the central Hilbert-von Neumann spectral resolution theorem. Proofs due to von Neumann, Lengyel, Cooper, Riesz and Lorch, and Lengyel and Stone are given explicitly, and a number of other proofs are sketched briefly. The relationships between the various methods of proof are discussed.

Chapter 6, in many ways the most unusual in the book, deals with the theory of matrix rings, extending the line of thought initiated in the author's earlier *Infinite Matrices and Sequence Spaces.* Chapter 7 takes up the Gelfand theory of commutative Banach algebras and develops this theory up to the point where a proof of the famous Wiener Tauberian theorem can be given. Finally, an extensive bibliography is given.

The text demands of the reader both a high level of general "mathematical maturity" and a fair working knowledge of the theory of functions of a real variable.

The principal drawback to this book is its somewhat disorganized character. For example, Chapter 6 is unrelated to any of the other chapters and constitutes, in essence, an appendix to *Infinite Matrices and Sequence Spaces.* Chapter 7 is independent of the preceding chapters; and although the methods developed in Chapter 7 could be used to give one of the most interesting proofs of the spectral resolution theorem in just a few additional pages, this is not done. The exposition throughout has the staccato character of lecture notes rather than the polished style customary in textbooks. It is my opinion that readers who are not interested in comparing a multiplicity of proofs of the spectral resolution theorem will find the recently published work of Riesz and Nagy more satisfactory.

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Dimensional Methods and Their Applications. C. M. Focken. St Martin's Press, New York; Edward Arnold, London, 1953. viii + 224 pp. $6.

The chief purpose of this book is to show the practical value of the use of dimensional analysis in solving problems of science and engineering.

In Chapter I, the author distinguishes between fundamental magnitudes as those that are arbitrarily defined, such as length, mass, and time, on the one hand, and derived magnitudes, such as Young's Modulus, on the other hand. He gives the basic rules for the conversion of units from one system to another.

In Chapter II, the "complete equation" is defined as one that remains true or invariable when the size of the fundamental units is changed. The general principles of dimensional analysis are defined. The pi theorem is stated and applications are given. This useful tool states that if there are n quantities, either physical magnitudes or experimental constants, such that one and only one complete equation holds among them, and if among these there are m fundamental magnitudes, the relationship among the n quantities may be expressed as a function of n-m independent dimensionless products of the original quantities. Numerous applications of this theorem and a general procedure for applying it to dimensional analysis due to Buckingham are given. O'Rahilly's measure ratio method for converting from one system of units to another is described.

In Chapter III, the questions of the dimensions of directed magnitudes and tensors of any rank are discussed. The problem of thermal magnitudes, requiring the introduction of a fundamental unit—for example, temperature or entropy—is discussed. Electric and magnetic magnitudes are described, with several suggested procedures for handling them, including the ideas of Maxwell and some more modern views.

In Chapter IV numerous applications to physical problems are described, including such modern devices as the chain-reacting pile (very briefly mentioned). Chapter V includes application to engineering phenomena and a description of model experiments.

The book contains numerous references to other workers in the field, including particularly P. W. Bridgman, E. Buckingham, H. Dingle, and Lord Rayleigh. It provides a more critical look into the problem of dimensions than the average scientist or engineer has given. The tables of dimensions—for example, of electromagnetic quantities in various systems—are useful. Some ideas on the design of experiments are suggested.

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Optical Instrumentation. George S. Monk and W. H. McCorkle, Eds. McGraw-Hill, New York–London, 1954. xxv + 262 pp. Illus. $3.75.

This is the eighth volume of the Plutonium Project Record of the "National Nuclear Energy Series." It contains a summary of the work carried out during World War II by members of the Optics Section of the Metallurgical Laboratory at the University of Chicago. This section, which started work in the fall of 1943 and was in existence for 2 years, was entrusted with the design and construction of optical equipment for remote control in irradiated areas. It also carried out research on the influence of high-energy radiation on optical materials and on the design of achromatic lenses consisting of materials that were found to be most resistant to destructive radiation.

