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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