mechanism of the scintillation process in organic materials (crystals, liquids, and plastics) and in inorganic crystals, particularly the alkali halides. Detailed consideration is given to those features of the scintillation process (in organics) that lead to a dependence of the scintillation efficiency on dE/dx of the exciting particle (ionization quenching). The origin of the "slow" scintillation component in organic crystals is discussed in some detail, and several alternative theories are summarized. The treatment of the scintillation process in alkali halides is focused largely on effects responsible for the dependence of scintillation efficiency on ionization density. The experimental and theoretical situation is reviewed thoroughly, and Birks discusses the close analogy between the behavior of alkali halides and that of organic crystals.

Category (b), the "practice" of scintillation counting, accounts for most of the material in the book. The detection of scintillation events is treated in a chapter that considers the problems of light guides, photomultiplier spectral response functions, electron multiplication, the energy resolution of scintillators, and time resolution. Included is a comprehensive table giving the characteristics of almost 100 different photomultiplier tubes available from U S and European manufacturers. The various sources of line broadening in gamma-ray and charged-particle spectroscopy are considered, and the author gives a valuable critique on the effects responsible for the gamma-ray line width in NaI(Tl). Four chapters are devoted to the properties and applications of various organic crystals, liquids, and plastics, with liberal documentation in the form of tables and graphs. Gamma-ray spectroscopy with NaI(Tl) is treated in detail. Electronic instrumentation which follows the scintillation counter (i.e. from pre-amp to multi-channel analyzer) is not considered in this book.

In summary, this volume will undoubtedly serve as a standard reference and source book for those engaged in the development or uses of the scintillation method. Fortunately, the delay between writing and publication has been minimized; references to the 1963 literature are included. Although it is not directed primarily to students, the book is written in a lucid manner permitting the nonspecialist to read, profitably, sections of interest to him. It might also be noted that the study of the scintillation process per se provides a valuable insight into many aspects of the interaction of radiations with matter and the subsequent transfer and dissipation of energy. Birk's book should, therefore, prove to be of considerable value to those interested in the general subjects of radiation physics and chemistry.

R. B. Murray received the PhD degree in physics from the University of Tennessee while he was a Pre-Doctoral Fellow at Oak Ridge National Laboratory. He has been a member of the research staff at ORNL since then, with the exception of one academic year spent as Visiting Associate Professor at the University of Delaware. His research activities have included studies of the scintillation process in activated alkali halides and, currently, the relation between color centers and luminescence in alkali iodides at low temperature.

. . . AND THE MOST COMPREHENSIVE WORK ON THERMAL CONDUCTIVITY OF REAL GASES AND LIQUIDS

Title Thermal Conductivity of Gases and Liquids

Author N. V. Tsederberg

Translator Scripta Technica (Russian to English); Robert D. Cess, editor

Publisher The MIT Press, 1965

Pages xiv + 246

Price $12.50

Reviewer John C. Chen

This is an English-language version of a monograph originally published in the Soviet Union. To the best of my knowledge, it is the most comprehensive work devoted to the thermal conductivity of real gases and liquids currently available. Literature in this field dates back almost a hundred years, and a book that seeks to review critically all the scattered publications, to examine the various theories, and to compare experimental results should be welcomed by any worker in the field.

The author maintains a good balance between the idealized ramifications of theory and the practicalities of experimentation. Thus, the first chapter discusses basic experimental methods for measurement of thermal conductivities, while the second chapter reviews the major theories for calculating thermal conductivities. The inherent uncertainties of each are discussed, and then theoretical and experimental results are compared. This same approach is taken throughout the book.

Subjects discussed include calculation of gaseous thermal conductivities from kinetic theory, temperature dependence of thermal conductivities for gases at near atmospheric pressures, and thermal conductivities of gases under high pressures, of liquids at both atmospheric and high pressures, of gaseous or liquid mixtures, and of gaseous plasmas. The discussions on conductivities of mixtures deal with mixtures of both reactive and inert gases and with both nonionic and electrolytic solutions.

References are well documented. The book presents a total of 336 references, of which approximately half are from Russian sources. This rather complete and up-to-date summary of Russian work would in itself be of interest to many research workers in the English-speaking countries.

To me, one of the most valuable aspects of this book is its many tables that compare and intercompare calculated and experimental results. Such tabulations will be useful to anyone interested in checking his own measurements with other similar results or in determining the validity of using a correlation in any specific circumstance. As an example, a table in the chapter on conductivities of liquid solutions compared experimental values to those obtained by application of the additive rule. It demonstrated that the often-recommended additive rule is valid only under certain limiting conditions (such as molecular-weight ratio >1.25 for normal polar liquids).

