addition, it is very difficult reading for anyone not already familiar with the subject. Bray and Loughhead themselves point out in the preface to their book the vital interrelation between non-LTE theory and chromospheric physics. I feel that the result of their omission is an inadequate discussion of the contribution of the study of line spectra to our understanding of chromospheric structure.

Chapter 6 is a treatment of wave propagation in an arbitrary atmosphere. The authors assume the basic equations of hydrodynamics as well as Maxwell's equations, and then proceed from there to review the research on the topic. In reading through the discussion, I found several places where it could be improved. For instance, the only diagnostic diagram shown is a one-dimensional approximation to the usual diagram. It is not completely clear from the discussion that the frequency domains where wave propagation is possible are a function of wave number. The discussion of the propagation of gravity waves with radiative losses is weak.

The final chapter is a discussion of the heating of the chromosphere and the formation of spicules. The discussion of heating is already out of date. Since this material was written, new evidence has been published that suggests high-frequency waves with periods of 100 seconds or less cannot, as was originally suspected, heat the low chromosphere. The new evidence suggests that the 300-sec oscillation must be re-examined as a source of the heating.

In summary the observational half of this book is a good review of the state of our knowledge of chromospheric fine structure that will be of use to the specialist. The theoretical half, on the other hand is not as good. *The Solar Chromosphere* belongs in the professional library of the working solar physicist, but considering the high price of the book, I cannot recommend that it be added to every astronomer's bookshelf.

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Understanding Technology

C. Susskind
163 pp. Johns Hopkins U. P., Baltimore, 1973. $6.95

It is generally acknowledged that human history is coterminous with the history of our technology. As *homo faber* we have, from whenever we could legitimately be called "human," lived by altering the environment by our tools. Of late, there has been a growing perception that something about our technological existence is problematical. Charles Susskind's book attempts to discuss what to do about the problem. The basic difficulty with the book stems from its antitheoretical character—no attempt is made to identify what exactly the problem might be.

But suppose, for the sake of argument, we go along and assume that there is some sort of a problem. Before we go any further, there is a methodological difficulty. How shall we talk about it? In contemporary society, communication that is not of the garden variety tends to occur in distinct sublanguages. Within the same society we have different sublanguages whose speakers do not comprehend each other. An engineer talking about linear-induction motors, say, makes about as much sense to an anthropologist, as the anthropologist talking about ethnomethodology does to the engineer. Susskind tries to confront this problem in terms of the oversimplistic dichotomy popularized by C. P. Snow. He assumes that there are two kinds of people, those who have simply a "liberal" education as against the others who know about technology. He wants to present in rough outline, something of what is said in one group of such sublanguages—called "technological"—to those who do not understand it. Since form and content are inseparable in such sublanguages, this brings about a discussion of contemporary machines and their performance and—his real concern—what social impact the use of such machines may have.

From the point of view of natural-science students the book fails because of the author's attempt to treat "technology" in isolation from "science." Connections are alluded to, but the development of technology becomes an incomprehensible sequence of mechanical inventions tumbling out of some mysterious horn of plenty. (Thus in a discussion of heat engines, the contributions of Watt, Newcomen, Smeaton, Rankine, even Daimler and Benz, are referred to, but not Sadi Carnot). Historians of science may perhaps often be faulted for ignoring technical practice and the basis of science on such practice, but Susskind's approach is at least equally unpardonable from the other side.

From the standpoint of students of philosophy and sociology the attempt fails for two reasons. First, it fails for any "nontechnological" reader because of the problem of translation between different sublanguages. Susskind cannot of course be blamed for not solving it, but one wishes he were somewhat more aware of the problem. The second reason is a naive reification of "technology" into something that exists almost autonomously, that we have to react to and cope with while tending the machinery and enjoying the commodities churned out by it. Here again, a vague gesture of acknowledgment is made in passing to social conditions that may somehow be involved in developing or sustaining a level of technological production. But it is no more than that. "Technology" advances, and society must adapt to its changes. His prognosis-cum-recommendation is that "we may come to look to the engineer for moral guidance." How society can ask the engineer for what on earth to do is unclear in view of the further admission that "no real basis exists on which anyone could compute what constitutes the public interest." But logical inconsistency does not appear bothersome to the author in his hit-and-run method of discourse.

