BOOK REVIEWS

Spectrum of Thorium from 9400 to 2000 Å. By J. Junkes, S. J., and E. W. Salpeter, S. J., 8 pp. + 16 plates. Specola Vaticana, Città del Vaticano, 1964. $10.00.
Reviewed by C. C. Kiess, Georgetown College Observatory.

Today's spectroscopists, engaged in the measurement of the many-lined spectra of the heavier atoms and of molecules, have, for several years, felt the need for a comparison spectrum with more secondary standards more accurately determined than the system prescribed by the International Astronomical Union about a half-century ago. This need has now been met with wavelengths in the spectrum of thorium, excited in electrodeless lamps and measured by Meggers and Stanley at the National Bureau of Standards, and by Stanley and co-workers at Purdue University.

The original set of secondary standards, measured in the spectrum of the iron arc according to specifications by the IAU, served well for investigations of the spectra of the lighter metals excited by arcs-in-air, and of gases excited in Geissler tubes. These wavelengths were measured interferometrically relative to the red ray of cadmium, the then primary standard of wavelength, with orders of interference of 30 000 to 40 000 waves. The accuracy attained did not exceed a part in three or four million for lines in the violet region, and a part in six or seven million for lines in the near infrared. Furthermore, these standards are nonuniformly distributed in the spectrum, some successive ones being separated by 50 Å or more. Altogether, after more than a decade of laborious measuring and computing, about 250 of these secondary standards were set up in conformity with IAU requirements.

The standard lines now available in the spectrum of thorium number more than 500. Owing to the higher orders of interference with which they were measured, their accuracy is at least ten times greater than that of the iron standards, and they are distributed along the spectrum at much smaller intervals, very few being separated by as much as 10 Å. However, to use these standards, "It is evident that for a quick and sure orientation in this highly complex spectrum, which is lacking in striking groups of lines, an appropriate map is needed. . . ." Such a map, prepared at the Specola Vaticana, shows all the lines measured by Zalubas, on grating spectrograms, with the identifying wavelengths marked in the margins above and below the thorium spectrum, those of standards being underscored. The complete map consists of sixteen charts, each with three sections of the spectrum. In the region 9400 to 4000 Å each section spans 200 Å, while between 4000 and 2300 Å the span is 100 Å, becoming 200 Å again between 2300 and 2000 Å. In addition to stronger and weaker exposures to thorium, each strip contains a juxtaposed exposure to the less complex and better known spectrum of the iron arc "for purposes of orientation". In form and make-up the map follows the style of Fr. Gatterer's *Grating Spectrum of Iron*, issued in 1951 by the same institution. This new set of maps will prove to be of tremendous value to all spectroscopists who use excited thorium as the source of a comparison spectrum.

Mathematical Theory of Probability and Statistics. By Richard von Mises. Hilda Geiringer, ed. 694 pp. Academic, New York, 1964. $22.00.
Reviewed by J. Gillis, Weizmann Institute of Science, Rehovot, Israel.

The reviewer once noticed that omitting the first chapter of most books on probability had little effect on the pleasure, profit, or otherwise to be derived from reading the remainder; and he has since acted accordingly. However, those who translated and edited von Mises' work on the subject were at least one move ahead. Because what had to be omitted now was two chapters. In this book the definitions section is particularly long and complicated. The old notion of the Kollektiv is preserved, a useful idea 35 years ago but long superfluous. And with the measure-theoretic approach somehow grafted on to it here and there, the whole makes a confusing mixture.

Those who get through (or around) this mixture to the rest of the book will be richly rewarded. The development begins with the most elementary considerations and includes some of the various derivations of the laws of large numbers. All of the standard distributions are discussed and the work is abundantly illustrated by interesting applications. Indeed this wealth of application is probably one of its strongest features.

Problems of inference and hypothesic testing occupy a particularly large place. The Bayes' approach; maximum likelihood; and the more modern sequential approach to errors of the two kinds; all of these are fully treated. Queuing theory is omitted, but there is nevertheless sufficient really good material in the book to make it a valuable handbook for those working in the field, either as theoreticians or practitioners.

