

developed. Perhaps there are new kinds of laws that physics and chemistry have not even hinted at.

The format is excellent; there are many bibliographic references for each chapter; mathematical equations are properly and well printed; there is a generous number of illustrations; and there is a subject and an author index.

Introduction to the Atomic Nucleus. By J. G. Cuninghame, 220 pp. Elsevier, Amsterdam, 1964. \$9.00.

Reviewed by J. E. Mansfield, Harvard University.

What we have here is a list of the results of nuclear physics, with commentary, intended primarily for chemists. There are some interesting features, though, that make it handy for the physicist. It is small—surely more of a handbook than the doorstops that usually bear this title. The technique is to describe a topic briefly, give the principal results, and refer to the basic papers listed after each chapter. It is a nice touch to give the page number of this reference section at the foot of each page.

The topics covered are quite various: nuclear forces, models, reactions; fission, radioactivity, interactions with matter. Thus it parallels the larger texts, like Evans, in about one-fifth the detail. The usefulness of such a book is of course dictated by one's needs. I do not see it as a bestseller for nuclear theorists. It has, however, definite attractiveness for the rest of the world. One would have expected—and welcomed—something on radiochemistry, the author's field.

Traité de la Méthode Scientifique. By René Leclercq. 215 pp. Dunod, Paris, 1964. Paper 18F.
Reviewed by R. B. Lindsay, Brown University.

Science has proved to be such a powerful tool for the handling of human experience that it is not surprising that examination of what makes it work has attracted the attention of many thoughtful people. Just how is it that some people are able to develop the clever ideas that enable us to talk successfully about nature and, what is more, do something about it in the invention of

gadgets? The volume under review is another in a long series of attempts to understand the character of scientific discovery and invention. The author in his introduction sets forth his aim as the clearest possible exposition of the mechanism of discovery and invention. By this he apparently means not only the logical analysis of the structure of scientific theories but also the psychological study of the way in which theories are invented. The latter in particular is a large order, and it must be confessed that little that has been written even by successful creative scientists themselves has really helped to supply useful recipes for scientific invention. Nevertheless, Mr. Leclercq's book casts interesting light on the whole problem.

The author begins by reviewing briefly his conception of the nature of science. Here he takes a rather broad view in that he looks upon science as satisfying not merely the human desire to *understand* but also the need to *act* effectively on the environment. Thus he effectively combines in a single discipline what are more commonly considered to be the two activities; science as such (or pure science) and technology. The treatment of the method of pure science is conventional, but is a useful review. This is followed by a long chapter on the historical development of the scientific method. In the opinion of the reviewer this would have been even more valuable than it is had the author traced the evolution of the present, powerful technique of the inductive-deductive method of scientific theorizing. Instead he enumerates and discusses briefly such special aspects as empiricism, dialectic, mathematical analysis, morphology, etc.

The gist of the book is found in two chapters entitled respectively "The Psychological Method" and "The Logical Method". The first deals mainly with the mental factors which have characterized creative scientists. The second (the longest in the volume) is essentially an attempt to apply symbolic logic to the analysis of theories and the criteria for their success. There are numerous illustrations, chosen mainly from the physical

sciences. Emphasis is laid on the methodological studies of Destouches and Février. The author concludes with a brief survey of the role of cybernetics in scientific research, with considerable attention to the use of computers of various kinds.

