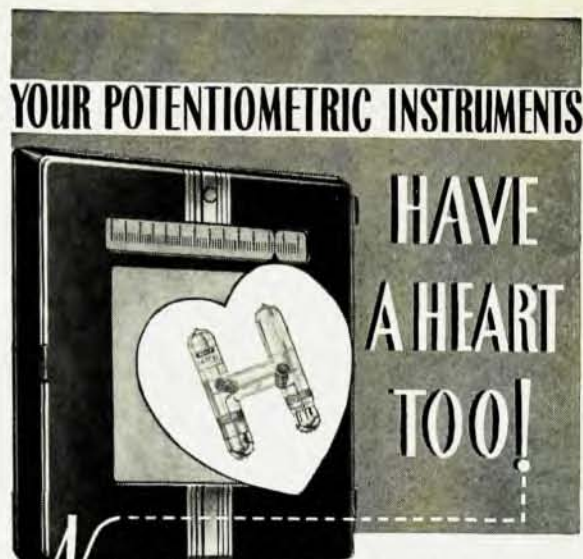




No matter how perfect otherwise, the human organism isn't much good without a dependable heart. The same is true of your automatic temperature and pH control instruments. The "heart" of most such instruments for the past quarter century has been the Eplab Standard Cell. It is a "yardstick" for translation of voltage to temperature or pH. The first American commercial cell of its type, constantly improved by research, it is "as standard as sterling". Get ACCURATE temperature or pH control with potentiometers and make sure the standard cells are EPLAB.

The Eppley Laboratory, Inc.

10 SHEFFIELD AVE.
NEWPORT, R.I.

EPLAB Standard CELLS
FOR POTENTIOMETRIC INSTRUMENTS
"As Standard as Sterling"

The text, from the viewpoint of a physicist, at least, could be improved by a more careful attention to detail and accuracy in the statement of physical principles. An example of this is the treatment given to "spin"; in Chap. 38, "Nucleonics for the Biologist", we find the statement "An additional property, *spin*, is the same for all [elementary particles], having the value $\frac{1}{2}$ ". There are two objections to this sentence. The obvious one is its incorrectness. The other objection, which is perhaps the more important, is that this is the only mention made of the concept of spin. Such a meager reference only serves to confuse the student. It would have been much better, if space did not permit a fuller discussion, to have omitted any mention at all of the concept. Several other examples of this type of thing have been forced into the text by the attempt to include as much material as possible into a reasonable number of pages.

These shortcomings of the book mean only that a course based on it will require careful attention and additional amplification by the instructor. However, as a basic outline of a broad and increasingly important field the book should find a receptive and enthusiastic audience.

Mesons and Fields; Vol. 1: Fields. By S. S. Schweber, H. A. Bethe, and F. de Hoffmann. 449 pp. Row, Peterson and Co., Evanston, Ill., 1955. \$8.00. Reviewed by Freeman J. Dyson, *The Institute for Advanced Study*.

I wish this book were as good as Volume 2, which the publishers, either by good luck or good judgment, put on the market first. In the blurb they say that Volume 1 "uses as the main basis Dyson's approach to field theory". So the unpleasant things I shall say about the book are aimed at myself as much as at the authors. When Einstein was asked his opinion of certain physicists who become too firmly attached to their own ideas, he answered with the German proverb "Eigener Dreck stinkt nicht", which may be translated, "Nobody minds the smell of his own dirt". These words state a general principle which is usually valid; but there are exceptions to it, and I am one of them.

As I read through the book I am overwhelmed with a feeling of monumental dullness. Why did the theory of fields, the dragon which we fought with such high hopes in 1947-49, end up as such a tame insipid beast? Is it true that field theory is a dull subject, or is it only dull writing that makes it seem so? These questions need an answer, and I shall try to answer them.