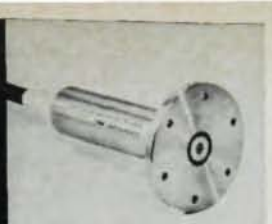
The Statistical Analysis of Experimental Data. By John Mandel. 410 pp. Interscience, New York, 1964. $12.00.
Reviewed by J. E. Mansfield, Harvard University.

Anyone who has tried to look up a point in one of the standard probability and statistics texts, which all seem to be oriented toward psychology and economics, will appreciate this effort. The stress is on analysis of data from chemistry and classical physics; the peculiar problems of nuclear and atomic physics receive short shrift. Still, there is little doubt that this book will be more useful than most.

Statistics is one of those things we all seem to know intuitively when we need to. But here, for instance, several important distinctions are made that may disturb crusty old intuitions—the difference, for instance, between precision and accuracy; or between a statistic and a population parameter. And a favorite device, the average deviation from the mean, is rudely unmasked. This last will no doubt disturb many physicists.

Some of the development is quite interesting. Confidence intervals are discussed in a very lucid fashion, using

TRW INSTRUMENTS



48,000°K BLACK BODY SOURCE

The TRW Model 27A Continuum Radiation Source approximates the spectral energy distribution and radiance of a black body at 48,000°K. It is particularly suited to vacuum-uv absorption spectroscopy, photolysis, photoluminescence, and radiation damage studies, and as a general purpose source of UV energy. The Model 27A exhibits this high radiance, and extremely clean continuum, from 900 to 6000A, and provides line emissions down to 95A. Intensity of radiation is reproducible within 5%.

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CONTINUUM

Continuum of the radiation was verified by studying the discharge characteristics using a vacuum-uv spectrograph. The photon emission of the Model 27A and the vacuum-uv absorption of O_2 was recorded on an Ilford Q-1 photographic plate shown in Figure 1. The top four spectra were obtained in a vacuum for reference purposes, using one, two, four, and eight discharges respectively. The next five traces were obtained with O_2 pressures of 8.5, 17, 26, 34, and 43 microns of mercury pressure. The sharp cutoff at about 1150A is due to the use of a lithium fluoride window. Figure 2 shows microdensitometer traces of the density as a function of wavelength for spectra four through nine.

TEMPERATURE

Figure 3 plots spectral steradiancy as a function of wavelength in the visible and near-uv regions for experimental values of peak emission from the Model 27A and theoretical values attributable to a black body of 48,000°K. Values for the Model 27A Continuum Radiation Source were obtained by comparing peak radiation to that from a carbon arc standard.