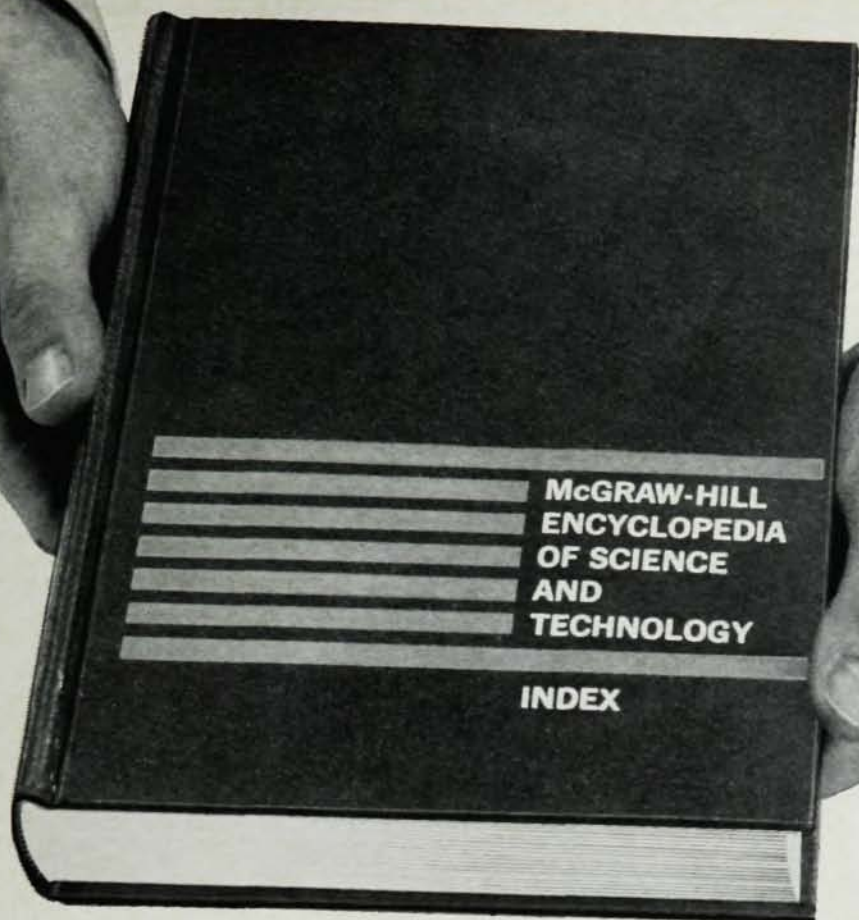
The bibliography, though gratifyingly extensive, would have been more useful had it been collected in one place instead of being scattered throughout in the form of footnotes. On the whole this book is a valuable addition to the growing library on the philosophy and psychology of physical science.

Phase Transitions. By Robert Brout. 202 pp. Benjamin, New York, 1965. \$9.00.
Reviewed by Stuart A. Rice, University of Chicago.

Every scientist interested in phase transitions will want to own a copy of the book under review because this is primarily a book of ideas. The present understanding of the nature of phase transitions is, to say the very least, primitive. As a result, almost all transitions have been discussed primarily within the framework of the molecular-field model. But even within this framework there have been inconsistencies and misunderstandings.

At first reading, Professor Brout's text appears superficial, but on re-reading this feeling is dispelled when it is realized that the analytical problems confronted in a mathematical theory of phase transitions are in almost all cases too subtle for current techniques. In view of this, I find the physical arguments and the graph-theory arguments given by Professor Brout suggestive of directions in which our understanding of the subject may be materially improved. As is attested by several footnotes referring to later work, the subject is in a state of flux so that several of the comments in the text had to be amended.

The greatest use for this text will be as a stimulant to further work and as a source of ideas for extensions of the theory using both physical and mathematical arguments. On these grounds I recommend it to all those interested in the statistical mechanics of condensed matter.



New! **Your key to every scientific and engineering problem**

Announcing the new, revised edition of the reference work which *Scientific American* called, "A first-class tool without substitute." The extraordinary volume you see here puts at your fingertips the latest information on over 100,000 subjects in every engineering and scientific field. It is the heart of a unique *Information Center* in encyclopedia form developed by McGraw-Hill. For concise, authoritative answers to specific questions that come up on the job...for consultation when your work leads you into areas outside your specialty...for keeping abreast of new developments over the whole spectrum of today's exploding technology...there has never been anything like this ready-reference tool.

More than 2,000 respected leaders of science and industry have pooled their knowledge and experience to create this *Information Center*. Here you will find every theory, concept, term...every significant new discovery and application...every major problem currently under study...precisely classified and described in 15 volumes of amazing usefulness. For a free illustrated Prospectus with complete details, simply mail the coupon. There is no obligation, of course. McGraw-Hill Encyclopedia of Science and Technology, 331 West 41st Street, New York, N.Y. 10036.

McGraw-Hill
Encyclopedia of
**science and
technology**



331 West 41 Street, New York, N.Y. 10036

Please send your free illustrated Prospectus with full details of this new *Information Center* for engineers and scientists. I understand there is no obligation.

