

to your local traffic jam, to the queue, wherever it may be—take it wherever you're apt to have a few moments to spare—each essay is self-contained, and each is a tidbit that can be read in a few minutes but savored considerably longer.

Franklin M. Branley
The American Museum—Hayden
Planetarium, New York

Micromechanics of Flow in Solids

By J. J. Gilman
294 pp. McGraw-Hill, New York, 1969.
\$15.00

Plastic flow is a macroscopic result of the motion of dislocations. The author, who published many papers on this motion, gives a summary of his work (and of the related publications by other scientists) in chapters 5 to 9 of this book. The first four chapters form a kind of introduction; their titles are: Introduction, Review of Elastic Behavior, Crystal Plasticity and Dislocation Geometry (the longest in the book). Of necessity, they are rather condensed, and the justification for many equations has to be looked for elsewhere in the literature (indicated by the author).

Many idealized models are considered and a great many equations given. The comparison with experimental data is not extensive; thus, of the 67 figures of chapter 4 only one presents an observed phenomenon, and two of the nine figures of chapter 5 refer to experimental results. In this respect, the volume is not greatly different from many other publications on solid-state physics and would be a very valuable survey of the theory of dislocations that is so important for strength and plasticity.

Unfortunately, the publisher's work is not as good as the content would deserve. Again and again, symbols appear in equations without any definition; two different symbols mean one quantity on one page; a misprint mars the very earliest equation (page 9) and many more stop the reader later on.

J. J. Bikerman
Shaker Heights, Ohio

Variational Principles in Heat Transfer: A Unified Lagrangian Analysis of Dissipative Phenomena

By M. A. Biot
185 pp. Oxford U. P., New York,
1970. Cloth \$12.80, paper \$6.40

Except for isolated cases, few of the equations of mathematical physics can be solved in terms of known functions. And of the techniques available to generate approximate solutions, undoubt-

edly the most useful are based on applications of one or another variational principle. It is interesting that although variational principles for the description of dissipative processes were first proposed long ago by Hermann von Helmholtz and Lord Rayleigh, they have only recently become subject to active investigation. *Variational Principles in Heat Transfer*, by Maurice Biot, collects the author's work on a unified analysis of heat transfer, including convection and conduction. The key idea is a generalization of the virtual-work concept; one consequence is the generation of variational equations containing terms analogous to generalized forces as in the Lagrangian formulation of mechanics. As is to be expected, the structure of the equation is suggestive of approximations. Several of these are worked out and shown to be accurate. The ideas involved are extendable to the discussion of other dissipative phenomena.

This is a personal book, giving an account, primarily of the author's work. Although other variational principles are very briefly discussed (for example, those of Prigogine-Glandsdorf and Galerkin) little effort is made to compare them with the author's approach. This is a pity, since some of the most interesting ideas in the theory of dissipative processes, for example the collection of phenomena labelled "dissipative structure," are aptly discussed in terms of variational principles. A description of that work, and its connection with the analysis presented, would have enriched the book.

This clearly written monograph will be of interest and value to all those fascinated by dissipative phenomena. I recommend it to them.

Stuart A. Rice
The James Franck Institute
University of Chicago

Particles, Sources and Fields

By J. Schwinger
425 pp. Addison-Wesley, Reading, Mass.,
1970. \$14.95

Any book by Julian Schwinger must be regarded as something of an event. No active physicist has contributed more to a larger variety of fields of theoretical physics than he has, and no one has been at it longer. Schwinger began doing original calculations with the Dirac equation while still a teenager in high school.

Schwinger's book is a systematic presentation of source theory—the Cambridge locals seem to refer to it as "sorcery"—as it applies to particle physics. The main idea is to separate particle phenomenology from particle structure. From a phenomenological point of view, particle interactions involve the creation

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