Pattern created by eddies in atmospheric boundary layer. (Photo by H. A. Panofsky.)

tional material and useful literature. A real effort has been made to condense, in readable form, the basic theory of waves in neutral atmospheres and in the ionosphere (acoustic, gravity, inertial and Rossby waves, as well as baroclinic modes so important in meteorological theory). One trouble I had with the book is in deciding on its potential audience. Beer has, by his own admission, set himself an impossible task by attempting "a compromise between the scientific textbook ... and ... the advanced research monograph." Inevitably, the result is neither; it comes closest to being a sort of introductory monograph; as such it has a great deal to recommend it, offering quite a bit of information in compact and well-illustrated format. Nevertheless, even in its objective as a monograph it has a number of defects. There are, for instance, important gaps; to mention but one, hardly any information is vouchsafed concerning abundant evidence that the jet stream generates traveling internal gravity wave fields. Furthermore several prevalent canards are perpetuated, such as the one implying that a disturbance moving at supersonic speed generates internal gravity wave fields whereas, in the linear theory at least, this is the condition for acoustic wave generation only. To generate internal gravity waves, the disturbance velocity must be *less* than some critical value (which is in fact *subsonic* for an isothermal atmosphere!).

Insofar as the use of this book by students is concerned, care is required because there are a number of muddy and misleading passages. For example, it is stated that "in a highly dispersive medium ... the concept of group velocity becomes meaningless, because there are not enough waves of nearly equal phase velocities to allow wave packets to form." This is not so; indeed, it is in highly dispersive media that the distinction between group and phase velocities comes into its own. A cursory examination of Sir James Lighthill's well-known proof of the identity of group and energy transport velocities shows that the concept is valid both for highly dispersive *and* narrow-band disturbances. Physical explanations are not always clear and there are some unfortunate definitions. For example, the Boussinesq approximation is said to be one in which "the atmosphere is taken to be uniform and incompressible in the horizontal direction, but to be compressible and in hydrostatic equilibrium in the vertical direction." Surely, it is more correct—and simpler—to say that it treats density as a constant in all terms of the equations of motion except the one in the external force (Subrahmanyan Chandrasekhar, *Hydrodynamic and Hydromagnetic Stability*, Clarendon Press, 1968).

On the whole, though, I would say that a praiseworthy effort has been made to produce a readable book; it is attractively laid out and illustrated, but the price will tend to limit the market to institutional buying. If read critically and with care it should be useful to researchers entering the field of atmospheric dynamics.

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Ice Physics

P. V. Hobbs
837 pp. Oxford U. P., New York, 1974. $85.00

Some people say the world will end in fire/Some say in ice. So wrote the poet Robert Frost and, though the number of books on ice does not yet approach the number written about thermodynamics, Peter Hobbs's monumental volume *Ice Physics* contributes massively to the score.

Until ten years ago, the only general volume available on ice was Ernest Dorsey's 1940 data compilation "Properties of ordinary water substance," but the past decade has now seen the publication of four books on the physics of ice by Elton Pounder (Pergamon, 1965), David Eisenberg and Walter Kauzmann (Oxford, 1969), Neville Fletcher (Cambridge, 1970) and now Peter Hobbs (Oxford, 1974), in addition to the proceedings of four international conferences. Liquid water is served about equally well.

This upsurge of interest in ice is due not so much to growing fears of a new glacial epoch in Europe, but rather to the facts that a molecular solid as complex as ice can now be treated with a reasonable amount of exactness (both theoretical and experimental) and that, of all simple materials in the world, water in all its forms is undoubtedly the one with the greatest significance for biological and geophysical processes.

Peter Hobbs, a product of John Mason's cloud-physics group in Imperial College London, is Professor of Atmospheric Sciences at the University of Washington and has contributed largely to the physics of ice in this context. His book reflects this interest by devoting 90 pages to ice in clouds compared with only 20 pages for all other applications, but basically it is an exposition of the pure physics of ice, directed at graduates in physics or chemistry working in neighboring fields. One might dispute the publishers' claim that it is the "first comprehensive account," since its subject matter is nearly identical with its smaller Cambridge counterpart, but comprehensive it certainly is. Crystallography, electrical, optical, mechanical and thermal properties, nucleation and crystal growth are all thoroughly covered, though no attention is given to liquid-water structure.

The discussion throughout is clear, accurate and logically presented with detailed experimental results and derivation of important theoretical treatments given in full. The bibliography of over 1200 items covers all important work up to 1973, and there is a useful index of experimental data. The design and production maintain the usual high standards of the Clarendon Press.

Certainly this will remain the standard reference work on ice physics for many years to come and should be in every library with even peripheral interest in the subject. Its size and cost will probably deter both the casual reader and private purchaser.

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Hydrogen Bonding

M. D. Joesten, L. J. Schaad
622 pp. Marcel Dekker, New York, 1974. $45.00

Studies on hydrogen bonding have grown extensively since the mid-1930's. The first attempt to cover this subject comprehensively was the 1960 book *The Hydrogen Bond* by George C. Pimentel and Aubrey L. McClellan. It is pointed out by these authors, and rightly so, that the hydrogen bond is as important to living things as the carbon–carbon bond.

The current book by Melvin D. Joesten and L. J. Schaad essentially updates the prior work of Pimentel and McClellan to early 1974. There is a similarity in the type and scope of coverage, in the arrangement of the bibliography, and in the extensive tabulation of data. There is a dichotomy in style that reflects the contribution and interest of each author. The chapter on the theory of the hydrogen bond, written by Schaad, is divided into two parts. The first is simply a general background to quantum theory, which can be skipped by those acquainted with the field but which should be quite helpful to beginners. The remaining four chapters, written by Joesten, cover such topics as experimental methods (mostly spectroscopic), thermodynamic and kinetic aspects, and correlations among the thermodynamic and spectroscopic data. These are areas in which Joesten has done research.

The authors are to be commended for organizing and arranging in a single work the data of several thousand publications scattered among many journals. But vast as it may seem, it should be noted that hydrogen bonding is just one aspect of the general field of electron donor–acceptor interactions. As such, the book should be of interest to a large segment of scientists ranging from biochemists to molecular physicists, with the largest audience being chemists.

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The World of Measurements

H. A. Klein
735 pp. Simon and Schuster, New York, 1974. $14.95

It pains me to write this kind of review, but this is not a very good book. The author, H. Arthur Klein, has gone to enormous trouble to deal with measurement systems in all of the various fields of physics, but his presentation reveals all too frequently that he does not understand what he is writing about.

His purpose of expounding and advocating the International System of Units (SI) is something to which I am most sympathetic. However, he has gone to great lengths to seek out all the units that have ever been used, some of which I have never encountered before in fifty years as a physicist, and I feel that this detracts a good deal from the usefulness of his presentation.

He confuses the weight-mass problem by suggesting that, using SI units, a housewife would buy food by the newton (the SI unit of force) whereas she would certainly buy it by the kilogram, since it is the mass of food she is interested in, even though the weighing process utilizes the gravitational force on