FIG. 1

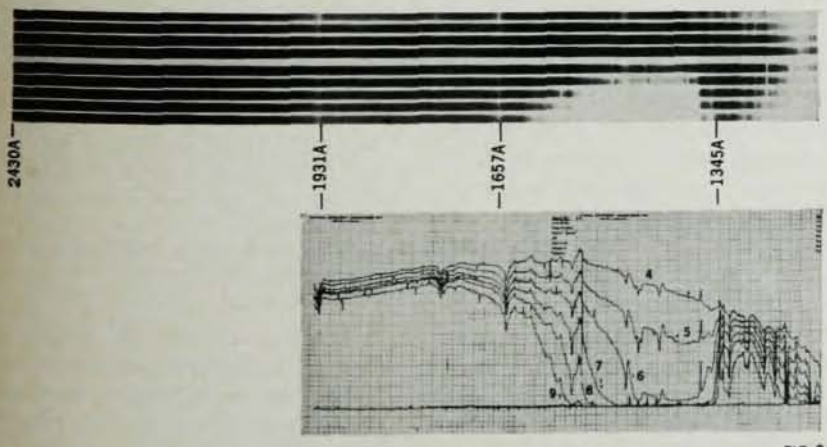

FIG. 2

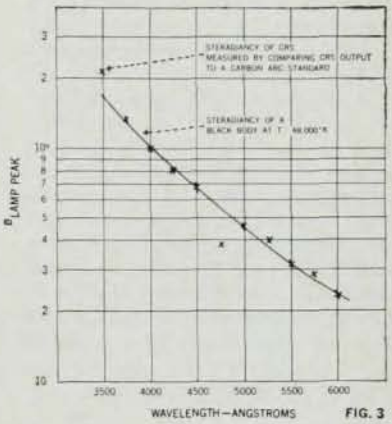

FIG. 3

APPLICATIONS

The TRW Model 27A Continuum Radiation Source is particularly suited to vacuum-uv absorption spectroscopy, photolysis, photoluminescence, radiation damage studies, as a general purpose UV source, and as a light source for shadowgraph recordings.

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For detailed information, write for Technical Data Bulletin CRS-1.

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the trick of considering the standard deviation as a parameter. Extension to the general case is then made with the help of Student's *t*. Conceptually this is much nicer than the usual treatment. The chapters on least squares and curve fitting are for the most part standard, but the examples are strongly physical.

In all, a useful book. In the interest of making it self-contained, the author has begun from a very elementary level. Were it not for the distraction of thumbing back, one could well start at Chapter 6. An interesting addition would have been a chapter on small-sample statistics. A few results are given without proof, such as the range approximation to the standard deviation; but some of the problems involved get passed by.

Introduction to General Relativity. By Ronald Adler, Maurice Bazin, and Menahem Schiffer. 451 pp. McGraw-Hill, New York, 1965.

Reviewed by Jacques E. Romain, Centre de Recherches Routières, Sterrebeek, Belgium.

The purpose of this book is overtly didactic. It is meant as a suitable basis for a semester course in general relativity, in which mathematicians could be acquainted with an attractive field of application of the methods of differential geometry and analysis, while physicists would be introduced to powerful mathematical methods of interest in various fields of theoretical physics. The emphasis is placed on two complementary aspects of a physical theory, namely, the physical motivations of the features chosen for the model, and the use of mathematical reasoning in the selection of physical laws. The authors have taken great pains to discuss these aspects in detail and to go through entire calculations to make sure that the reader has had an ample opportunity to grasp the mathematical and physical justifications of the choices being made while the equations are built under his eyes, besides mastering the particular technique being displayed. The arguments are detailed and convincing, and are sparsed with very interesting and seldom-made remarks.

To be sure, the book is not a full-size encyclopedia of all the possible types of questions investigated in the field of general relativity, and one would search in vain the subject index for such words, now familiar to specialists, as news function, Möller's complex, or Petrov classification. But the book does not claim to be such an encyclopedia; as an introduction, it is quite complete and contains several topics which one would expect to find only in more advanced books, e.g., a discussion of the attempt to explain the perihelion advances classically by the Sun's oblateness, a study of the Cauchy problem in general relativity, a fairly detailed analysis of gravitational waves in the linearized approximation, and a brief exposition of Gödel's cosmological solution and of the "steady-state" theory. The book contains its own (very good) introduction to vector and tensor calculus. After the field equations are established and the spherical-symmetry cases are solved in both empty and nonempty space, the equations of motion and the conservation laws are reviewed. Two chapters are devoted to cosmology, the central role being held by the Robertson-Walker metric. The problem of the unification of gravitation and electromagnetism is examined in the last chapter, where Weyl's attempt (as something like a case study) and the "already-unified" field theory are exposed in some detail.

On the whole, this book may be considered an excellent modern textbook. In view of its clarity and completeness, it is among the best suited to self-study.

Fundamentals of Engineering Mechanics. By L. Levinson. Transl. from Russian. 350 pp. (P. Noordhoff, Groningen) Gordon & Breach, New York, 1965. $10.50.

Reviewed by T. Teichmann, General Atomic Division, General Dynamics Corporation.

The modern trend in teaching mechanics to beginning engineering students is to accentuate concepts rather than applications. If it is properly done, this approach has many advantages in the long run, particularly for the better students, though it must be admitted that many students find a more practical approach easier to digest at this stage. This Russian book