

lished anything in science, which explains our ignorance. He had, however, according to Kargon, a profound influence upon his times, and his disciples helped spread his teachings.

An important protagonist for the revival of atomism at that time was Francis Bacon, Baron Verulam. If there was a connection between Hariot and Bacon it is far from evident. Kargon writes: "The relationship between Francis Bacon. . . and the revival of atomism in the 17th century has, for several reasons, been clouded in mystery." He then goes on to show that "Bacon was both an atomist, and an anti-atomist at different points in his long career." I do not find his arguments on anti-atomism entirely convincing.

Although the title of the book implies that coverage is limited to the development of atomism in England,

the author includes discussion of the ideas of non-English scientists who had an influence on the evolution of thought in England. Prominent in this respect were René Descartes and Gassend. The author's criticism of some of Descartes's theories reminded me of Voltaire's sarcastic remark: "Descartes auroit été le plus grand Philosophe de la Terre, s'il eut moins inventé." (p. 160 in Voltaire's *Elémens de la Philosophie de Neuton*, 1738.)

According to Kargon, the most important step toward acceptance of the atomic hypothesis occurred with the publication of Walter Charleton's book entitled *The Darknes of Atheism Refuted by the Light of Nature: a physico-theologicall Treatise*. It was more important to show that there is nothing impious in the atomic idea than to advance any experimental or other proof.

The end of the book is taken up by a discussion of the ideas of Robert Boyle, Barrow and Isaac Newton. As the author puts it: "By 1700 the adherents of atomism had prevailed over the obstacles which faced their predecessors in 1600." Not that it was straight sailing. Much could be said about the further vicissitudes of atomism until its final acceptance in the 20th century.

On the whole, Kargon's book is to be recommended. There are some statements with which the reader may disagree—the style is somewhat uneven—but the book contains so much interesting information that every historically minded scientist (not only the physicist) will benefit from it.

* * *

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Half lives, decay modes, abundances, level schemes . . .

TABLE OF ISOTOPES. (6th edition)
By C. M. Lederer, J. M. Hollander,
I. Perlman. 607 pp. Wiley, New
York, 1967. Cloth \$7.95, paper
\$4.95

by Emilio G. Segrè

The tables of isotopes published by several authors and agencies are an eloquent testimonial to the development of nuclear physics. Natural activities had been tabulated by an international committee in 1931,¹ but it was only with the dramatic developments following the Curie-Joliot discovery of artificial radioactivity that tables of isotopes became desirable. Single workers started to prepare their own and charts appeared on the walls of laboratories. Perhaps the first published one (1934) was the table by Enrico Fermi, Edoardo Amaldi, O. D'Agostino, Franco Rasetti and Emilio G. Segrè.² It has entries for 47 radioactive nuclei; one could still memorize its contents. By the next year a similar table had grown to 71 entries representing radioactivities, and I vividly remember the isotope chart with Z as abscissa and N as ordinate used in our laboratory to keep abreast of the new discoveries. In this chart stable isotopes were black dots, radioactive

ones, red, as to be expected. Mass assignments were often subject to change and moveable pins recommended themselves for markers. The entries in the tables were standardized in a form that is not radically different from the present one. By 1937 M. Stanley Livingston and Hans Bethe in the third article of Bethe's bible,³ had a much larger table and chart in which, however, the emphasis was put on reactions rather than on isotopes.

Three years later, in 1940, we find the first compilation by John J. Livingston and Glenn T. Seaborg⁴ containing about 230 radioactive nuclei and about 290 stable ones. This is the ancestor by five generations of the tables under review.

A new table was issued by Seaborg in 1944. The information grew conspicuously during the war although some of it remained classified for several years after the end of the war. A chart compiled by me and my wife, Elfriede, at Los Alamos was made available in 1946.⁵ This was one of the first documents in which results of war-time research were published. The chart contained information on neutron cross sections that was considered confidential, but ultimately it was

cleared for publication. In 1948 a new *Table of Isotopes* by Seaborg and Isadore Perlman gave a great wealth of new results. It lists about 1150 nuclei and it contains much material that was useful for the elaboration of nuclear systematics.

