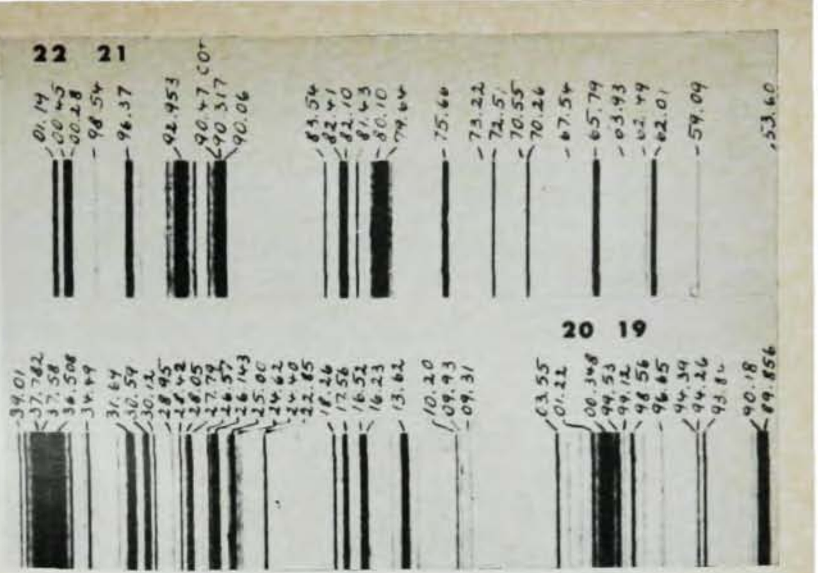
A portion of the Specola Vaticana spectogram of copper, same size as original. Full chart is 10½ x 14 in.



calculation of the forces on two-dimensional airfoils or the Helmholtz-Kirchhoff theory of free streamlines. But in each case the classical work is only the first step in the development of a more powerful theory. Thus the airfoil analysis is extended to deal with time-dependent flows, and leads up to an entire chapter devoted to effective and constructive approximate methods for dealing with thin airfoils.

The analysis of cascade theory leads to some very beautiful problems of function theory which are elegantly solved, and there is also an interesting chapter on the related question of planing motion.

The last part of the book deals with problems of gas dynamics, potential gas flow, and gas jets. Here too the semiclassical methods are presented (e.g., Pandth-Meyer expansions), but always as the starting point for further developments.

Each chapter begins with a "problem formulation" explaining the physical background of the problem to be discussed. On the other hand very little space is given to the actual derivation of the equations, which are more or less taken for granted.

The English translation is good. The reviewer knows of no similar book in English and strongly recommends it to anyone who wants to become acquainted with the techniques created by the Moscow school for solving problems in the mechanics of nonviscous fluids.

Atomic Spectra in the Vacuum Ultraviolet from 2250 to 1100 Å. Part One: Al, C, Cu, Fe, Ge, Hg, Si, (H_2). By J. Junkes, E. W. Salpeter, and G. Milazzo. 124 pp. plus 9 charts. Specola Vaticana, Vatican City, 1965. Paper, $10.00.
Reviewed by C. C. Kiess, Georgetown College Observatory.

The spectroscopists of the Specola Vaticana have set for themselves the problem of mapping ultraviolet atomic spectra in the region where vacuum techniques are required down to 1100 Å. The work was undertaken, and is being continued, to satisfy the growing needs not only of physicists and spectrochemists but also of astronomers and space scientists, for spectral data in the region to which our atmosphere is opaque.

Part One, which is the subject of this review, is primarily a set of maps of the short-wave spectra emitted in hollow-cathode discharges of the elements aluminum, carbon, copper, iron, germanium, mercury, and silicon. Other parts of the completed *Atlas of Atomic Spectra in the Vacuum Ultraviolet* will appear in due course. The elements treated in the first installment were chosen because many of their spectral lines have been measured accurately and are suitable standards of comparison for wavelength measurements. An additional map in the present lot portrays the spectra of the Lyman and Werner bands of molecular hydrogen (H_2), of which some lines persistently appear in spectra excited in hollow cathodes.

The maps are eighteen-fold enlargements of original spectrograms that were obtained with a concave grating of 1200 grooves/mm set up in an Eagle mounting. Each map consists of seven strips covering a range of 160 or 170 Å, with sufficient overlap at the ends to join with the preceding and following strips. The wavelengths of all lines, including those of impurities, are marked in the margin above each strip. Most of them are wavelengths taken from the literature, but if these are lacking, wavelengths derived from the new spectrograms are given. In format the maps are nearly twice the size of those previously published by the Specola Vaticana for iron and thorium, and in quality they conform to the high standards adopted for the earlier work.

Accompanying the charts is a paperbound text with a foreword stating the purpose of the work and an introduction describing various details of the experimental procedures. The remainder of the textual matter presents individually for each element and for H_2 an account of and references to previous work; and a list of known lines, including those newly measured, with their wavelengths, estimated intensities, excitation state, and source. These parts of the text are independently numbered so that "after the whole work is completed, the charts can be arranged alphabetically, according to elements, and all sheets of text and wavelengths can be taken apart and rebound together as one desires." These maps and texts greatly supplement existing descriptive material, and supply valuable tools for the practical spectroscopist.

