What connection exists between Rutherford's outright "simplicity," his extreme "humanness," his larger-than-life personality, and the immensity and style of his scientific creation, each will judge for himself. Oliphant does not indulge much in philosophical speculation. His is a story simply, naturally, casually told: a modest style that harmonizes with the subject but does not distract attention from it. But the spirit that moves the author is deep and sustained. It is best expressed in his own closing words:

"His (Rutherford's) success came as much from complete dedication to his work as from his innate ability, so that even the average student was inspired to emulate him. Yet ordinary as he was, there was something in him which raised him high above others, and put him in the company of the greatest of men, and this something earned for him both the profound respect and the deep love of all who came under his influence."

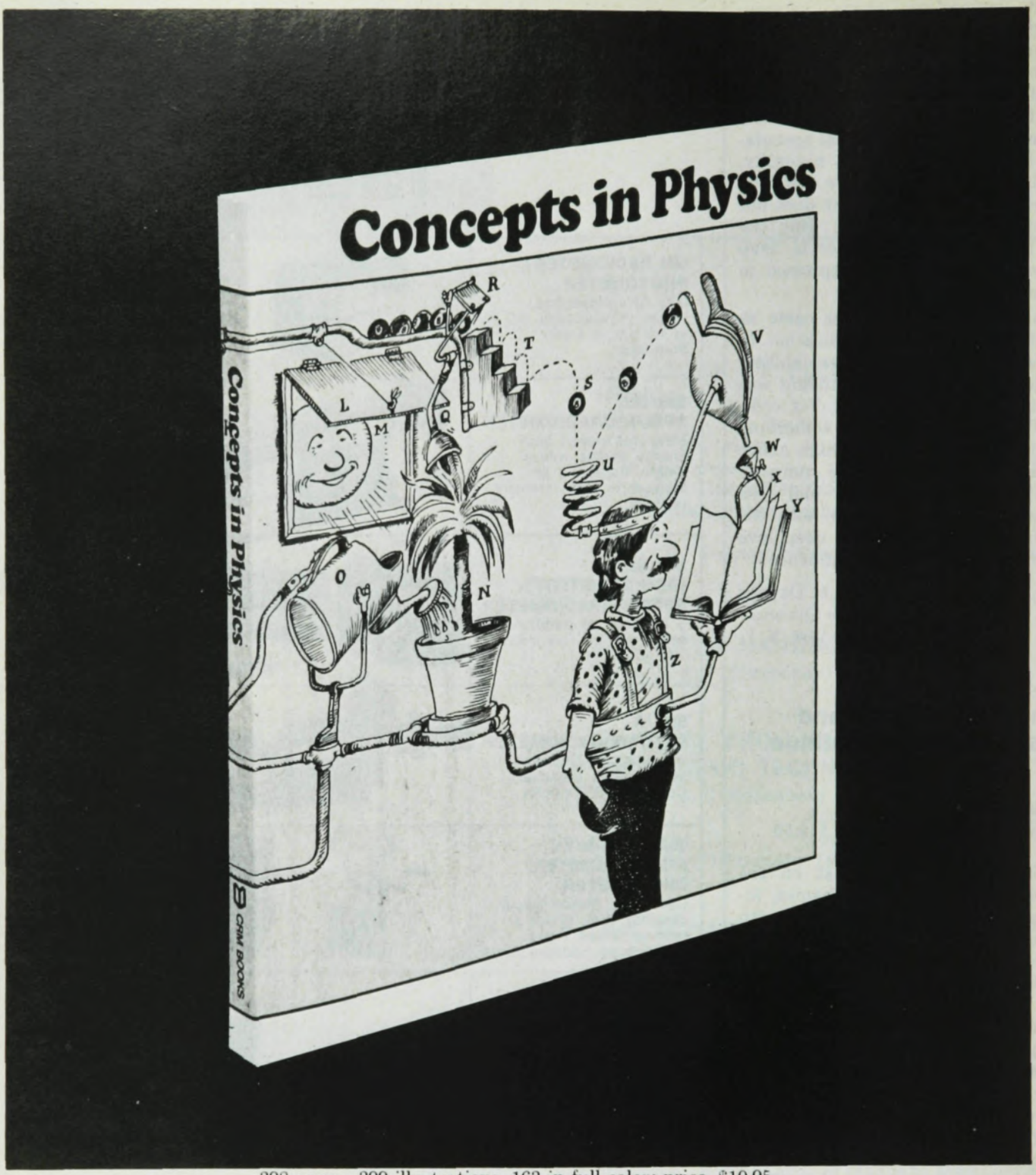
SAMUEL DEVONS
Columbia University
New York, N. Y.