Name

Address

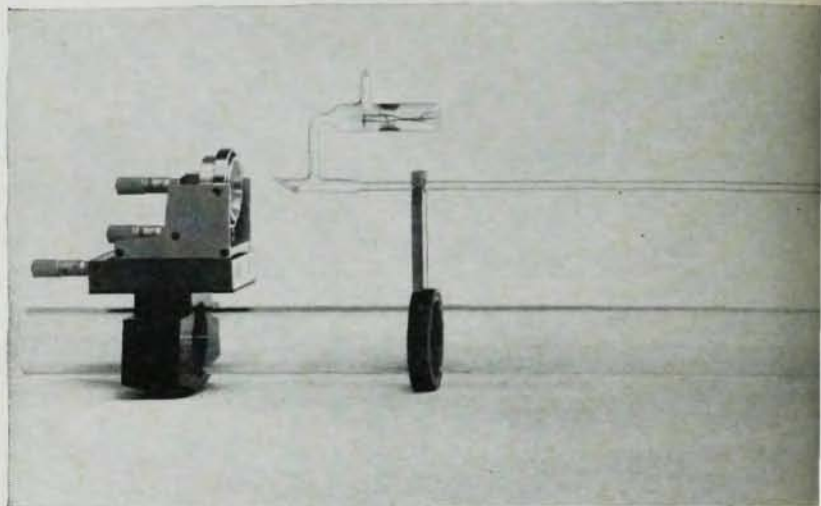
City

State Zone or Zip No.

Profession

Physics Today—10-65

as easy as



PAS Laser Resonator with Gimbal Mounted Mirrors.

Precise, quick, repeatable position

You can construct versatile, sophisticated experimental apparatus using the various components and systems available to you from Lansing Research Corporation.

Translation Stages

The TR 100 series precision linear translation stage provides zero shake, low friction, linear translation. Three pre-loaded recirculating ball bushings in the moving platform travel on hardened centerless ground rods. This low break-away friction design overcomes the problems encountered when making very small translations with surface contact devices.

- x,y-motion is obtained by stacking two translation stages using a stacking plate accessory.
- x,y,z-motion is provided by adding a variable height stage (TR-183) to the pair of stacked TR's.

Gimbal Suspensions

GS 200 and GS 500 series Precision Gimbal Suspensions allow rotation of a mounted element about two orthogonal axes. Two gimbal rings, independently suspended about vertical and horizontal axes, are mounted on a rigid base structure. Gimbal rotation is obtained through a precision micrometer or differential screw drive employing direct magnetic coupling between the drive spindle and gimbal.

The GS 200 and GS 500 series are nominally designed for two and five inch diameter optical or mechanical elements respectively. Accessories include adaptor sets for mounting other diam-

eter elements (GS 001 or 010); element rotators permit continuous rotation of the mounted element about an axis thogonal to the plane defined by the two axes of gimbal rotation (GS 003); piezoelectric devices for microtranslation of mounted element (PD 203).

SPECIFICATIONS	TR-115	TR-155	TR-132	TR-142	TR-162	TR-183
MAXIMUM TRAVEL	1	0.05	1	0.05	.01	1
MINIMUM TRANSLATION	.0001	.000005	.0001	.000005	.000001	.00
LOAD CAPACITY	100	100	100	100	100	10
LENGTH OF BASE	7	7	5	5	5	3 D
WIDTH OF BASE	7 1/2	7 1/2	4	4	4	
HEIGHT OF MOVING	1.125	1.125	1.125	1.125	1.125	185 A
SURFACE						
DIMENSIONS ABOVE ARE POUNDS, INCHES.						
DELIVERY	STOCK	STOCK	STOCK	STOCK	STOCK	STO
PRICE	\$185.00	\$260.00	\$135.00	\$210.00	\$210.00	\$180
DRIVEN BY	MH 301	DS 505	MH 301	DS 505	DS 501	

DRILLED AND TAPPED FOR MOUNTING.

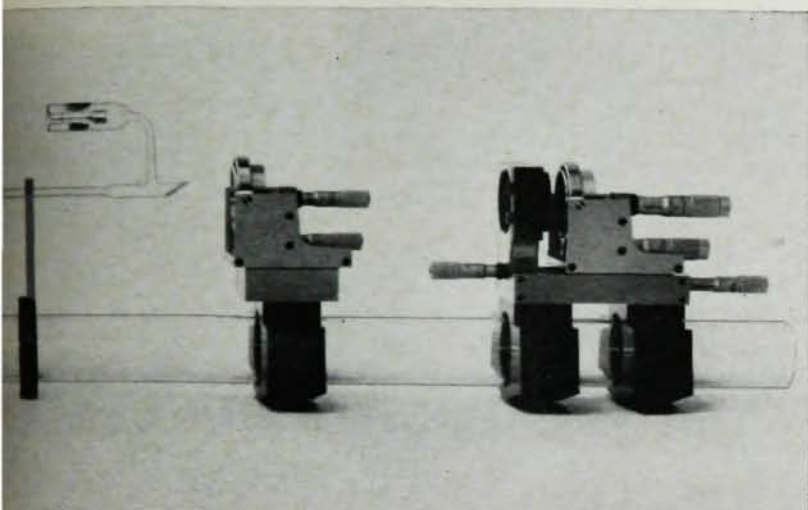
All Lansing Research Corporation devices may be obtained either a MH 301 precision micrometer head or a new DS series Differential Screw Device, capable of controlled mechanical translations as small as a wavelength of light.

