or other locations of primarily industrial interest. The text is strong on definitions and descriptive content, which is useful in a field where quantification is sketchy due to the limited scope of the theory and abstraction so far achieved. As is perhaps unavoidable, the coverage of the various topics is not uniformly up to date. The book presents some areas, such as sieve fractionation, gravitational and centrifugal sedimentation, elutriation, and extractive stream methods, in broad surveys with useful references. A particular strength is the emphasis on the development of information concerning collective behavior in fineparticle motion, where, for example, the fluid-mediated interaction of nearby fineparticles can exert significant influence on each other. In at least two cases, however, the presentation does not describe progress achieved by 1980. Kaye neglects laser Doppler velocimeters for remote sensing of particles, commercially available from several manufacturers, and single-particle suspensions and the measurements they make possible (methods of Arthur Ashkin, E. James Davis, Stephen Arnold, and collaborators).

While *Direct Characterization of Fineparticles* is primarily concerned with measurement methodology, its final chapter, on shape characterization, discusses descriptors of shape and concludes with some comments on the application of fractal dimensions, a current and growing field of interest in the physics literature and elsewhere.

WILLIAM H. MARLOW
Brookhaven National Laboratory

Irreversible Thermodynamics

Y. L. Yao

357 pp., Science Press, Beijing (US dist. Van Nostrand Reinhold, New York, 1981). $29.50

Thermodynamics, Statistical Physics and Kinetics

Y. B. Rumer, M. S. Ryvkin

600 pp., Mir, Moscow (US dist. Imported, Chicago, 1981). $12.00

These two books are intended both as texts and as references for active researchers. They share many of the same good and bad features; namely, they contain exhaustive discussions of the classical topics in these fields but are deficient in material of current interest. For example, the text by Y. L. Yao gives careful but uninspiring coverage to the conservation laws and to the standard formalism of linear irreversible thermodynamics and then consiers only briefly slightly nonlinear processes. There is no real mention of the recent, important developments in oscillatory chemical changes and their fascinating practical and mathematical implications. Although roughly half the book is devoted to applications, the discussion is resolutely formal: Yao makes no comparisons to actual experimental data. Needless to say, this detracts somewhat from the book's utility as a text. One of the more positive features of this book is the treatment of complex (but linear) systems in which a variety of generalized forces is present in a network of parallel and series elements. However, considerable space is given to the application of this formalism to electrical circuits (and entropy production in them), which is not really a significant part of irreversible thermodynamics.

The text by V. B. Rumer and M. S. Ryvkin, translated from the Russian, is an impressively dense mass of information which, considering the amount of material, is reasonably free of errors. The authors have devoted a quarter of the book to classical thermodynamics and they include a remarkable number of worthwhile illustrative problems in a careful exposition of the principles. Another quarter they devote to kinetics and nonequilibrium thermodynamics, which turns out to contain an extensive discussion of the Boltzmann equation, its extension to dense gases by Nikolai Bogoliubov and the solution of the equations for dilute gases and plasmas. They mention only briefly the time-correlation function approach ("Kubo method") to dynamical problems. For the student, this unfortunate emphasis gives an incorrect picture of currently important problems and techniques in nonequilibrium statistical physics.

The most serious defect in this textbook, however, is to be found in the section on the fundamentals of statistical mechanics, where the development is based on a classical phase-space approach that has been replaced during the last 25 years by quantum statistical mechanics in most pedagogical treatments. The reasons for the switch from classical to quantum mechanics are by now obvious: elimination of problems concerning the size of the volume element in phase space and statistical counting factors; and the desirability of the use of quantum mechanics to describe matter at the molecular level. Furthermore, one can obtain the classical results as a limiting case by introducing the elegant and powerful Wigner–Kirkwood argument. Unfortunately, the Wigner–Kirkwood theory is not even mentioned by Rumer and Ryvkin; rather they "establish" the quantum-classical correspondence by comparing a few of the cases (such as the ideal monatomic gas), that can be solved in closed form both by classical and, in the limit, by quantum statistical mechanics. On the other hand, the number and variety of specific applications they touch on in a statistical mechanical section is impressive. It includes Landau theory of phase transitions, BCS theory of superconductivity, Bogoliubov theory of superfluidity and degenerate gases. To sum up, this text can be useful as a supplement and as a quick reference for courses in thermodynamics and statistical mechanics. At the amazing price of $12.00, it is highly recommended for that purpose. Yao's book on irreversible thermodynamics is too long and too detailed to be really useful as a textbook, but could find occasional utility as a reference.

WILLIAM A. STEELE
Pennsylvania State University

Theories of Light from Descartes to Newton

A. I. Sabra

365 pp. Cambridge U. P., New York, 1982. $39.50 cloth, $12.95 paper

Samuel Johnson once said, "We all *know* what light is, but it is not easy to *tell* what it is." *Theories of Light* describes and analyzes an important period in the history of optics: when renewed interest in the physical world and the freedom of inquiry nurtured by the Renaissance were directed toward the nature of light; when early scientists, such as Rene Descartes, Francis Bacon, Pierre de Fermat, Ole Roemer, Christiaan Huygens, Robert Hooke and Isaac Newton, grappled with the nature of the speed of light, of reflection, of refraction, of dispersion, of interference, and even of scientific inquiry.

Like all artists and scientists, these men of science had distinctive philosophical styles and approaches toward their investigations. Near one end of a conceptual spectrum was Descartes, for whom explanation usually took the form of deduction: Starting from a few fundamental principles or propositions, he deduced laws of optics, often by analogy with mechanics—he almost completely neglected induction as a method of forming general principles