

straight-line trajectories are intrinsically distinguishable from all other particle trajectories. However, one cannot distinguish between different straight-line trajectories, hence the special relativity of straight-line motion. In the general theory there are *ab initio* no such distinguishable trajectories; all trajectories are equivalent, hence the general relativity of all motion.

Because of the small amount of new material contained therein, it is difficult to recommend the purchase of the second edition of Fock's book to anyone who already owns the first edition. However, for those who do not now own a copy of this book and are seriously interested in the field of relativity, it is strongly recommended that they obtain one of its editions.

Isobaric Nuclei with the Mass Number $A = 73$. By Ye. P. Grigor'ev. Translated from Russian by Prasenjit Basu. 48 pp. \$3.50.

Isobaric Nuclei with the Mass Number $A = 74$. By B. S. Dzhelepov. Translated from Russian by Prasenjit Basu. 58 pp. \$3.50.

Isobaric Nuclei with the Mass Number $A = 110$. By B. S. Dzhelepov and N. N. Zhukovskii. Translated from Russian by R. F. Kelleher. 90 pp. \$5.00.

Isobaric Nuclei with the Mass Number $A = 140$. By B. S. Dzhelepov, V. P. Prikhodtseva, and Yu. V. Khol'nov. Translated from Russian by Prasenjit Basu. 128 pp. \$5.00.

The translations were edited by Reginald W. Clarke and published by (Pergamon, Oxford) Macmillan, New York, 1963. Reviewed by Katharine Way, Oak Ridge National Laboratory.

Anyone who is starting out to make nuclear level schemes should read at least one of these four little books. Even old hands can learn something about the range of points to be considered and about useful tools of the trade.

Each booklet sets forth in detail the reasoning necessary in order to synthesize the experimental data on the production and decay of all known nuclei with a common A -value into a set of interconnected level schemes. Almost all of the types of data which one is likely to meet are considered somewhere in the series: data on gamma energies, intensities, coincidences, angular correlation, conversion coefficients, β -spectra, shapes,

ϵ/β^+ ratios, L/K capture ratios, etc. In each category the existing, usually discrepant, results are confronted, discussed, and analyzed to find their net contribution to the final picture.

The treatment of gamma-gamma angular correlation for ^{110}Ag seems particularly thorough. The kind of intensity balance sheet which is necessary in the construction of any complicated level scheme is set forth in detail for ^{140}Ce and ^{74}As . Assignment of gamma-ray multipolarities from K-conversion coefficients for high-energy gammas is compared with assignments from pair-production coefficients for ^{140}La .

In addition, there are a number of comparisons of particular values with systematic trends, checks often neglected by the experimenter whose attention becomes focused on a single nucleus. The booklet for $A = 74$ also contains "notes on possible experiments" showing how the data collection can be used to plan fruitful new investigations.

Those of us who are used to more condensed presentations will find that the arrangement of the material is not convenient. It is difficult to find the level schemes themselves and extremely difficult to look back and find the supporting arguments for some conclusions which are basic to later arguments; for example, the parity of the 2.925-MeV level in ^{110}Cd . (This reviewer never did locate it.) But one cannot have everything. A clear, concise format would preclude the unique feature of these booklets, namely the detailed discussions of the many steps which must be gone through before an informative level scheme can be constructed. Nowhere else have these been set forth in a systematic way.

The actual data of the booklets are out of date, as is the case with almost every publication in nuclear physics. The Pergamon Press date is 1963; the fine-print Moscow-Leningrad date, 1960. In the booklets for $A = 73$ and $A = 74$, there are no references to journals appearing later than 1959. The other two have a few 1960 citations. None, therefore, can be used as a summary of our present knowledge of a given A -chain. Even some 1959 European work is omitted, which shows that there is a

difficulty in communication in both directions between East and West. The price is high—5¢ to 7¢ per page. But the scientific quality is also high, resulting from a knowledgeable, sophisticated approach to the analysis of data by this group of scientists around B. S. Dzhelepov.

An Introduction to the Theory of Seismology (3rd ed.). By K. E. Bullen. 381 pp. Cambridge University Press, New York, 1963. \$9.50.

Reviewed by R. B. Lindsay, Brown University.

