real thing) the second of two slim "flexi-covered" volumes of excerpts at $3.25 (or, if ordered from England, $2.52, as undergraduates foolish enough not to have accounts at Blackwell's might note.) Volume 1, published about five years ago, contains eight extraordinary papers in low-temperature physics, and is of unquestioned value as a reference book in that field. But the ten papers in volume 2 are united only by their common authorship, being even less unified in content than the subtitle suggests, for "quantum mechanics" here embraces nuclear physics, astrophysics, particle physics, quantum electrodynamics, and the like. If the first selection from the collected papers offers a concentrated bit of Landau, this one provides a quick tour of the whole terrain.

It is a guided tour too, with 50 introductory pages by D. ter Haar that attempt to supply background and to provide a contemporary retrospective evaluation of the papers. This is hard to do in five pages per paper, especially since a fair part of these essays is devoted not to a context and critical assessment, but to derivations alternative to those given by Landau. Thus, as is generally the case with cut-rate tours, the guide succeeds in being both tantalizingly brief and maddeningly irrelevant.

If you like to buy souvenirs, you could do worse with your $2.52, but as one who has never had much use for guided tours or momentos, I would recommend saving the guinea and taking your own selected tour in the library.

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The Chemical Physics of Ice

By N. H. Fletcher
271 pp. Cambridge U. P., Cambridge, England, 1970. $13.50

For 30 years science has had to do without any new H_2O books, but now within the space of only one year the ancient University Presses of Britain have contributed D. Eisenberg and W. Kauzmann's *The Structure and Properties of Water* from Oxford, and N. H. Fletcher's *Chemical Physics of Ice* from Cambridge.

The latter is shorter; the subject has not quite so many ramifications, but the properties of ice are capably and systematically covered: the structures and energies of ice in its various forms, freezing, crystal growth, thermal properties, lattice dynamics, point defects, mechanical and electrical properties. Clearly the subject has been underdocumented for a long time; a monograph of this type is what is needed for a start.

The book is aimed partly at specialist glaciologists, and partly at graduate or advanced undergraduate students who . . . "are looking for something on which to try their teeth . . . the detailed study of a reasonably simple material like ice is admirable for this purpose." Glaciologists may be amused to hear that ice is a reasonably simple material. But let them try some other less simply-ordered molecular solid in such detail, and the truth of this judgment will stand out.

It would be possible to fault this monograph on details, more on points of opinion or of emphasis than of fact, but the specialists will approve it in most things and can benefit from it. It will be of most value to the chemical physicist just about to enter the subject.

Glaciology is a subject important in environmental science—for example there is radar mapping of frozen continents, there is nucleation of high-altitude water vapor. There is also the tribologically important and dangerous layer of liquid water that, according to "Faraday's hypothesis" is believed to be present on all ice surfaces at temperatures not too far below 0°C. All sorts of environmental scientists and biologists will wish for knowledge of this "reasonably simple material." But it is rarely pure or homogeneous. Everyday ice, even glacier ice, is full of air bubbles that affect nearly all its properties. Ionic impurities dominate the electrical conduction, as would be the case for any protonic semiconductor.

The monograph is well produced and indexed, it is written by an author who is actively contributing to the subject, and what he has written will encourage a wider interest among physicists. A surprisingly large number of leading chemical physicists appear to have contributed to this subject already.

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Quantum Mechanics

By E. Merzbacher
(2nd edition) 621 pp. Wiley, New York, 1970. $13.95

Eugen Merzbacher's text of graduate-level quantum mechanics is well known for its straightforward presentation of the usual set of topics. There is surprising agreement as to what this set of topics should include as determined, say, by the tables of contents of the four or five widely used modern texts. There is little agreement, though, on how the student should best go about mastering the subject or how the teacher should present it. This text, originally published in 1961, is notable for making its contents accessible to the average student. It lacks (perhaps necessarily) the elaborate formal development of the two volumes of Albert Messiah or the sophistication of Kurt Gottfried's book.

The material of the 22 original chap-

Ice formation in Greenland. Shear flow from basal zone of the Moltke glacier, a geophysically polar ice mass. Note the entrained pebble-sized rock fragments. (Photograph by Maynard Miller, Michigan State University.)

ters has been improved and rearranged slightly to form the first 20 chapters of the 24 of this edition. One major change is that the subject of rotations and other symmetry operations is now in the 16th instead of the final chapter. This is an improvement because it allows the perturbation methods that follow to be applied to a wider, more representative set of problems.

Another change is the insertion of a brief chapter entitled "Dynamics of Two-Level Systems" in which the author uses this simple example to discuss the density-matrix description of ensembles and the conventional "reduction of the wave packet" view of measurement theory. Anyone contemplating the adoption of this book as a text for his course might do well to study this brief chapter of 18 pages, because it reveals the strengths and weaknesses of the author's approach. New ideas are exposed via very simple mathematics and thus presented in a simple way. One may complain that the generality and revolutionary implications of these ideas are neglected. The timid mind will not be frightened, but the adventurous one will not be greatly stimulated.

In the final four chapters the idea of second quantization is introduced and applied to the electromagnetic field and to electrons. The development begins by postulating that the eigenstates of the occupation-number operators form a complete set. In the final chapter the one-electron Dirac field is recovered from the many-particle theory, and applications are discussed. Not having tried this approach in the classroom, I have no informed opinion of its value. It is certainly true that students find the historical approach of quantizing the modes of the classical field difficult. The density of new ideas in these final pages would, I think, not allow their use as standard text material, but the more enterprising students may enjoy seeing a preview of these advanced topics.

This book has been improved in thoughtful and careful ways, but it is not greatly changed.

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Cosmic Electrodynamics

By J. H. Piddington
305 pp. Interscience, New York, 1969. $18.50

In his preface J. H. Piddington suggests that "a monograph dealing with such a fast developing subject tends to grow out of date." He then continues with the somewhat contradictory remark: "However, a large part of the material has now settled into permanent form, ..." Despite the doubts expressed by the first statement and the possibility of considerable disagreement as to how