Mathematical Theory of Optics. By R. K. Luneburg. 448 pp. University of California Press, Berkeley, 1965.
Reviewed by Harold Mendlowitz, National Bureau of Standards.

Optics can be considered a very broad field in which many somewhat related disciplines are studied, often quite independently. One might be interested in spectroscopy, lens design, electromagnetic theory, electron optics, linear or nonlinear optics, geometrical optics, etc. Luneburg in his 1944 Brown University lectures dealt with the mathematical approach to the study of light propagation through various media. This book is a reprint of the lecture notes of that course, which, although much in demand, has long been out of print.

One has here a highly sophisticated approach to geometrical optics and instrument design, very much in the tradition of Hamilton. Also there are additional new discoveries and applications (ca. 1944), as well as a treatment of the scalar wave theory of the propagation of light, which is tied in with geometric optics.

At the outset, the author connects the solutions of Maxwell's equations in the dipole approximation to geometrical optics in terms of the hypersurfaces of discontinuities of these solutions rather than only using the short-wavelength approximation. After this has been accomplished he produces a very elegant mathematical approach to the theory of geometrical optics and instrument design. One might sometimes get the feeling that all that Maxwell's equations do is to provide a starting point from which the author can go on and exhibit his virtuosity. One also can get this feeling from his treatment of the scalar wave equation with applications to optical instruments. This is not meant to criticize the book. On the contrary it is meant to point out that many of the mathematical devices employed can have wider application and that there is much one can learn from the author's approach.

The book is divided into six chapters that cover the broad categories: Maxwell's equations and geometrical optics, Hamilton's theory, first-order optics, third-order aberrations, applications, and diffraction theory of optical instruments. These chapters are divided into more than fifty sections with an average of about five subsections, each of these separately treating interesting topics. There are two appendices and also supplementary notes on electron optics by Chako and Blank and three supplements by Herzberger on optical qualities of glass, mathematics and geometrical optics, and symmetry and asymmetry in optical images.

There are two shortcomings, neither of which is the fault of the author. The first is the lack of an index. Although the table of contents is rather detailed, an index would have greatly increased the usefulness of the book. The second is that the type and format used are similar to those in some of the new lecture-note series; they may give one the feeling of timeliness and hurry but a lack of permanence. This is not the way I would present a classic. It might be argued that a change in type and format would have made the book prohibitively expensive. I am not convinced. In spite of these criticisms of the publishers, the University of California Press has done a service to the scientific community by publishing this classic.

Mathematical Analysis of Observations. By B. M. Shchigolev. Transl. from the Russian by Scripta Technica. 350 pp. (Iliffe Books, London) American Elsevier, New York, 1965. $12.50.
Reviewed by Jacques E. Romain, Centre de Recherches Routières, Sterrebeek (Brabant), Belgium.

An unspoken law about translated books says that any such book has a low probability of being irreproachable simultaneously with respect to style and contents. The book under review is one of the happy few that belong to the tail of the probability distribution, what is commonly called an exception to the rule. Indeed the book is written in so clear and agreeable a style that it would seem hard to guess it is a translation, were that not stated on the first page. Moreover, this reviewer has not spotted any error, except two inadvertent substitutions of "conditional equations" for "normal equations" in one paragraph, a minor slip of the pen that could happen to any author.

Due credit being thus given to the anonymous translator, the praise goes to the author for care and clarity of exposition, adequateness of explanatory remarks, and numerous worked-out examples (mostly taken from astronomy) that illustrate the methods described. The book is fully self-contained and requires no previous knowledge (not even the concept of probability) except standard mathematical techniques. The presentation is meant for students and starts from an elementary level.

Topics included are theory of errors involved in the use of approximate numbers (including point interpolation from numerical tables), essentials of probability theory and of the theory of random-measurement errors (whether the single measurements are equally precise or not), determination of parameters by the least-squares method, choice and testing of empirical formulas to be fitted to data, elementary statistical analysis of observational material (including correlation of two variables). The book does not include intermediate or advanced statistical methods (systematic use of Student's and chi-square tests, multiple and partial correlation, analysis of variance, analysis of time series, planning of experiments, etc.).

To summarize, in view of its prominent qualities the book may be commended for teaching and self-study to a reader who needs a detailed and readable explanation of the topics covered. It may also serve as an introduction to more advanced statistical treatises, but it can in no way replace such treatises.

Temperatures Very Low and Very High. By Mark W. Zemansky. 127 pp. Van Nostrand, Princeton, N.J., 1964. Paper $11.50.
Reviewed by M. E. Straumanis, University of Missouri at Rolla.

This small book is the sixth of the series of Van Nostrand Momentum Books, published for the Commission on College Physics. The book contains the following sections: (1) temperature as a property of matter; (2) temperature, entropy, and disorder; (3) the approach to absolute zero; (4) the approach to infinite temperature; and (5) beyond infinity to negative temperatures. The book concludes with a bibliography (on one page) and a three-page index. There are four plates in the book.

Sections 2, 3, and 4 are written in an interesting way and are quite readable. They supply new information (for example that the Rankine scale is used in engineering, page 16)