By that time the literature on nuclei was forming an avalanche. The abstracting and compiling of data could not be managed any more by one or two persons in their spare time; it became necessary to organize a professional service. The National Bureau of Standards as well as several national laboratories entered the field and gave valuable compilations of data. Thomas Lauritsen and Katharine Way were especially deserving for their critical and laborious contributions. Compilations were also prepared for the standard reference books, such as the Landolt-Börnstein *Tables*, here and abroad. The culmination of this process is the establishment of a new journal: *Nuclear Data*!

Nowadays the problem of compressing the existing information in a book of tables of easy and clear consultation is difficult and requires much ingenuity and thought. The magnitude of the abstracting problem is indicated

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by the number of papers quoted in the bibliography of the book under review: approximately 10 000. In this new set of tables the authors have wisely divided the book in two major sections: A table of isotopes in the familiar style occupies the first 152 pages. It contains atomic number, mass number, abundance, half life, type of decay, major radiations and principal modes of production for about 1824 nuclei, both stable and radioactive.

The following 393 pages give level schemes and detailed information in graphical form for isobars of different mass numbers. The figures are supplemented by tables giving many details on radiation, angular correlations, conversion coefficients, spins, magnetic moments, etc., in a condensed but clear form. The bibliog-

raphy, reaching to January 1966, follows, and the book closes with a useful collection of miscellaneous tables of numerical data continuously needed by investigators working on nuclear problems, such as energy conversion factors, conversion coefficients, standard energies of substance, x-ray levels, etc.

In a book such as this it is very important to condense the information in portable form and at the same time leave it intelligible. This result has been achieved, in my opinion, very successfully by using a judicious method of presentation combined with typographical ingenuity, appropriate paper, and a well studied format. It is surprising how portable can be a tome of 594 pages containing probably \$10 billion worth of information.

I have no doubt that the book will

be the standard reference for years to come, as were its predecessors, and I look forward now to the parallel evolution of the particle tables.

* * *

Emilio G. Segrè, professor of physics at the University of California, Berkeley, shared the 1959 Nobel Prize for the discovery of the antiproton.

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You can neither win nor break even

ENTROPY AND LOW TEMPERATURE PHYSICS. By J.S. Dugdale. 206 pp. Hutchinson, London, 1966. Paper 15 s

by R. Bruce Lindsay

Though thermodynamics is nowadays frequently dismissed by many physicists as the concern primarily of chemists and engineers, it remains one of the greatest theories ever invented, with important applications in every branch of science. It is agreeable to note another book on the subject written by a physicist. The author of the volume under review is professor of physics at the University of Leeds in England. He has chosen to develop his treatment of the subject from the standpoint of the concept of entropy, in which he says he became particularly interested while he was a student of the late Sir Francis Simon of the Clarendon Laboratory at the University of Oxford.

Although there is indeed a good deal about entropy in the book, examination discloses that it is in the main a condensed but clear, conventional treatment of thermodynamics from both the classical macroscopic and microscopic statistical points of view. The discussion of classical thermodynamics emphasizes to a certain extent the history of its development, but on

the whole the analysis is straightforwardly didactic.

Quantum-statistical considerations are introduced in the middle of the book, and the essential formulas are reproduced. There is, however, practically nothing in the way of quantum-mechanical background. Thus the Pauli exclusion principle is mentioned only casually without detailed discussion. Most of the statistical applications are to gases though specific heats

and magnetism of solids are briefly discussed.

One of the interesting features of the book is its emphasis on the third law of thermodynamics (Nernst heat theorem). The title is justified to the extent that about 40 pages are devoted to low-temperature physics, with a 20-page chapter describing experimental methods for obtaining and measuring low temperatures.

The author's style is clear and his analytical deductions are accurate. The book should appeal to advanced undergraduate and graduate students of physics with the usual mathematical equipment. The bibliography is unfortunately rather sketchy for the purposes of the serious student.

* * *

The reviewer is Hazard Professor of Physics at Brown University.



RUDOLF CLAUSIUS (1822-88). His famous statements of the first and second laws of thermodynamics are:

1. Die Energie der Welt ist constant.
2. Die Entropie der Welt strebt einem Maximum zu.