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Comets, Meteorites & Men

P. L. Brown
255 pp. Taplinger, New York, 1973. $12.50

"Nowadays, in the West, neither the visual nor the photographic discovery of a new comet stirs much interest outside the close, intimate world of the initiates." Clearly this book antedates the coming of Comet Kohoutek! Certainly Kohoutek the media happening and Kohoutek the target of many scientific investigations will deserve a work of its own.

As a popular presentation of cometary science Before Kohoutek, *Comets, Meteorites and Men* is of modest interest. As a summary of astronomers' anecdotes and legends, the stuff known collectively as "comet tales," it does much better. If we are disappointed to find no mention of the controlling role of water ice on the evaporation of other substances and are sorry to see that the discarded gravel-bank model for the nucleus is treated as a serious current rival of the icy-conglomerate theory, we can revive our spirits by leafing through the generous selection of comet lore. Especially interesting is the lengthy excerpt from the *San Francisco Examiner* hoax of 8 March 1891. Therein is described the fabulous electrified and automated comet-discovery apparatus of noted astronomer Edward Emerson Barnard (famous for "Barnard's Star"). Since the press had been warned to expect ritual disavowals of this secret project, the infuriated Barnard could not prevail on them to publish his denial until 1893. It should be noted that such an apparatus is still lacking, although it must be

well within the current state of the art.

In another chapter, we read of the less celebrated observer William F. Denning (1848–1931) who "remained a life-long bachelor in order to devote the maximum possible time to his observational work." Thus, Denning was spared the anguish felt by another comet enthusiast, who missed a new comet due to the death of his wife.

Six of the seventeen chapters are devoted to meteors, meteoroids and meteorites (the author's definitions of these terms are, however, not the accepted ones). The presentation is rather interesting, although several important topics, such as luminous efficiency, are not discussed, or are only briefly mentioned. In the latter category it is particularly regrettable that while radioactive dating is described, the implications of such studies of meteorites for the general understanding of solar system evolution is not brought out.

P. L. Brown, who is an experienced amateur astronomer and author, also discusses the prices paid for meteorites. Many astronomers have had some fleeting contact with this subject and each may have his own story to add to the list. I recall correspondence with a midwestern farmer in the early 1960's who had ploughed up a stone and needed to know whether museums paid more for a single big meteorite or several smaller ones.

This book will interest the general reader, although it is not really much more up-to-date than similar volumes written a decade or more ago. It would have benefitted a great deal from a prepublication review by a scientist working in the fields discussed. Also lacking is careful attention by the manuscript editor. On one page, for example, "Clairaut" is misspelled six times, and on another page, "Bennett" is also multiply misspelled, although both words are done correctly elsewhere in the book. The index is excellent.

Although flawed, this book will be a useful addition to many libraries at a time of wide public interest in comets. Perhaps somewhere a young reader will be inspired to join the hunt, for, the author tells us, even in the 1970's, "Medals and immortal glory are still to be won."

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Comet Burnham 1960 II with its "wagging tail" was recorded at Lowell Observatory.

The Dynamics of Atoms in Crystals

W. Cochran
145 pp. Crane, Russak, New York, 1973. $13.95 hardcover, $6.95 paperback

The most truly characteristic aspects that distinguish solid-state physics from the other branches result from the periodicity of a crystalline solid. In demonstrating the various concepts that follow from translational symmetry (for example, collective elementary excitations and their interactions) one can scarcely choose better elementary examples than those encountered in lattice dynamics. One is thus not surprised to find that a projected series of student texts entitled, "The Structure and Properties of Solids," should include an early volume on lattice dynamics. An advantage of a series of relatively short texts over the traditional single comprehensive volume is that authors with genuine expertise in their various subfields can be induced to contribute. The present series sets a high standard with the choice of William Cochran of the University of Edinburgh. Cochran's work has strongly influenced the development of modern lattice-dynamical theory, and he has been instrumental in unifying recent developments with a series of timely reviews of the subject during the past decade.

This text could hardly be other than accurate and authoritative in its treatment of topics. These topics include chapters on the dynamics of both one- and three-dimensional lattices, elementary diffraction theory, experimental methods of determining phonon dispersion relations, as well as chapters on thermal, optical and transport properties of crystals at least insofar as they are concerned with vibrational excitations. Cochran also includes two further topics, anharmonicity and the role of lattice dynamical instabilities in