mark: "the golden age of complete understanding of auroral science is perhaps still in the somewhat distant future."

The contents of the book do not comprise an introduction to the subject of atmospheric emissions, nor were they intended to. The book contains a very well balanced assembly of contributions by renowned scientists on topics of current observational and theoretical interest. The first 351 pages deal with auroral characteristics, observational material obtained from observations from the ground, aircraft, rocket, and satellites, and with the fundamental causes of the aurora. The remaining 210 pages are oriented to the upper atmospheric airglow, covering well both observational and theoretical aspects.

I recommend the book both for persons having general interests in geophysics and for the research specialist in upper atmospheric phenomena.

ADEN B. MEINEL
Optical Sciences Center,
University of Arizona, Tucson

Water as a Solid

The Chemical Physics of Ice. N. H. FLETCHER. Cambridge University Press, New York, 1970. xii, 272 pp. + plates. $13.50. Cambridge Monographs on Physics.

Considering the great abundance and universal significance of water, and the fact that about one-half of all fresh water on earth is in the solid state, there is a remarkable lack of coherent textbooks about ice. Thus it is inevitable that this new work by a respected author will find ready and widespread acceptance.

The author's declared aim is twofold: to provide a text on chemical physics for graduate students and advanced undergraduates, using ice to illustrate the application and interrelation of basic principles in quantum mechanics and solid state physics, and to set out established knowledge of the chemical physics of ice for the benefit of those who are interested in ice as a material.

The idea of using ice as a model solid for teaching purposes seems excellent in conception, and probably there will be only minor argument about the execution. However, there are many texts on physics and chemistry but few on ice, and this book is likely to be judged mainly on its merits as a monograph on ice.

The first chapter deals with the structure and properties of the water molecule, and from this base there follows an exposition of the structure and energy of ordinary ice and ice polymorphs; the structure of liquid water and the freezing process; growth of crystals from the vapor and the melt; and thermal properties and lattice dynamics. After this treatment for perfect crystals there is a discussion of defects, impurities, and diffusion, and the book concludes with chapters on mechanical and electrical properties of single crystals.

The text is orderly and economical, marshaling theoretical arguments and experimental facts so as to develop results with the logical progression of retrospect. In the chapters dealing with freezing and crystal growth the author writes with obvious zest on his own research specialties. The chapters on mechanical and electrical properties are less satisfying, but adequate. The general style is stark and uncompromising, and although this may be consistent with the author's aims it could be disconcerting to readers lacking background in physical chemistry. Symbols are not always defined as they occur, and there is no glossary of notation. The author follows his own preference in units, which does not conform completely to the international system.

Fletcher's book complements the recent book *Structure and Properties of Waters* by Eisenberg and Kauzmann (reviewed in *Science* 14 Nov. 1969), which devotes about one-third of its length to ice and achieves a comfortable style for readers from other disciplines without in any way compromising its content. Neither of these books treats polycrystalline ice, and neither attempts a comprehensive compilation of data; a successor to Dorsey's 30-year-old compendium still remains to be written.

The Chemical Physics of Ice fills a long-standing need for a basic text on the physics of ice. It can be recommended as an invaluable grounding and guide to the literature for physicists and chemists, and with some reservations for engineers, geologists, and biologists interested in ice.

MALCOLM MELLOR
U.S. Army Cold Regions Research and Engineering Laboratory, Hanover, New Hampshire

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