I believe, in spite of appearances, that the meson field theory has a vital part to play in the description of nature. I say in spite of appearances, because the theory is full of mathematical inconsistencies, and nobody yet has found a way to deduce from it any precise consequence which could be proved or disproved by experiment. Here lies the paradox, the unexpected and exciting twist; we have a theory which is basic to our whole way of thinking about mesons, and still we do not know

what this theory predicts that mesons should do. That is the real, tantalizing mystery of field theory. And here is a book which expounds the whole subject with as much excitement as if it were a recitation of the multiplication table.

The following is a summary of the book's contents. First, 150 pages establishing from first principles the formal mathematical machinery of field quantization and deriving the various types of relativistic field equation. Next, 200 pages of detailed exposition of the rules for calculating observable quantities from the theory, using a perturbation theory in which the interactions between particles are considered to be small. Finally, 50 pages which are in the style of a review article, listing and briefly discussing a huge number of papers which have appeared in the research journals during the last 7 years.

The depressing effect of the whole work arises from the combination of bad style and bad subject matter. I shall deal first with the question of style. The authors follow the policy of writing out in full detail all the steps in their calculations. This policy is not objectionable, and is even helpful to the reader, if it is pursued in moderation. But when elementary algebraic derivations from equation x to equation $x + 1$ occupy so great a bulk as they do here, the result is that the salient points of the argument are buried and obscured. The tedium of the dull stretches is greatly increased by the repetition of a meaningless phrase, "Now it is evident that", "However as we have seen", "Thus", "Therefore", or "Furthermore" at the beginning of almost every sentence. Good English abhors conjunctions at the beginning of sentences. In this respect, as also in his choice of subject matter, Heitler in the first edition of his *Quantum Theory of Radiation* set a high standard which has not been equaled by any later textbook.

Here the choice of subject matter is bad in two ways. First, throughout the book there is an emphasis on formal mathematical machinery and a neglect of physics. Second, the long central section, which comprises the main part of the book, is devoted to perturbation calculations treating the particle interactions as small. Since meson interactions are not small, these calculations have useful applications only in electrodynamics and not in meson physics. If the book were titled as a textbook in quantum electrodynamics, it would make sense to fill half of it with such calculations. In a book which claims to be an introduction to meson physics, it makes no sense.

What is conspicuously lacking in the whole exposition is a critical and enquiring mind. From the mathematical mumbo-jumbo of renormalization, to the rituals of perturbation theory in which large quantities are assumed to be small, everything is solemnly presented to the reader as a sacred dogma, which it would be impious to question. I happen to believe that there is a place for renormalization and perturbation theory, even in meson physics. But even the most fervent believer should be aware that in matters scientific his beliefs

Published March 1956

Science and Information Theory

By LÉON BRILLOUIN

Department of Physics, Columbia University,
New York

March 1956, 320 pp., illus., \$6.80

The information content of a message or observation is defined in terms of the statistical probability of its occurrence. The theory of information deals with the implications and applications of this definition, without regard to any meaning or value inherent in the message or observation.

This new theory which has been developed in recent years has found wide applications in different fields: telecommunications, computing, pure physics, discussion of the fundamental process of scientific observation.

Science and Information Theory contains a clear and concise presentation of the new theory as well as applications to a number of special problems which are worked out in detail. The author also devotes one section of the volume to the relation between information and entropy.

All researchers working in the physical sciences,—particularly theoretical and experimental physicists, electronic, communication and radio engineers,—will welcome Dr. Brillouin's book, which may well open new vistas on a topic of steadily increasing importance.

CONTENTS:

The Definition of Information
Application of the Definitions and General Discussion
Redundancy in the English Language
Principles of Coding, Discussion of the Capacity of a Channel
Coding Problems
Error Detecting and Correcting Codes
Applications to Some Special Problems
The Analysis of Signals, Fourier Method and Sampling Procedure
Summary of Thermodynamics
Thermal Agitation and Brownian Motion
Thermal Noise in an Electric Circuit; Nyquist's Formula
The Negentropy Principle of Information
Maxwell's Demon and the Negentropy Principle of Information
The Negentropy Principle of Information in General Physics
Observation and Information
Information Theory, the Uncertainty Principle, and Physical Limits of Observation
The Negentropy Principle of Information in Telecommunications
Writing, Printing, and Reading
The Problem of Computing
Information, Organization, and Other Problems
Index.