The volume consists of two parts. The first part, entitled "A survey of optical and associated problems," makes the reader familiar with the peculiar optical problems encountered, discusses in general the possible ways of solution, and gives an over-all picture of the achievements made. The third chapter of this part is devoted to miscellaneous instruments and to investigations in connection with the project, and it also gives an account of work that was done on the production of thin films by evaporation and sputtering in vacuum. Two tables containing valuable data regarding a great number of deposited films deserve special mention. The production of low-reflection coatings is also briefly discussed, since they are of great importance for the reduction of light losses in all instruments composed of a great number of single-refracting elements—for example, periscopes and borescopes.

The second part of the volume is a collection of 37 papers based on the periodical reports of the Optics Section. These papers give detailed information on topics treated summarily in the first part. Of special interest are the papers by G. S. Monk on the coloration of optical materials by the radiation of a reactor as well as several papers concerning the application of plastic high-quality lenses.

The discussion of the optical details is kept so simple that a modest knowledge of geometric optics is sufficient. The book is of great value for general and special information on optical instrumentation in nuclear research. It may also serve as a textbook for special courses in this field. In keeping with the nature of the book, developments during recent years have not been included. However, an appendix to part I of up-to-date references regarding the achievements made elsewhere since 1945 would have been of great value.

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Scintillation Counters. J. B. Birks, McGraw-Hill, New York; Pergamon Press, London, 1953. 148 pp. Illus. + plates. $4.50.

The fact that individual photons and nuclear particles can effect a short light flash in many luminescent materials has led to the recent development and wide application of the scintillation counter as an important instrument for the detection and measurement of these radiations. J. B. Birks' book, which is one of a series of monographs on current research in electronics and applied physics, is a critical review of the development of this instrument through 1953 and a clearly presented description and analysis of its components, techniques, and applications.

The book begins with a short historical introduction that illustrates how the remarkable versatility of the scintillation counter was achieved as a result of the relatively recent development of the high-gain photomultiplier tube and the discovery of a variety of new phosphors. The second chapter specifies the combination of components of the modern scintillation counter and describes the basic processes involved in its operation. Detection efficiency is obtained from a consideration of the interaction of ionizing particles and x- or gamma-ray quanta with the phosphor. A general formula is derived for the magnitude of the current pulse at the output of the photomultiplier caused by an ionizing particle of a given energy. A useful contribution are formulas that incorporate an economy of parameters especially appropriate to the typical scintillation-counter arrangement. The third chapter is a discussion of the two main classes of photomultiplier tubes that have been found useful for scintillation counting. Some of the important characteristics are given for the commercially available types. Chapter 4 considers the problem of pulse height and time resolution, two of the most significant properties of the counter.

The major part of the monograph is an extensive summary and theoretical treatment of luminescent materials applicable to scintillation counting. The published theoretical and experimental work on the more important inorganic crystalline phosphors, such as zinc sulfide, the alkali halides, and the tungstates, is well covered. The author has provided a list of most of the inorganic materials reported to be phosphors, grouped according to their constituent elements.

Organic crystal, plastic, and solution phosphors are given an especially thorough treatment. These chapters include some of Birks' own contributions to the theory of luminescence and the scintillation process in organic phosphors. As the author points out, the luminescence of organic substances is an inherent molecular property, and therefore the mechanism differs fundamentally from that of inorganic crystals. His pertinent proposition is that the transition from the second or higher electronic state of an excited molecule is accompanied by the emission of ultra-fast, short wavelength fluorescence, which is strongly absorbed by a neighboring molecule. This process recurs, producing a "photon cascade," with very close to 100-percent quantum efficiency until the excess energy is dissipated thermally, when the final transition from the first electronic excited state to the ground state gives the normally observed fluorescence. A convincing argument is made for this mechanism on the ground that it allows a modification of the older theories such that the predicted fluorescence efficiency of an organic phosphor for incident short-range ionizing particles is in more satisfactory agreement with experimental data.

The concluding chapter is a survey of the applications of the photomultiplier scintillation counter to date. These applications include the detection and energy measurement of x- and gamma-radiation, electrons and heavy particles, and slow and fast neutrons. A description is given of the apparatus and techniques for the study of mesons, positrons, and short-lived nuclear isomers. The book contains an adequate bibliography that gives the reader good access to the literature.

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