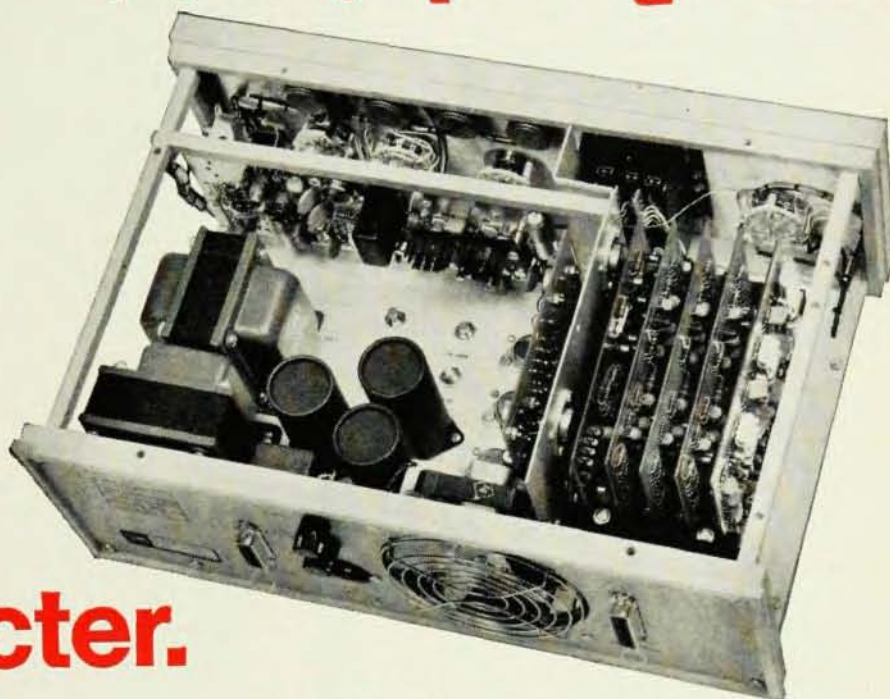
Earthquakes have long had a grim fascination for the human race, both because of the mystery of their origin and their often highly destructive character. Serious scientific study of them dates from the middle of the 18th Century, though the establishment of seismological stations did not begin until about a hundred years later. The mathematical study of seismology developed, of course, out of the analysis of mechanical wave propagation in the late 18th and early 19th Centuries. In this respect, seismology is a branch of acoustics, though a somewhat specialized one since elastic waves in solid media are in general more complicated than elastic waves in fluids.

The present volume is the third and considerably expanded edition of a highly successful general treatise on seismology, of which the first edition appeared in 1947. It contains in the first six chapters a good review of the general mathematical theory of elastic solids as well as vibrations and elastic waves, more or less equivalent to what one would find in a substantial book on mechanical radiation. The specific application to elastic waves in the earth begins in Chapter 7 with the study of propagation in a stratified sphere. The use of ray analysis as an approximation to the strict wave treatment is introduced early and used extensively.

Practical details are not overlooked, and there is an interesting chapter on the various kinds of seismographs and their modes of action. The nature and organization of seismological observatories are also discussed, as well as the employment of the observations obtained there to increase our knowl-



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edge of the nature of both the upper layers of the earth and its deep interior. The third edition contains much new material on long-period oscillations of the earth as a whole, and on the seismological detection of nuclear explosions.

The book contains an unusually thorough bibliography. From the clarity of its style and its ample coverage of material, the work should continue to be of great value to all workers in this important field of physical science.

X-Ray Optics and X-Ray Microanalysis. Symp. Proc. (Stanford, Calif., August 1962). H. H. Pattee, V. E. Cosslett, and Arne Engström, eds. 622 pp. Academic Press, New York, 1963. \$22.00.
Reviewed by L. Marton, National Bureau of Standards.

