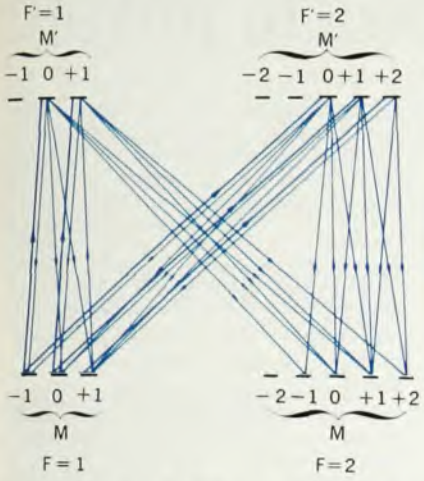


**TYPICAL OPTICAL transitions are shown in the optical pumping cycle of an atom having a $^2S_{1/2}$ ground state, a $^2P_{1/2}$ resonant excited state and a nuclear spin $I = 3/2$.**

the section of interest and obtain a current summary of that field. Graduate students should find it useful in surveying the current problems in atomic and electron physics.

The book begins with a chapter on optical pumping, in which not only the experimental, but also the theoretical foundations are discussed. The next section on electron swarms presents information on electron–atom interactions and also includes afterglow experiments. The discussion on shock tubes is primarily a rather complete description of production techniques of high-temperature shock waves in gases.

Chemical-reaction rate measurements at high temperature are included in the flame-kinetic studies, a section that has a particularly extensive bibliography. In dealing with the interaction of heavy particles with solids, the authors present, among other things, an interesting discussion of the "channeling" effect in crystals, where the incident particle moves between the layers of atoms forming the lattice. The book closes with a chapter on electric arcs, their production and application to the study of atomic processes.

In general this book should be useful to anyone working or thinking of working in atomic-collision physics. It is well written and provides a clear and concise review of current work.

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## Storage tubes

ELECTRONIC IMAGE STORAGE. B. Kazan and M. Knoll, ed. 498 pp. Academic, New York, 1968. $19.50

by LADISLAUS MARTON

B. Kazan and M. Knoll's book is an outgrowth of two of their own earlier publications. In 1952 they published a relatively short book titled *Storage Tubes and Their Basic Principles.* This was followed four years later by a critical review entitled "Viewing Storage Tubes," published in *Advances in Electronics and Electron Physics.*

*Electron Image Storage,* an entirely up-to-date and expanded version of the earlier book, begins with a thorough discussion of basic processes, such as secondary emission, photo emission, photoconductivity, electron bombardment, induced conductivity and luminescence phenomena. This section is followed by the description of writing and reading processes in charge-storage devices, by the discussion of signal-converter devices (which exist in a remarkable variety) and display devices, such as cathode-ray tubes, electrostatic film-deformation displays, xerographic displays, birefringent, crystal displays and many others.

The last two important chapters deal with camera-pickup devices and image-converter devices which, although not strictly storage devices, are sufficiently related to be included. A rather useful appendix at the end contains "Storage Tube Definitions" taken from the 1962 Institute of Radio Engineers Standards on Electron Tubes.

Although I have concentrated on the vacuum-device aspects, on which the authors are very well known authorities, the book contains an added short chapter on magnetic-storage devices. It is so condensed that it serves only to whet the reader's appetite for looking at the (fortunately sufficient) references. With the extremely widespread applications of storage and similar devices (television, telemetering, computers, teaching, decision making, and many others), it became quite timely to reissue an improved version of the authors' older book. The new version will, no doubt, be very well received by the scientific and technological community.

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## Carbon and its modifications

CHEMISTRY AND PHYSICS OF CARBON: A SERIES OF ADVANCES, VOL. 4. Philip L. Walker, Jr. ed. 399 pp. Marcel Dekker, New York, 1968. $20.75

by MARTIN E. STRAUMANIS

This volume is the fourth in a series, edited by Philip Walker Jr, professor and head of the materials science department at Pennsylvania State University, and consists of six articles written by 11 authors, all of them experts in carbon research.

The first four chapters are of interest for the physicist. Considering the great importance of carbon and its modifications in nature, in industry and in research, there is no wonder that many crucial experiments and measurements were performed with carbon, graphite and diamond. It follows from the first article, written by W. Ruland, that the allotropy of carbon gave an impulse to one of the first structural studies with x rays. Accordingly the theory of scattering of x rays by carbon and graphite is in the first article, with mathematical descriptions of two-dimensional lattices, of small-angle scattering, order and disorder phenomena, lattice imperfections and preferred orientation.

Rates of carbon vaporization, heats of sublimation, composition of vapor, melting of graphite and similar problems are discussed in the next article by H. B. Palmer and Mordecai Shelef.

In the following chapter, S. B. Austerman discusses the crystallization of graphite from solutions in molten metals (iron, nickel, molybdenum, chromium). Iron can be evaporated from a solution of carbon in iron at 3000°C, and graphite crystals grow from the melt. There is also a possibility of controlling the amount of defects in such crystals. The article by T. Tsuzuku and M. H. Saito shows how internal friction measurements can determine the dislocation movement in