ACADEMIC PRESS INC., PUBLISHERS
125 EAST 23 STREET NEW YORK 10, N.Y.

PHYSICISTS ENGINEERS

SEMICONDUCTOR DEVELOPMENT

Responsible positions are now available with one of the leading and fastest growing manufacturers of semiconductors. These are outstanding opportunities in research, development or applications of advanced silicon and germanium transistors.

You'll be located in pleasant, suburban Boston where cultural and educational advantages are found for you and your family. And you're only an hour's drive from New England's vacationland.

Send resume or call

Transitron electronic corporation
407 MAIN STREET, MELROSE, MASS. MELrose 4-9600

EXPERIMENTAL and/or NUCLEAR PHYSICIST

For responsible stimulating Research and Development positions with the nation's leading firm in the field of continuous process measurements and automatic control systems.

Make your own future in

Radiation Sources
and Detectors
Ionization Chambers
Ultraviolet
Spectroscopy
Scintillation Crystals
Nuclear Magnetic
Resonance

Beta
Gamma
Neutron
Infra-red
Phosphors

also

Development of transducers for continuous measurement of viscosity, pressure, temperature, density, flow and chemical composition of process streams.

**Industrial
Nucleonics**
CORPORATION

1205 Chesapeake Ave. Columbus 12, Ohio

Control the Modern way... with AccuRay

are open to doubt. In a book of 400 pages there should have been space for a careful and critical discussion of the still open question, whether the relativistic field theory of mesons and nucleons has any relevance to the real world.

To avoid misunderstanding, I should like to add that my favorable opinion of Volume 2 is not changed by the failure of Volume 1. In style and subject the two volumes are completely different. In Volume 2 the authors argue warmly in favor of the practical usefulness of meson theory. They are obviously enthusiastic about it. But they are not uncritical.

Hochvakuum-Elektronenröhren. Vol. I of Physikalische Grundlagen. By H. Rothe and W. Kleen. 297 pp. (Akademische Verlagsgesellschaft, Germany) Academic Press Inc., New York, 1955. \$8.33. Reviewed by M. W. Muller, Varian Associates.

This is the first of four books comprising an extensive revision of the well-known classic on vacuum tubes. It is to be followed by volumes on Vacuum-Tube Characteristics, Input Amplifiers, and Interference Phenomena.

Since the publication of the earlier version of this work (1940-41) the field of vacuum-tube technology has made enormous strides; in particular the emphasis on high-frequency applications has led to a heavy concern with tubes of the disc-seal and electron-beam varieties. The present volume does justice to the physical background material called for by these advances; the inclusion of the new material justifies the increase in the total length by a factor larger than two.

The only portions of the book that have been taken over from the earlier work without extensive changes are the chapters on secondary electron emission and on the laws of the diode. Even here, however, new sections have been added to give a treatment of spherical electrode geometry, so important in the design of modern electron guns. By the inclusion of tables and graphs of numerical values of current relations and transit times the authors have succeeded in making these portions of their book a self-contained and readable encyclopedia of the diode.

The chapters on electrode field calculations, amplification factors, interelectrode capacities, and current division in multi-electrode tubes have similarly been enlarged so as to include an adequate compendium of information for the designer of vacuum tubes. Especially noteworthy are the discussions of numerical and analog methods for solving Laplace's equation, the remarks (pp. 104-107) on characteristic properties of plane and axially symmetric fields, and the tabulations and graphs of simplification factors.

The chapters on electron trajectories, optics, and beams are essentially new, and provide a usable outline of these topics for the vacuum-tube engineer. The coverage here is somewhat less comprehensive, but enough detailed information is included to make the treatment useful as a reference as well as a textbook. One finds,