Scanning Fabry-Perot Interferometers

The FP 200 series Scanning Fabry-Perot Interferometer stable Fabry-Perot cavity with both variable mirror spacing and piezoelectric scanning. Three models are offered; the

LANSING RESE

Y, Z, θ , Φ , Ψ



PD 203 Scanning Fabry-Perot Interferometer.

f optical and mechanical elements.

SPECIFICATIONS	GS-203	GS-253	GS-503	GS-553
RESOLUTION (seconds)	1	0.1	0.5	.05
RESETTABILITY (seconds)	6	0.6	3	2
TOTAL ANGULAR MOTION (deg.)	15	1.5	6	1
APERTURE	1.175	1.75	4.75	4.75
MAXIMUM OD OF MOUNTED ELEMENT	2.00	2.00	5.00	5.00
WIDTH	4	4	7 $\frac{1}{2}$	7 $\frac{1}{2}$
HORIZONTAL ROTATION	2 $\frac{1}{2}$	2 $\frac{1}{2}$	4	4
AXIS ELEVATION				
OVERALL HEIGHT	3 $\frac{1}{2}$	2 $\frac{1}{2}$	7 $\frac{1}{2}$	7 $\frac{1}{2}$
LENGTH AT BASE	4	4	6	6
DIMENSIONS ARE IN INCHES				
ACCESSORY SERIES	GS-000	GS-000	GS-010	GS-010
DELIVERY	STOCK	STOCK	STOCK	STOCK
PRICE	\$145.00	\$295.00	\$245.00	\$395.00

201 with a large semi-fixed cavity; the FP 202, which adds a TR 132 to the FP 201 to provide continuous variation over a one inch dimension at any fixed separation; the FP 203 with a shorter cavity (5.5 cm max.), continuously variable over 2.5 m.

The piezoelectric scanning unit used in these devices may be obtained separately as the PD 202, in a fixed mount for independent application, and PD 203, used as the inner gimbal of a GS 203 or GS 253 gimbal suspension.

FP 201, \$850.00. FP 202, \$985.00. FP 203, \$835.00.
PD 202, \$235.00. PD 203, \$235.00.

Position and Support Systems

Lansing PAS 700 series Position and Support systems provide a versatile and reliable means of assembling optical and mechanical elements in a stable configuration.

The mounting rods are Corning 7913 or 7740 glass. 7913 glass has a linear coefficient of expansion of 0.45×10^{-6} per $^{\circ}\text{F}$., and 7740, 1.8×10^{-6} per $^{\circ}\text{F}$. (For comparison, Invar has a linear coefficient of expansion of 0.45×10^{-6} per $^{\circ}\text{F}$, steel 6.3×10^{-6} , aluminum 12×10^{-6}).

One, two, and three rod systems are standard. Accessories include laser tube mounts; one inch on center tapped plates; special element mounts, right angle mounts for construction of thermally stable glass rectangles for Mach-Zehnder and other interferometer configurations; variable angle mounts for Brillouin scattering experiments.

Catalog & Other Products

Complete product descriptions, specifications, prices, pictures and application information are in our new Product Catalog (No. 2).

For your copy of this new catalog or for answers to questions concerning these products, please write or phone:

PO Box 81, Ithaca, New York 14851
Telephone 607-272-3265

CORPORATION

The writing of a book requires a great deal of time and labor. To write one on a subject which is poorly understood and which is changing rapidly can only be construed as the act of a brave man, and we should all be grateful to Professor Brout for having provided us with the text in question.

Lectures on General Relativity. Summer School Proc. (Brandeis U., 1964). By A. Trautman, et al. 459 pp. Prentice-Hall, Englewood Cliffs, N. J., 1965. Paper \$5.00. Reviewed by Jacques E. Romain, Centre de Recherches Routières, Sterrebeek, Belgium.

