nonnegative integer is a sum of four integral squares and that three integral squares will not suffice. If every nonnegative integer can be written as a sum of h elements from A we call A a *basis of order h*. An important problem is to determine whether a sequence is a basis, and, if so, to find its minimal order.

2) Fix $h \geqq 2$ and let $r_h(n)$ be the number of ways of writing the nonnegative integer n as a sum of h elements from A. What can we say about the values of $r_h(n)$ as a function of n? A closely related problem is the determination of the rate of growth of $r_h(0) + \ldots + r_h(N)$ as a function of N. Both of these questions are, in turn, related to those in problem 1. For to say that A is a basis of order h is to say that $r_h(n) > 0$ for all nonnegative integers n.

3) If A and B are sequences, we form the new sequence $A + B$ consisting of all distinct integers which are the sum of an element of A and an element of B. If we know something about the density of A (where "density" is a measure of the abundance of A in the sequence of all nonnegative integers) and the density of B, what can be said about the density of $A + B$? Is a sequence of large density necessarily a basis?

To a large extent the book is organized around the methods used in investigating such questions. Thus we find a chapter dealing with number theoretic methods, another with probability methods, and a third with sieve methods. The chapter on sieve methods differs from the rest of the book in that no applications of these methods are carried out in detail. However, the various applications are discussed in the chapter's excellent introduction, which also includes an interesting and highly readable historical account of the sieve technique from Eratosthenes to Atle Selberg. This account is noteworthy also for its discussion of the relationships between the various sieve methods now available.

The chapter on probability methods (whose applicability to problems of this kind was first observed and exploited by Paul Erdös) is self-contained, for it has an introduction to probability theory which suffices for the applications presented. In fact, the authors have succeeded in making each of the five chapters a self-contained unit, and there is justice in their claim "that any single chapter can conveniently be read by itself."

The authors have given us the first connected account of this important branch of the theory of numbers to appear in print and have done so in a masterly way. Not only have they performed the very difficult job of collecting results from many sources, relating them, and presenting them in a unified manner, but they have also, in some cases, corrected errors and obscurities in the original sources. There are numerous references to the literature, and for the specialist the bibliography alone will be worth the price of the book.

Halberstam and Roth have made an outstanding contribution to the mathematical literature. We are promised a second volume, but unfortunately not very soon.

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A Practical Aid

The Structure of Polymers. M. L. MILLER. Reinhold, New York, 1966. 720 pp., illus. $27.

The Structure of Polymers is directed, as a practical aid, toward industrial scientists who are not necessarily specialists in polymer chemistry but who must come to grips with one aspect or another of the relationship between molecular structure and the mechanical and chemical properties of high polymers.

Considered broadly, as it is in the present work, the subject matter pertinent to this relationship comprises a substantial part of polymer science. Miller has dealt with the problem of organization first of all by subdividing the book into chapters which are as nearly as possible independent entities, and second, by a selectivity of material of which I shall speak later. The character of his book is epitomized by two chapters, one on the stiffness of molecules as related particularly to mechanical properties and the glassy state, and another, dominated by a discussion of stereoregularity, on molecular isomerism. Also treated are molecular weight and molecular weight distribution, branching, molecular interactions, hydrodynamic volume of molecules, networks, copolymers, crystallinity, orientation, polyelectrolytes, and electrical properties.

Miller frames his discussions almost exclusively around selected experimental results. It is through his acuity in the choice of illustrative data and in their modes of presentation that the book acquires its individuality and, in my opinion, its measure of success. From his treatment of topics most familiar to me, I would judge that his survey of the literature of the last 15 years has been remarkably thorough and that he has been perceptive in its distillation.

Not everyone will agree with the author in matters of emphasis. His dismissal of the Weissenberg effect as an annoyance to operators of viscometers could mislead workers who may have to deal with extrusion of polymers. Again, older data seemingly apt for purpose of illustration may now prove to be less definitive, as in a table relating crystallite size to melting point for polyethylenes with varying degrees of branching. A plague of works of this type, the imperfect generalization, induced by a reluctance to devote space to finer distinctions, is also encountered. I find these defects to be minor.

Accessibility of information is excellent as a result of the use of about 250 carefully labeled and readily readable graphs and tables. The subject index stands up well to test and the conventional author index has been eschewed in favor of a helpful polymer index. Practical polymer scientists will find this a useful book.

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Mutagenic Chemicals

The Actions of Chemicals on Dividing Cells. BENGT A. KIHLMAN. Prentice-Hall, Englewood Cliffs, N.J., 1966. 272 pp., illus. $10.

In 1956, at the Fifth International Conference on Radiobiology, an eminent biologist, who was concerned by the public's apathy regarding the mutagenic effects of radiation, made a plea that the assembled group not publicize the potential dangers from mutagenic chemicals. The reason for this stand was the fear that if geneticists made shotgun attacks against a large number of mutagens they would weaken their warnings against the indiscriminate use of radiation, which presented a clear-cut genetic hazard. Any arguments about whether or not geneticists should heed this advice have become

academic since the publication of Rachel Carson's *Silent Spring*. The lay public is now acutely aware of the hazards attendant on the indiscriminate use of chemical agents.

