body, xerogels, rubber elasticity, viscosity with and without Brownian motion, non-Newtonian flow, drop size in liquid sprays, flow of a swirling liquid through an orifice, shattering of liquid drops by air blast, foams, coagulation of smokes, fluidized powders, free flowing and sticky. The volume is excellently produced, with legible type, equations and charts, and attractive reproductions of photographs. The reader has here in a single volume an authoritative summary of the rapidly developing science of rheology in these increasingly important systems of technology.

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Modulation Theory. Harold S. Black. Van Nostrand, New York–London, 1953. 363 pp. Illus. + plates. $8.75.

The Bell Telephone laboratories have, of necessity, been vitally concerned with the systems approach to communication problems for many years because of its important economic bearing on the business of the Bell System companies. It is thus no accident that much of the pioneering work in this field by Nyquist, Shannon, and others, originated in that organization.

This recent volume in the Bell Laboratories series continues in the best of this tradition and is a valuable contribution to the science of communications. Heretofore, modulation theory has been treated in most textbooks and many articles from the point of view of apparatus design. This book is unique in that it considers modulation in the light of modern information theory, thus giving primary emphasis to the systems aspects of modulation.

The first third of the book is concerned with the generalized theory of modulation, particularly as it influences systems design. The latter two-thirds covers specific applications in the amplitude, frequency, and pulse modulation cases. The author avoids the distraction of excessive circuit minutia but includes practical illustrations, where required, in the form of simplified diagrams.

There is an excellent treatment of the various forms of pulse modulation, almost one-third of the text being devoted to this material. Although pulse circuitry and its associated techniques generally have become quite familiar to communications engineers because of the widespread use of radar, this broad discussion of all forms of pulse modulation will be found extremely useful and worth while to have in one place.

The material contained in *Modulation Theory* has been used in the communications development training program of the Bell Telephone Laboratories and makes an excellent textbook as well as a reference book. One of its most valuable parts is the list of references, numbering more than 300 in all, given at the end of each chapter. A number of problems are also included, which may be used by the student to check his understanding of the text. Although devoted entirely to modulation theory, the text is not excessively mathematical in nature, since the author wisely concentrates on the results of the mathematical processes and not on the details of the mathematical manipulations.

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