that no knowledge of phase can be obtained by photographic techniques.

On the whole, the book is a reasonably useful addition to the literature on optical masers. Unfortunately its usefulness will be short-lived because the literature on the subject is accumulating at an increasing rate. According to a recent survey, the rate has doubled in the past six months.

E. I. GORDON
Bell Telephone Laboratories, Murray Hill, New Jersey

Electrical Engineering

Quantum Physics of Electronics. Sumner N. Levine. Macmillan, New York, 1965. xiv + 301 pp. Illus. $8.95.

With the advent of the transistor and, more recently, the maser and laser, it has become increasingly important for electrical engineering students to obtain a background in modern physics. This is particularly true for Ph.D. students who intend to continue in the field of research and, to a lesser extent, for the electronics design engineer who will use the devices. The latter must have some understanding of the underlying physical principles on which the devices operate in order to exploit their potential most effectively. It therefore seems highly desirable today for the engineer to study the Hamiltonian and Lagrangian forms of classical mechanics, quantum mechanics, thermodynamics, classical and quantum statistical mechanics, solid-state physics, and the quantum theory of radiation and acoustics. Of course, this curriculum sounds like that of a physics major, but it is the physics used in modern electronics devices.

The present book goes a long way toward providing the student an introduction to most of the required topics. In chapter 1 the author introduces, in an abstract way, the operator algebra necessary for quantum mechanics, and in chapter 2 he develops the underlying principles of quantum mechanics, including such topics as spin and angular momentum, a particle in a three-dimensional box, and the harmonic oscillator. The approximation methods that are applicable to many particle systems are developed in chapter 3. A knowledge of this material is required for understanding lasers and masers. In chapter 4 a few topics in statistical mechanics and thermodynamics are introduced, including an introduction to the ideas of transport theory. In chapter 5 various types of electron emission are discussed, using statistical methods. The band theory of solids is given in chapter 6, and transport theory is developed further in chapter 7, while the final chapter provides a very brief introduction to lasers. The appendices include introductions to classical mechanics, theory of small oscillations, Maxwell field theory, and transformation of operators.

The topics included could well involve a book ten times the size of this one, but the author does a fairly good job in giving the reader a flavor of the topics covered. In order to cover some rather difficult material, he has had to simplify some derivations. This leaves a rather large gap between the analysis and the physical interpretation of the results which may be difficult for beginners to bridge. Although the book is relatively easy to read, the instructor will have to supply quite a bit of detail as well as a more physical interpretation of the results for the student.

WILLIAM H. LOUISELL
Bell Telephone Laboratories, Murray Hill, New Jersey

Statistics for Biologists

Multivariate Statistical Analysis for Biologists. Hilary L. Seal. Wiley, New York, 1965. xii + 207 pp. Illus. $7.75.

The author, Hilary Seal, presupposes that biologists, the intended audience of this slim volume of selected recipes, have a "nodding" acquaintance with normal, chi-square, and F distributions as well as the ability to differentiate between a parameter value and its sample estimate. His *modus operandi* consists of explication by illustration, utilizing data obtained from published biological and biometrical research. Typically a set of data is presented and then analyzed, often by several alternative statistical models which are in turn explained in some detail. Unfortunately, Seal frequently neglects to state for which population, implied by the model, the inference that he draws is valid, not a trivial point for the investigator. Vectors and matrices are introduced quite early and in a natural manner for the purpose of simplifying the algebraic manipulations. Computer routines necessary for the calculation of the various estimates and tests of significance are given ample discussion.

The first half of the book, in which the case of a single dependent variate is discussed, consists of the following chapters: (i) "The linear model and its least squares analysis," (ii) "Orthogonal vectors and the analysis of variance," (iii) "Analysis of covariance," and (iv) "Multiple regression." Although all this, the author admits, is within the customary purview of the univariate analysis of many variables, he implicitly maintains that it is a necessary introduction to the main burden of the book, multivariate statistical analysis. In the second half of the book there are the following chapters: (v) "The p-variate linear model," (vi) "Principal components," (vii) "Canonical analysis" (chiefly a mixture of multivariate analysis of variance, discriminatory techniques, and canonical correlation), and (viii) "Factor analysis." There is also an appendix on computer routines and another on block designs with missing observations.

The book abounds with "Quotations from an Unfamiliar Bartlett," but, strangely enough, there is not a single reference to the foremost pioneer of multivariate analysis, Harold Hotelling. The very terms, principal components, and canonical correlations, as well as the methods, are entirely due to him. Indeed, we have here the first book on multivariate analysis that does not mention Hotelling's T^2 statistic, although it is implicitly used in a disguised form.

I feel that at the very most the impact of this text will be modest, and then only because of its chief attribute —exposing the numerical guts of particular techniques.

SEYMOUR GEISSER
National Institutes of Health, Bethesda, Maryland

Earth Sciences

The Habitable Earth. Ronald Fraser. Basic Books, New York, 1965. 155 pp. Illus. $4.50.

This book is a clear and vivid summary of recent geophysical, geochemical, meteorological, and oceanographic discoveries that are transforming the earth sciences. The years from 1950 to 1963 were notable ones in geophysics. Benioff recognized seismic