in the study of interacting particles in modern field theory that comprises the second half of the book. Lee develops the formalism hand-in-hand with the physical ideas of non-Abelian gauge theories and QCD. He illustrates the need to specify gauges when carrying out the quantization and the origin of the Gribov ambiguity (corresponding to the vanishing of a Jacobian in making gauge changes) with a simple and illuminating mechanical model of point particle motion. This is just one example of very recent original research by the author that frequently appears in this volume. Lee also describes and traces the confinement and asymptotic freedom problems in QCD. He develops in detail path integration methods that lead to the Feynman rules for calculation, including the origin of the Faddeev–Popov ghosts and the construction of the effective Lagrangian of QCD, which he recently derived in collaboration with N. H. Christ.

The book concludes with extensive applications of QCD. Lee considers quark models of the hadron, the gauge theory of weak and electromagnetic interactions, high-energy processes and the quark–parton model, jets and the gluon sector in QCD, and chiral symmetry. These chapters carry the reader through many practical calculations, such as the discussion of correlations in analyses of three-jet events. There is also a variety of good exercises for the serious student.

The students in Beijing privileged to hear Lee's lectures in 1979 had a rare and very valuable treat. Many more can now share that treat.

Sidney Drell
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Electromagnetic Radiation

F. H. Read
345 pp. Wiley, New York, 1980. $58.50

It has been said that one who knew everything about one thing would know everything about everything! Though the task that Frank H. Read has undertaken in the book *Electromagnetic Radiation* is a discussion of less than everything about light, he does cover the classical and quantum aspects of electromagnetic radiation in a thorough yet concise fashion. He has written this textbook for advanced undergraduates or first-year graduate students (for whom the level of mathematical sophistication and physical explanations is probably more appropriate). The book can, however, also suit the wider audience of practicing physicists and engineers interested in an initial "look-see" into such topics as the coherence of laser light. The careful presentation in the text and the well-chosen references will help satisfy such an interest.

Starting with Maxwell's equations, the author discusses the propagation of electromagnetic waves and their generation by moving electrical charges. After formulating the concepts of the quantum theory of radiation and atomic energy levels initially in a theoretical manner, he applies them to intrinsically interesting technical developments. To cite an example, he presents the idea of the stimulated emission of radiation according to the classic derivation of Einstein and subsequently uses it in the explanation of the laser and the maser. Similarly, in the chapter on the scattering and absorption of radiation he looks in a general way at Compton scattering of a photon by a free electron; in a later chapter, he analyzes the role that Compton scattering plays in the detection of gamma rays with scintillation counters. This procedure, which includes obtaining numerical estimates for the significant quantities, clearly gives added insight into the physical process being considered.

Although I enjoyed reading the book, I sometimes felt that its emphasis should have been a bit different. The discussion of the classical electromagnetic field on the basis of Maxwell's equations would have been improved with greater emphasis on the equations in vacuum and with a subsequent discussion pointing out that the customary way of defining the phenomenological permeabilities and the effective fields is just a very convenient, but limited, model for treating the complex interaction of radiation with matter. This is the approach followed in the *Feynman Lectures in Physics, Vol. II, The Electromagnetic Field.* It does minimize the confusion that can arise in differentiating between the B and H (E and D) fields, particularly when the presentation employs MKS units.

In short, this fine textbook may well start a student of physics on "the yellow brick road" to everything about light.