Many of the hazardous chemicals produce their effects mainly by attacking the genes and chromosomes of the cell. In *The Actions of Chemicals on Dividing Cells* Bengt A. Kihlman surveys the various chemicals that can affect chromosome structure and cell division. The book, however, is more than a survey and consists, in the main, of a synthesis in which Kihlman presents an argument as to how he thinks these various chemicals might act. He tries to show that all the chemicals that affect cell division and chromosome structure do so by attacking DNA. The reasoning often seems quite tenuous, since the various chemicals produce different types of chromosomal effects even when their postulated reactions would lead one to expect them to produce the same aberration. This is only a minor fault, however, since Kihlman is scrupulous about presenting all the data pertaining to a given point. Thus the reader is made aware of the evidence on both sides of any given question and can decide for himself whether or not he agrees with the argument.

In his introduction Kihlman has written a disclaimer regarding his proficiency in English, which is not his native tongue. Either he is too modest or he has had good editors. In any case, would that all English-speaking scientists wrote as well.

The book contains a wealth of information in highly condensed form. In the hands of a scientist interested in the effects of many of these radiomimetic chemicals it is sure to become thumbworn. The only admonition necessary is that the reader should remember that the book presents an argument and an interpretation, albeit by a scientist who has been active in the field, which are by no means universally accepted. In spite of this, the fact that a man of Kihlman's experience presents the argument should prevent us from rejecting it out of hand.

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Principles, Techniques, and Uses of Lasers

The Laser. WILLIAM V. SMITH and PETER P. SOROKIN. McGraw-Hill, New York, 1966. 510 pp., illus. $15.50.

Introduction to Laser Physics. BELA A. LENGYEL. Wiley, New York, 1966. 327 pp., illus. $8.95.

Lasers and Their Applications. KURT R. STEHLING. World, Cleveland, 1966. 123 pp., illus. $6.

Laser Receivers: Devices, Techniques, Systems. MONTE ROSS. Wiley, New York, 1966. 417 pp., illus. $14.95.

A book about quantum electronics, and especially one about lasers, is difficult to write. The field draws on widely different areas in physics, electrical engineering, and chemistry in order to solve the problems of generating and using coherent optical radiation. No single book can be truly comprehensive, nor should it try to be. The authors of *The Laser* have recognized this and have written a true book instead of a bibliographic catalog. This they have done by specializing and by emphasizing problems that have interested them. Thus, although one may feel that the Sm^{++} ion has received attention which is out of proportion, the reward for this is that the physics of this ion is discussed in great detail and physical principles applicable to a wide range of solid-state laser problems are explicated. The book opens with an introduction, which is followed by chapters on resonant optical cavities and gas lasers, solid-state lasers, and amplifiers, Q-switched and Raman lasers. These are followed by three chapters on the physical principles of gas lasers, the spectroscopy of solid-state laser materials (100 pages), and the injection laser. The final chapter is on applications. This is a fine, well-written book which has attempted to treat matters in some depth. I recommend it to all workers in the field and to anyone seeking a nonsuperficial understanding of the field. There are, no doubt, many criticisms that could be made of the treatment of each specialized topic. For instance, I felt that the importance of ion pair relaxation should have been mentioned. The book is not comprehensive for the reason described above, and the reader should realize this, but it represents a very real contribution.

Introduction to Laser Physics appears to have been written for a person with a background equivalent to that of a fourth-year undergraduate or first-year graduate student seeking an introduction to the field. A similar book, *The Laser*, by the same author, was published by Wiley in 1962. A glance at the tables of contents indicates a strong similarity between the two. Further, many passages appear which are identical, word for word, usually near identical figures. The newer book is not, however, simply a rehash of the previous one. It is much larger (311 pages of text as opposed to 125), the discussion appears to have been largely rewritten, and coverage has been expanded whenever necessary. The book begins with background material on radiation and atomic physics and the general description and theory of lasers. The middle third of the book is concerned with types of lasers: solid-state, fluid, and gas. The last third discusses the variation of laser oscillations in space and time, nonlinear phenomena, and applications. However, the coverage of so many topics does lead to problems. I found the discussion of ions in crystals somewhat oversimplified. The inclusion of so many details on laser materials gives the reader little opportunity to discriminate between good and bad systems or knowledge of how to do so. Lengyel's book includes a comprehensive survey of the literature through 1965 which will make it useful to workers in the field as well as to beginners.

Lasers and Their Applications is aimed at the educated layman, preferably with a modicum of technical background. Written in a breezy, newspaper style, the book opens with a description of the history of the laser and its principles of operation. The remainder of the book is devoted to applications, present and future, real and imagined. By and large, the discussion is quite realistic except for the military and space applications, where one feels the bizarre intruding. This is a popular exposition by a man who is not a worker in the field, and it has the common defects of such expositions. Aside from this, it may be useful to someone looking for a popular discussion with an emphasis on applications rather than underlying principles.

Laser Receivers: Devices, Techniques, Systems is concerned with the growing interest in electro-optical communications and radar systems, especially those in which lasers are used. A discussion of noise and infor-