are not usable on all computers.)

In his preface, Georgi mentions that the book is based on a course he has taught at Harvard University for 15 years. Clearly, then, it has been successful in this context, and if an instructor desires to have a text that discusses waves from the standpoint of a modern field theorist (including even an appendix about Goldstone bosons!), this book may well meet his or her needs.

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Liquid Crystals

S. Chandrasekhar
Cambridge U. P., New York, 1992. Second edition. 460 pp. $100.00 hc ISBN 0-521-41747-3 $39.95 pb ISBN 0-521-42741-X

When the first edition of Sivaramakrishna Chandrasekhar's highly acclaimed book appeared a decade and a half ago, liquid crystals were still something of a curiosity. Physicists were discovering phases and phenomena that are now commonplace, and were beginning to recognize the universal properties relating liquid crystals to other physical systems such as superfluids. On the industrial side, the twisted nematic cell, patented in 1972, had just found its way into wristwatches and calculators. Nevertheless, prophets of doom from time to time opined that the field had been exhausted and little was left to accomplish.

Cut to the present. Attendance at the biennial International Liquid Crystal Conference has quadrupled, and it's easy to spend more time at topical meetings than in one's office. The annual worldwide market for flat-panel liquid crystal displays now exceeds $3.5 billion, and is expanding so rapidly that it is expected to surpass the market for cathode-ray tubes within five years. The field of liquid crystals was recognized with Pierre-Gilles de Gennes' 1991 Nobel Prize in Physics, and researchers are *still* discovering new phases and phenomena at an ever-increasing rate. "Antiferroelectricity," "nonlinear optics," "pattern formation," "blue phase," "boojum," "discotic," and "twisted grain boundary" are among the many terms that have been added to the liquid crystal lexicon since the publication of the first edition of *Liquid Crystals* in 1977. These are certainly interesting times.

In this milieu Chandrasekhar, a renowned leader in liquid crystal research and a cofounder of the International Liquid Crystal Society, has updated and revised his book. His new edition includes several topics that were first emerging in the late 1970s, as well as phenomena discovered in the intervening years.

Perhaps the most significant revision is the addition of a chapter on discotic liquid crystals, a field developed in large part by the author. The traditional liquid crystalline molecule is approximately rod-shaped, giving rise to many of the phases and physical characteristics we normally associate with liquid crystals. Disk-shaped molecules also display a variety of mesogenic phases. As with rod-shaped molecules, the symmetry axis of these planar molecules may exhibit long-range orientational order. In fact, for molecules with sufficient biaxial character, one may even encounter a biaxial nematic phase. At lower temperatures a variety of columnar phases may obtain, in which the disk-shaped molecules stack in columns that themselves are ordered. These phases, which exhibit fascinating and potentially advantageous optical and mechanical properties, have not been observed with rod-shaped molecules.

Another new topic that Chandrasekhar weaves into this new edition is blue phases, which occur in chiral systems near the cholesteric–isotropic phase transition. These phases exhibit complex helical structures in three dimensions and have rather striking macroscopic optical properties. During the past 15 plus years, considerable effort has also been spent understanding the many new smectic A phases. In addition to the traditional smectic A phase (these days called the smectic A_1 phase), we now have smectic A_2, A_d and $\tilde{A}$ phases, and most recently a chiral version of the smectic A ("twisted grain boundary") phase. Chandrasekhar deals rather nicely with these issues. The second edition also discusses ferroelectric liquid crystals and touches on other contemporary topics such as the hexatic phase and smectic layering at a free surface.

It's difficult in a book of this sort, however, to cover all topics to everyone's satisfaction. In the first edition Chandrasekhar eschewed lyotropic liquid crystals, as they were not well understood at the time; although our understanding has greatly improved, the new edition treats lyotropics only in other contexts, such as biaxiality. Interfacial behavior is a vast and vital area of research, as it addresses both fundamental and practical issues, but it receives only a smattering of attention in the book. Other important areas that receive scant or no coverage include nonlinear optics,

lower symmetry smectic phases ("smectic polymorphism"), polymer liquid crystals, and issues relating to devices. A brief chapter on devices would have been especially useful for the physicist attempting to explain the workings of an active matrix LCD computer display to a nonscientist. By the same token, defects and hydrodynamics receive perhaps more attention than my own prejudices consider appropriate.

In format and style the new edition is similar to the old: It tends to mirror the scientific literature rather than being pedagogical. In consequence, I find it inappropriate as a textbook for a graduate student's first course in liquid crystals. Nevertheless, its strengths far outnumber its weaknesses, as the new edition brings the reader comfortably up-to-date with many of the developments in the field during the past 16 years. Errors in the first edition have been corrected, and many appropriate references to more recent results have been incorporated into the text. As a general reference, to be supplemented with an occasional specialized review article, this book will be a highly desirable resource for the more advanced graduate student and the researcher in liquid crystals and related fields.

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Getting to Know Semiconductors

M. E. Levinshtein and G. S. Simin
World Scientific, River Edge, N. J., 1992. 174 pp. $28.00 hc
ISBN 981-02-0760-3

I've been sitting here for weeks, scratching my head and wondering who would want to read this idiosyncratic little book about semiconductors. Suddenly it dawned on me: *You* would. You, the avid reader of PHYSICS TODAY and especially of the book reviews, will want to read this book. If you are like me, you look at the book reviews to learn of books well outside your specialty that might satisfy your mild curiosity. So, here it is: your introduction to semiconductors.

Levinshtein and Simin do not tell you about bipolar transistors, nor even about field-effect transistors, so they perforce miss much of the magic by which semiconductor electronics has recently been transforming our lives. What this book does is present in a very clear way how semiconduc-