John C. Herrera
Brookhaven National Laboratory

Acoustics: An Introduction to Its Physical Principles and Applications

A. D. Pierce
642 pp. McGraw-Hill, New York, 1981. $28.95

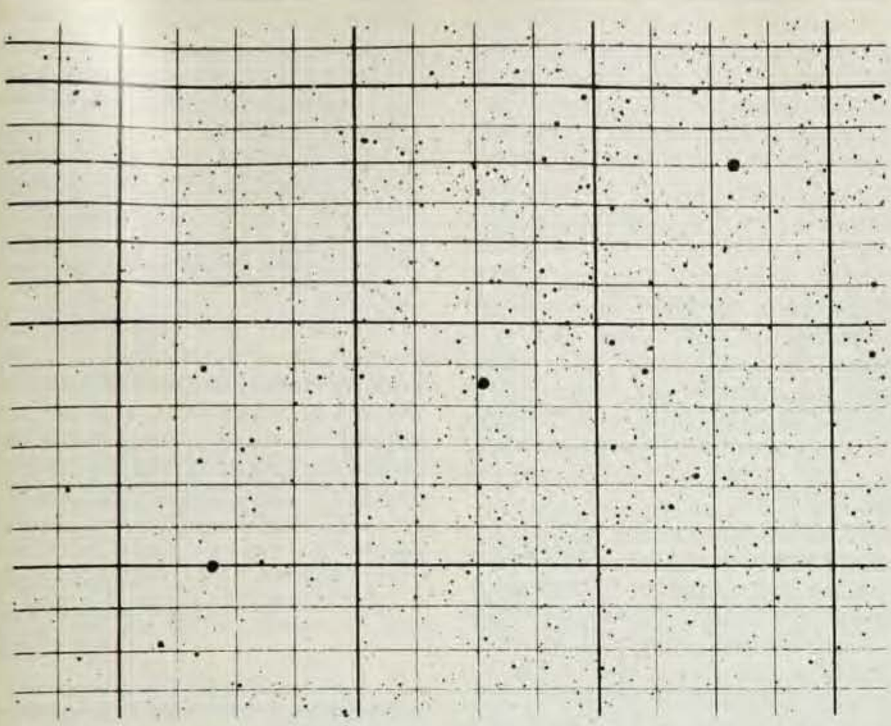
Publication of a new advanced text on the foundations and principles of acoustics is so rare an event as surely to elicit great curiosity. A book as successful as this one earns praise as well. One anticipates that many of a new generation of graduate students will form their skills through Pierce's *Acoustics*; when they have mastered it, they will be well and broadly founded in physical acoustics.

Allan Pierce based this book on his own years of experience in research and teaching in acoustics at MIT and the Georgia Institute of Technology. Preliminary versions have been used as class notes for a three-term (one academic year) introductory course in acoustics for graduate students in various fields of engineering, physics and mathematics. While this is the audience for which the book is designed, the author indicates that it is also suitable for a one-term senior-level course if the instructor avoids the more highly mathematical sections. Several such selections are suggested. Professional acousticians concerned with analysis should also profit from reference to this book, especially with respect to those areas in which they are not fully aware of current work.

Organized into eleven chapters, the book develops those concepts appropriate to application in such areas as audio engineering, noise control, architectural acoustics, propagation in the atmosphere, and remote sensing. Other areas—propagation in the ocean, interaction of sound and structural vibration and arrays of sources—are touched on more or less briefly. Pierce has quite properly resisted the temptation to be encyclopedic in favor of a thorough and coherent development of basic principles through more nearly "classical" areas of application.

Two chapters and parts of a third are devoted to radiation from small objects, baffled sources, and flexural waves on an infinite plane. They include the expected theorems and examples, but also introduce the method of matched asymptotic expansions in application to small bodies. A fine chapter on room acoustics treats the statistical description of high-frequency response in considerable detail. A chapter on low-frequency transmission in tubes and horns precedes excellent chapters on ray acoustics (including inhomogeneous and moving media) and on scattering and diffraction. The latter, the longest chapter in the book, very thoroughly covers the principles of wedge diffraction, creeping waves, fields near caustics, and bistatic scattering measurements. The final two chapters constitute a thorough introduction to the nonideal phenomena of real fluids: viscous effects (vorticity and entropy modes, acoustic boundary layer, attenuation in tubes and porous media, and relaxation processes in gases) and nonlinear effects (weak shocks, N waves, ballistic shocks, but not parametric arrays).

We can illustrate what Pierce's



The stars of Orion's belt appear in this portion of one of the 456 photographic plates that comprise the *True Visual Magnitude Photographic Star Atlas* compiled by C. Papadopolous and C. Scovil (Pergamon, New York, 1981. $675.00). The Atlas includes stars visible from the Earth with magnitudes of 13.5 or greater, shown in the same relative magnitudes that the human eye sees them. The distortions toward red or blue that photographs of stars usually suffer have been eliminated.