The proceedings of the 1964 Brandeis Summer Institute of Theoretical Physics consist of two parts, devoted respectively to general relativity and to quantum field theory. This first volume is made up of three lectures by outstanding specialists. Pains have been taken to integrate the contributions and to provide cross-references among them.

A. Trautman's "Foundations and Current Problems of General Relativity", which takes over half the space, is a full book in itself. It constitutes a self-contained and up-to-date course covering the essential aspects of general relativity. It is written at a high level and contains brief expositions of the required mathematical tools. The approach is decidedly geometric. Trautman's exposition is one of the best available introductions to the new formalism which has recently invaded the field and which may obscure the physics behind the theory unless the physical interpretations of the mathematical concepts are clearly grasped. The author's profound remarks will be a great help in this respect. In order to take full profit from this presentation, the reader should have a reasonable advance knowledge of standard general relativity.

F.A.E. Pirani contributes a sizable and authoritative introduction to gravitational wave theory. Again the theoretical level is high. The author begins with physical aspects, then introduces spinors and bases the bulk of his exposition on spinor formalism.

Under the title "Some Special Solutions of the Einstein Equations", H.

Bondi presents not a complete and systematic exposition, but a beautiful, crystal-clear, and humorous discussion of the principles of both special and general relativity, followed by an analysis of problems principally related to gravitation-wave emitters and receivers. His purpose is to make the reader feel the physics behind the formalism, and to conjure away the "black magic" feeling. The approach is stimulating and illuminated by a lot of cleverly presented thought experiments. This essay is very good reading for anyone, including the seasoned specialists.

It is good fortune that such a unique and consistently excellent book is available at a moderate price. It must not be absent from the bookshelf of any relativist, even though it is, quite unfortunately, not provided with a subject index.

Progress in Optics, Volume 4. E. Wolf, ed. 327 pp. (North-Holland, Amsterdam) John Wiley, New York, 1965. \$13.50. Reviewed by H. E. J. Neugebauer, Xerox Corporation, Brussels.

Many are the branches of optics. This is evidenced by every new volume of *Progress in Optics*. Its editor does not seem to forget a single one. Volume 4 offers articles ranging from abstract theory to experimental studies almost falling into the field of chemistry. A critical remark may be in place: The volume would certainly have gained if the editor had had the time to rewrite two or three of the articles. He has demonstrated in his book and many scientific publications how lucid a writer he is.

Focke's clear and concise review of higher-order aberration theory can be recommended as summary for the experts and as introduction for the reader less familiar with this branch of optics. It is a welcome supplement to M. Herzberger's publications on the subject. Bryngdahl's "Applications of Shearing Interferometry" reflects the author's mastery of the subject, both experimentally and theoretically. Many people might think that surface deterioration of optical glass by chemical reactions is hardly a field of optics. Yet, Kinoshita's article should be read by everybody concerned with the design and use of optical systems. It

is also proof that a less known field may be represented in a way arousing the interest of an uninitiated reader. The article on optical constants of thin films by Rouard and Bousquet is remarkable for drawing a clear line between older determinations of optical constants based on erroneous assumptions and incomplete theories as opposed to more recent work. Much of the older work is relegated to that of historical interest. The reader obtains a vivid impression of how much must still be done after the older work has lost some of its value. Wedford's "Aberration Theory of Gratings and Grating Mountings" leaves the reader with the impression that this is one of the simplest chapters of optics. Yet, nothing of importance seems to be omitted.

Two articles are concerned with diffraction theory. Both authors, Rubinowicz on the Miyamoto-Wolf diffraction wave and Kottler on diffraction at a black screen, are given to reminiscing. Rubinowicz renders a good account of the modern theory of the diffraction wave in scalar, electromagnetic, and quantum field theory. Unfortunately, his melancholy statement that an ingenious theory sometimes produces little effect in related branches of physics may prove correct. Kottler confines himself to older scalar theories. It is hoped that the promised second part will include all the modern developments, both, in theory and experiment.

Studies in Penetration of Charged Particles in Matter. 388 pp. National Academy of Sciences—National Research Council, Washington, D. C., 1964. Paper \$7.00. Reviewed by J. E. Mansfield, Harvard University.

Often a program of preparing a state-of-the-art report so stimulates research that it is nearly impossible to produce a timely report. The fast pace of developments has brought about such a situation since a subcommittee of the NRC Nuclear Science Committee undertook to unify the extremely varied recent results in one of the pioneer branches of modern physics. The result is this collection of twelve reports in considerably greater detail than is usual in the literature. Fano's reprinted review of the theory of