The triennial series of symposia on x-ray microtechniques publishes its proceedings under varying titles. The first of these symposia was published under the title *X-ray Microscopy and Micro-radiography*. The second had in common with the present third one, the title: *X-ray Optics and X-ray Microanalysis*. The emphasis, however, has shifted this time quite considerably with a greater emphasis on x-ray microanalysis than on the other techniques. Simple statistics illustrate this point better than anything else. Of the sixty papers presented at the third symposium, 52 are contained in the present volume. Due to lack of space, eight had to be omitted. More than a third of all the papers deal with the Castaing technique; in the present volume twenty papers are devoted to this last subject, twelve to all aspects of instrumentation of x-ray optics, two to metallurgy and mineralogy, eleven to biology, and only seven to physics. The distribution of the unprinted papers is roughly the same.

Among the physics papers one of the longest and best documented is by Vittorio Luzzati on "Small Angle X-Ray Scattering on an Absolute Scale." Quite interesting is W. Hink's contribution on "Spectral Emission of a Microfocus X-ray Tube" as well as a paper by M. Green on "The Efficiency of Production of Characteristic X-Radiation." Another contribution worth mentioning is that of G. L.

Johnson and R. F. Wuerker on "Reflectance Measurements at Carbon-K and Beryllium-K Wavelengths."

Instrumentation papers contain many ingenious ideas. I would like to pick out a contribution by Paul Kirkpatrick on "Grazing-Incidence Telescopic Systems" as well as the paper by W. Petzold and W. Hink on "Substratum Influence on the Reflectance of Aluminum Vapor-Deposited Films for X-Rays."

The papers which have not been printed in the volume are listed in the preface. Out of the eight listed, I would have liked to have seen at least two, one by Pattee on "Selected-Area, Soft X-Ray Microdiffraction", and Friedman's "X-Ray Astronomy." There is some justification for not including the "X-Ray Astronomy" paper because after all his is not an x-ray microtechnique contribution and it has been published elsewhere. Nevertheless it would have been stimulating for those reading on x-ray microtechniques to have an inclusion of a not too distant area where techniques are somewhat similar to the ones employed by the microtechnique.

Point Defects in Metals. By A. C. Damask and G. J. Dienes. 314 pp. Gordon & Breach, New York, 1964. \$19.50. Professional edition (individuals only) \$9.50.
Reviewed by R. Smoluchowski, Princeton University.

Even those who have only a nodding acquaintance with the solid state know that the expressions "crystal clear" and "crystal perfect" are the result of a misunderstanding. The ideal and esthetically very attractive notion of crystalline order is only a rough first approximation to physical reality. The next step, the consideration of crystalline defects, is a condition *sine qua non* for a proper understanding of most of the observed facts. The plethora of various defects, their complementarity, symmetry, interrelation, and interaction remind us in many ways of the abundance and nature of elementary particles in nuclear physics. There are two defects which are truly basic and particularly simple: the vacancy and the interstitial. To be sure the crystalline surface is an even more basic and unavoidable defect but for various reasons it is an

exceedingly complicated imperfection and elusive both from theoretical and experimental points of view. In solids other than metals, vacancies and interstitials involve serious electronic perturbations which make their complete understanding considerably more difficult than in metals. For this reason the greatest progress has been made in the area of "point" defects in metals. Damask and Dienes' book provides an excellent systematic introduction into this very active field by giving an up-to-date summary of the experimental facts and of the theoretical background.

For many readers the book's most valuable part will be its last and longest chapter which describes some of the essential experimental facts on which our present knowledge of point defects in metals is based. In a very clear, concise, and impartial way the various results are discussed and the conclusions concerning such areas as quenching, irradiation, plastic deformation, mechanical properties, and annealing are presented. The first chapter is devoted to a treatment of the general theory of point defects, and, apart from a couple of short excursions into statistical mechanics, it requires either none or only the simplest mathematical tools. The arguments are usually presented in the language of thermodynamics and physical chemistry. The quite spectacular recent computational results on the formation and stability of various radiation induced defects are fully discussed. The subsequent chapter on the formalism of annealing kinetics as related to the atomic mechanism is an excellent summary of the authors' most recent contribution in this field. A very useful discussion of the numerous methods of determination of activation energies from the analysis of annealing curves is given in a separate short chapter. Finally a chapter is devoted to the relation between point defects and various measurable properties such as neutron transmission, lattice constants, stored energy, electrical resistivity, etc.

The book is eminently suitable for an experimentalist and a theoretician as a key to the whole area of point defects in solids. The accent is on reasonably well established facts and