With regard to the general usefulness of this book, I felt that the lack of a subject index, list of tables, and list of figures is a definite shortcoming. Such aids would have greatly simplified the readers' task of finding the specific paragraph or chart appropriate for a definite need.

One other shortcoming, which should be noted, is that the author does not include liquid metals in his discussions. This class of fluids has become increasingly more important, especially in the nuclear and space fields. A number of measurements of thermal conductivities of liquid metals have been reported and should have been included in such a monograph. Moreover, a discussion of the theory of thermal conduction in a liquid metal, with the attendant electron-transfer mechanism, would have been a worthwhile addition to this book.

Aside from these two criticisms, I found this to be a worthwhile book. The translation is excellent. The text and captions are free from ambiguous or unfamiliar phrasing, which often are present in translated technical articles. In general, this monograph can be recommended for any research scientist or design engineer interested in the field of thermal conduction in liquids and gases.

J. C. Chen is an Associate Chemical Engineer in the Nuclear Engineering Department of Brookhaven National Laboratory. Currently, he is the acting group leader for heat-transfer research at BNL. His research interests have been in the area of combined radiation-conduction heat transfer, boiling liquid-metal heat transfer, and multiple scattering of electromagnetic radiation. He obtained his BChE from the Cooper Union, MS from the Carnegie Institute of Technology, and PhD from the University of Michigan.

FUN TO READ

Title The Ambidextrous Universe

Author Martin Gardner

Publisher Basic Books, 1964

Pages x + 294

Price $5.95

Reviewer Jeremy Bernstein

Martin Gardner, well known to readers of the **Scientific American** as the editor of the Mathematical Games department, is a scientific "amateur" in the oldest and best sense of the word—"amateur" in the sense of one who loves. His latest book, which is concerned with "handedness", the role of the left- and right-handed characteristics of mathematical, physical, and biological phenomena, brims over with that sense of pleasure that the love of science can induce and that is often lacking in technical books by scientists, themselves. Gardner has set himself the task of explaining to the non-physicist the background and meaning of the discovery of parity violation in the weak interactions. It is an extremely difficult thing to do. Just imagine trying. One quickly finds oneself thrown farther and farther back, to some place where one can make contact between the experience of the physicist and the experience of the typical layman. It is something like the story of the man who tried to explain the color white to someone who was blind from birth: "White is like the color of milk." "What is milk?" "Milk is something you drink from a glass." "A glass?" "Here is a glass." "Ah! now I know what white is."

Gardner begins his story with simple descriptions of experiments with a mirror—a mirror that reflects left into right. He proceeds to describe the difference between objects that are mirror symmetric (can be superimposed on their mirror images) and objects that are not. He shows by means of some fascinating examples what role this sense of symmetry plays in the visual arts and what role the lack of symmetry plays in biological systems whose molecules are arranged in helical arrays with a definite screw sense. He discusses right and left handedness in people and then proceeds to the central theme of the book—what he calls the Ozma problem: how to tell extra-terrestrials which hand we specify as our right hand and which our left, and how to make sure that *our* definition agrees, in an absolute sense, with *theirs*.

To a physicist, the solution of this problem has been known since the fall of parity, in 1957. So in a sense, a physicist reading the book is in something of the position of the reader of a mystery story who knows the solution but is interested in reading the story anyway, because the characters and the background are so fascinating. Indeed, most physicists will probably be made somewhat uneasy by those parts of the book in which the physical principles are described and simplified. It is essentially hopeless to give a rigorous understanding to the layman of, say, the intrinsic parity of a pi meson and to see how this is related to left and right handedness and how it can be determined by experiment. On these points Gardner is honest but, necessarily, vague. Eventually, one is forced to say that parity cannot be made fully clear without quantum mechanics. (In fact it is hard to imagine what role parity conservation plays in classical physics and to formulate its experimental consequences for, say, mechanics.) The physicist can fill in the gaps and imprecisions in the book for himself and will get a great deal of pleasure from the remarkably diverse examples of mirror symmetry and its lack in fields outside his specialty.

The last sections of the book deal in some speculations related to replacing parity conjugation by charge-parity symmetry (CP invariance) as the basic discrete symmetry of the world. Gardner may be feeling, alongside most professional physicists, something of the sense of dismay produced by the discovery (in the Summer of 1964) that even this invariance is no good. His book was written, or at least finished, in June of 1964, and by August the Princeton Group, headed by J. Cronin and V.