Momentum, Energy and Mass Transfer in Continua

J. C. Slattery
McGraw-Hill, New York, 1972. $19.50

This is an introductory text on the basic equations of fluid mechanics, including heat and mass transfer, with emphasis on their axiomatic, deductive, continuum formulation. There is no attempt to relate them to microscopic physics. The author, J. C. Slattery, is professor of chemical engineering at Northwestern University, and has published extensively in mixture transport phenomena. He makes a serious effort to broaden the scope by solving many explicit boundary-value problems, especially on viscous flows and on heat and mass transfer. This effort is only partly successful; 679 pages are simply not enough to allow adequate treatment of both mathematical continuum mechanics and what might be called "phenomenological fluid mechanics," the largely observable world of fascinating physical phenomena such as instabilities, surface waves, shock waves, rotating flows, nonlinear stress effects, vortex lines and sheets, drops and bubbles, buoyant flows, turbulence, and so on. Most of these phenomena are accorded little or no space.

Scientists and engineers will miss experimental information, especially on those phenomena for which formal mathematical solutions are not avail-



398 pages; 399 illustrations, 163 in full color; price, $10.95

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able. There are only two flow photographs and one plot of measured data. For readers who think graphically, there are far too few qualitative sketches, and some of those are more ikonic than realistic.

Surprising in a book with the orientation of this one is the mere passing mention accorded vorticity and surface tension. The careful, general discussion of "jump conditions," however, may be more useful to readers interested in surface tension than are some of the *ad hoc* solutions in other books.

Treatments superior to those in other textbooks also include that on finite averaging techniques in the development of equations for flows through porous media, and that on some nonroutine mass-transfer phenomena.

A paradoxical aspect of this book is the startling contrast between the formalistic handling of the basic equations and the obsolete, misleading treatment of turbulent-flow theory. Slattery begins with a brief (and inadequate) warning to the reader, then treats turbulent momentum, heat and mass transfers in a manner scientifically worthy of the early 1930's.

The discussions are largely matters of "eddy viscosity" and "eddy diffusivity," without mention of conditions necessary for validity of these concepts, and with no hint that these conditions are violated in all of the traditional, fully turbulent shear flows, including those treated. The unfortunate inconsistency of viewpoint is exemplified by the fact that there is no mention of the necessary (though not sufficient) condition that the principal axes of the mean stress and strain-rate tensors be parallel—this in a book that so carefully spells out the analogous conditions in establishing the constitutive equation for a "Newtonian fluid."

Even the deductive turbulent cases are not free of error. One of the averaged momentum equations for fully developed turbulent flow through a tube inexplicably lacks the second moment of the turbulent velocity, the Reynolds normal stress.

What, then is the place of this textbook in the physical-science literature? For a graduate course on fluid mechanics, the extensive material on kinematics, on basic equations, on integral averaging techniques, and on some heat and mass transfer problems, could be combined with material on specific flow phenomena from other books. At an analogous level we find the books of L. D. Landau and E. M. Lifshitz, *Fluid Mechanics* (Addison-Wesley, 1959), which is a bit careless with some of the basic concepts on which Slattery is most careful and which has a broader coverage of fluid-dynamic topics, and of G. K. Batchelor, *An Introduction to Fluid Dynamics* (Cambridge U. P.

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1967), which is a very good physico-mathematical text on classical hydrodynamics. R. S. Brodkey's *The Phenomena of Fluid Motions* (Addison-Wesley, 1967) can supply some of the qualitative or graphic sense, and the recent text on turbulent flow by H. Tennekes and J. L. Lumley *A First Course in Turbulence*, (MIT, 1972) might be used to round out that topic.

STANLEY CORRSIN
Johns Hopkins University
Baltimore, Md.

Complex Permittivity: Theory and Measurement

B. K. P. Scaife, ed.
170 pp. English Universities Press, London, UK, 1971. £3.45

The three long chapters in this book are devoted to a discussion of the theory of dispersion in polar dielectrics by B. K. P. Scaife, a survey of the effects of pressure on dielectric properties by W. G. S. Scaife, and a review of the methods for measuring complex permittivity by R. G. Bennett and J. H. Calderwood.

The theoretical chapter is a development and extension of what might be called the Fröhlich approach, to which the author has made numerous contributions. This is a useful, purely classical discussion of fluctuation theory and of diffusion and inertial models, but in his approach the author presents correlation-function theory macroscopically with no account of R. Kubo's treatment or developments of it and makes no mention of calculations of these functions for various models by Roy Gordon and others. R. W. Zwanzig's results on effects of dipole–dipole coupling are used to point up difficulties with attempts to generalize Onsager's equation for the static permittivity to the time-dependent case, but neither the model nor its development are adequately described.

The chapter on pressure effects is a survey of experimental techniques and results for nonpolar gases, nonpolar and polar liquids, ionic crystals, polymers, ferroelectric crystals and ice, principally for static permittivity and relaxation at audio and radio frequencies. The account is quite comprehensive and a useful guide to the literature, except that it was presumably written before a considerable body of recent work on dielectric virial coefficients and far infrared absorption in gases was published.

The chapter on experimental techniques discusses bridge methods for audio and radio frequencies, resonance methods for the uhf region, and microwave transmission line and waveguide