The photographs, each about 330 mm square, cover areas of 11 degrees square, with centers 10 degrees apart. Transparent overlays, shown here in black, are supplied for estimating the positions of observed objects.

Acoustics both contains and omits by comparing it to other advanced texts. The 1968 text by Philip M. Morse and Karl U. Ingard spends a great deal of time on linear oscillators; waves on strings, plates and so on; plasma acoustics; and interaction with light waves; little on these topics will be found here. Eugen Skudrzyk's *Foundations of Acoustics* (1971) includes a unique long introduction on mathematical techniques, statistics and signal processing. Both books, but especially the latter, treat radiation problems in various ideal coordinate systems with a detail not found in Pierce's text. However, nothing comparable to his treatment of propagation is found in either of the other books. In balance, I prefer Pierce's mix of topics. With significant reductions of mass and cost, he has set forth a deep but comprehensive exposition of the principles of physical acoustics, which will prepare the student well for more advanced study of one of more specialties.

Each chapter contains about 30 statements of interesting problems, for which the publisher has announced that a book of solutions is forthcoming. The author assiduously cites original references, modern as well as historical, whenever possible; only occasionally does this praiseworthy habit seem to interfere with citations of recent literature that might more effectively guide the student to appreciate the concept being discussed. The subject index is excellent; it never failed me.

P. W. Smith
Bolt Beranek and Newman Inc.

How to Grow Science

M. Moravcsik
206 pp. Universe Books, New York, 1980. $12.50

Teaching and Learning About Science and Society

J. Ziman
190 pp. Cambridge U. P., New York, 1980. $22.50

Michael Moravcsik and John Ziman are both practicing physicists whose experiences have led them to scrutinize contemporary science and the perceptions of it by nonscientists. These two books result from the authors' convictions that more understanding of the nature of scientific endeavor is essential for its optimal integration into our culture.

Moravcsik, professor of physics and research associate in the Institute of Theoretical Physics at the University of Oregon, has long been active in scientific policy and funding considerations and is the author of *Science Development: The Building of Science in Less Developed Countries* (1976). In *How to Grow Science* he comments on the current *modus operandi* within science, the interaction between science and technology, the social implications of both, and "the science of science." His tone is generally upbeat and optimistic. In addition to addressing the general public, Moravcsik has much to say to nonscientists making science policy. Scientists, for the most part, will find little that is new to them. Finding themselves nodding in agreement with most of what Moravcsik says, they will be able to recommend this book to provide answers to general questions asked of scientists.

Moravcsik provides a selective bibliography useful for further reading, but he does not give specific references for information incorporated into his text. For the most part, this is not a serious detraction, but some readers might be curious to know more about "Lotka's Law" (page 88), for example. Moravcsik has also provided four appendices: How to Correct One-Dimensional Thinking; Evolving the Organism of Science: Applying A Fable; Two Ways of Mountaineering; and How Can Two Scientists Disagree? These contain valuable insights and provide a few glimpses of the author's humor.

John Ziman's book *Teaching and Learning About Science and Society* is more sharply focused than Moravcsik's. Equally concerned about the misconceptions of science that abound in our society, Ziman proposes that definite educational reform is to remedy or at least ameliorate the situation.

Ziman is professor of physics at the University of Bristol and already known to a wide audience through his earlier books *Public Knowledge* (1968), *Force of Knowledge* (1976) and *Reliable Knowledge* (1978).

Ziman criticizes present education in science: It is geared at all levels toward the training of research scientists and thus does not answer the needs of the vast majority of students, including future science teachers; it fosters doctrinaire scientism; it fails to explicate what science is, what it can do, what it is like to be a scientist and what good science is.

Ziman's model of the scientific enterprise, illustrated with clever diagrams, identifies the individual and social components within the scientific community and the interrelations with other elements of society, such as the general public, the managers of big science, the makers of science policy and the technological developers. This model and its ramifications, so Ziman argues, can be presented within the educational structure through courses