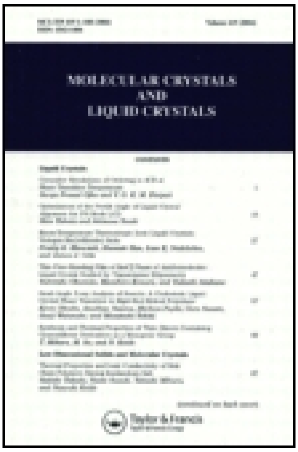

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A review of: "The Physics of Liquid Crystals, by P. G. de Gennes and J. Prost, second edition, Oxford Science Publications; Oxford University Press, 1993, Oxford, U.K.; New York, N.Y.; ISBN: 0-19-852024-7; xvi + 597 pages; $90.00"

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The Physics of Liquid Crystals, by P. G. de Gennes and J. Prost, second edition, Oxford Science Publications; Oxford University Press, 1993, Oxford, U.K.; New York, N.Y.; ISBN: 0-19-852024-7; xvi + 597 pages; $90.00.

The first edition of this monograph, published in 1974, offered pioneering physical insight into the properties of various liquid-crystal mesophases, in particular the nematics and cholesterics. It quickly became a standard reference text for the field. It also firmly established the study of liquid crystals as a fundamental component of 'soft matter' science. Over the past-twenty years, liquid-crystal systems have proven to be remarkably flexible, enabling investigation of numerous physical concepts and ideas. Furthermore, liquid crystals have become increasingly technologically important, primarily in display applications.

In the present edition, after initially discussing new perspectives of liquid crystals, the authors weave several additional sections into the fairly well established areas of nematics and cholesterics, e.g., the biaxial nematic phase, blue phases, computer simulation results, etc. Their discussion of smectics has been significantly expanded, from one chapter to four, reflecting the substantial advance in liquid-crystal research over the past twenty years. Despite the increased attention, the authors qualify their treatment of smectics in the last chapter with the following sentence. Developing all aspects of phase transitions involving smectics or columnar phases would require a separate book (of more than 600 pages). As a matter of fact, since the publication of the first edition, many books and extensive review articles on liquid crystals with special emphasis have been published. It is therefore difficult to delve deeply into all topics of current interest. Nevertheless, de Gennes and Prost have struck an excellent balance in presenting the essential ideas related to the technologically important nematic and cholesteric phases and the academically enlightening smectic and columnar phases. Consequently, this book would serve not only as an excellent textbook for a course on liquid crystals but also as a valuable reference for further research at the frontier of soft matter physics. In my opinion, however, reducing the discussion on the dynamical properties of nematics, smectics and columnar phases and adding a brief chapter on various liquid-crystal devices would have been extremely useful for the scientists attempting to explain the basic physical principles behind an active matrix liquid crystal display to a layperson.

Due to the intrinsic anisotropy of the liquid-crystal molecules and corresponding mesophases, in many circumstances complicated mathematical forms are necessary to explain their distinct physical properties. In most of these cases, the authors have provided illuminating qualitative physical pictures with their exceptional physical insight. The book contains many elegant analogies with well-known physical phenomena, e.g., the idea of "dislocation" current in explaining the dislocations found in the smectic phase, the similarity of the incommensurate smectic-A phase and the cholesteric phase under an applied magnetic field, the remarkable analogy and important differences between the nematic-smectic-A and normal-superconductor transitions, etc. In the end, it is apparent that liquid crystals do not simply provide useful analogies and model systems, but that they also offer original problems that have the potential for defining new physical concepts. The second edition of The Physics of Liquid-Crystals will be a highly desirable resource for researchers in liquid crystals and related fields.

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