think of waves. Hertz's motivation, Buchwald shows, was the conflict in Germany toward the end of the 19th century between two competing views of electromagnetism: There was Helmholtz's view, in which everything was explained in terms of interaction potentials with no specification of the nature of electric charge or current, and there was Wilhelm Weber's, which used electric particles—"atoms" of electricity—that exerted central forces on one another (with the forces depending on both distance and the first and second time derivatives of the distance). As a student Hertz was also imbued with the view that the purpose of experiment was to produce novel effects (hence the title of the book), rather than to test theory. Thus he regarded experiments that showed a positive effect more highly than those that gave a null result.

Buchwald's book, particularly for those who know the history and its modern interpretation, is a fascinating detective story. How will Hertz, who appears to be looking elsewhere, reach the point where he will demonstrate the existence of electromagnetic waves, and how will he actually demonstrate it? Along the way we are given detailed accounts of the experiment in which Hertz failed to show the electric nature of cathode rays, his observation of the photoelectric effect, his experiments on the evaporation of liquids and his first construction of a spark-switched oscillator with a resonant spark gap used as a detector. Hertz could then attempt to show that electric forces propagate and demonstrate indirectly that dielectric polarization can be caused by electromagnetic action, something he was not able to observe directly. Hertz used his oscillator–resonator apparatus to show the interference between the electric force produced directly by a spark gap and the force produced by a wire attached to the gap. Once he had demonstrated this interference, he began to think about electromagnetic waves and performed the experiment showing the interference of the waves produced by the spark gap and by reflection from a metal plate.

Throughout this account, Buchwald interprets the experiments in the context of what Hertz knew at the time. Thus there is no space-charge explanation of Hertz's failure to show the electric nature of cathode rays. This treatment results in a more correct and, I believe, a more interesting history. We learn what the science was at the time, with all its complexity, not the interpretation given later. Although the text contains considerable technical detail, it is quite readable, even for those without extensive knowledge of electromagnetic theory. For those who want even more technical detail, Buchwald includes 80 pages of appendices.

Buchwald previously gave us excellent histories of optics and electromagnetic theory in the 19th century: *The Rise of the Wave Theory of Light* (University of Chicago, 1989) and *From Maxwell to Microphysics* (University of Chicago, 1985). This account of Hertz's experimental work is a worthy successor to those volumes. I strongly recommend it.

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The Physics of Liquid Crystals

P. G. de Gennes and J. Prost
Oxford U. P., New York, 1993. 597 pp. $90.00 hc ISBN 0-19-852024-7

The past 20 years of theoretical and experimental liquid crystal research have been very fruitful. This is especially true in the area of smectic liquid crystals, marked by the discoveries of the twist-grain boundary phase (the liquid crystal analog of the Abrikosov flux lattice in type-II superconductors), the breakdown of conventional elasticity and hydrodynamics and the existence of frustrated smectic phases. A nearly complete understanding of the fascinating cholesteric blue phases has also been obtained. More recently there has been a flurry of theoretical activity regarding nematic polymers as well as large-scale numerical simulations of low-molecular-weight and polymeric liquid crystals.

The Physics of Liquid Crystals by Pierre-Gilles de Gennes and Jacques Prost is an update and revision of de Gennes's classic volume of the same title published more than 20 years ago. In revising the first edition, the authors have chosen to focus on some but not all of the important developments since then. Even with the omissions the book is nearly 600 pages long (nearly twice the size of the first edition), so some judicious selection of topics was certainly required. The new material focuses on smectic and columnar phases, with the single chapter on smectics in the first edition expanded into four chapters covering the statics, dynamics, defect structures and phase transitions of smectic and columnar phases. The first edition's chapters on nematics and cholesterics have been updated to some degree, most notably with the addition of a lengthy discussion of the cholesteric blue phases. Some of the nicest additions to the first introductory chapter are a "poor man's" elasticity theory of liquid crystalline phases and an elementary discussion of the statistical mechanics of long-range order in a variety of phases. In the second chapter, on the statics of nematics, the authors have updated the discussion of experiments on the nematic–isotropic transition and added a description of the mean-field theory of biaxial nematics.

The four new chapters on smectics and columnar phases are beautifully done. The authors have devoted considerable space to discussing chiral systems, two-dimensional phase transitions, the twist-grain boundary phase and the breakdown of conventional hydrodynamics. In many of these discussions the authors present valuable original insights not found in the original references. They have also paid considerable attention to summarizing the status of agreement or disagreement between theory and experiment, especially in the case of the nematic–smectic transition, which continues to be somewhat puzzling.

There are a few minor problems with the book. A serious error remains in figure 3.20, which gives an incorrect pictorial view of the molecular origin of flexoelectricity (the dipole moments on the banana-shaped molecules should all have the same orientation relative to the concave side of the molecules). This figure had the same error in the first edition, and it is unfortunate that it was not corrected in the second. (Robert Meyer brought this error to my attention.) Also, I found the brief section on computer simulations to be unsatisfying. No mention is made of the molecular dynamics simulations of hard spherocylinders and the thermotropic Gay–Berne potential. The most recent reference cited is to Monte Carlo work that is a decade old. While I appreciate the authors' decision not to focus on numerical work, more recent references would have been very helpful to those readers who wish to learn more about this area. It is misleading to have a section on computer simulations with no mention, however brief, of the current state of the art.

In spite of these caveats, this is still a remarkable book that ought to be on the shelf of every liquid-crystal physicist. It continues to be the best introductory book for a beginning graduate student as well as a very valuable reference source for experts in the field.

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Electron Paramagnetic Resonance: Elementary Theory and Practical Applications

John A. Weil, James R. Bolton and John E. Wertz
Wiley, New York, 1994. 568 pp. $111.95 hc ISBN 0-471-57234-9

Electron Paramagnetic Resonance: Elementary Theory and Practical Applications is the successor edition to the classic *Electron Spin Resonance—Elementary Theory and Practical Applications* by John Wertz and James Bolton (Wiley, 1972). Over the past 22 years, the earlier book has provided many students in chemistry and physics with their first formal introduction to EPR (formerly electron spin resonance). I have used it successfully as the textbook for both a graduate course and senior honors independent study programs for many years.

The Wertz–Bolton text was distinguished by its clarity and careful coverage of the basic topics as well as by its excellent selection of problems. Consequently, it is a pleasure to report that the new edition retains all of these qualities, even though the emphasis has been completely revised to reflect the extent to which EPR has evolved during the intervening years. The authors have made the wise choice of giving a detailed exposition of a limited number of carefully selected examples rather than providing a wider but more superficial discussion of more topics. They have also constrained their discussion to those EPR spectra obtained using continuous-wave techniques; a revision that included pulsed EPR spectra and techniques would have been made cumbersome by many additional chapters. Nonetheless there remains a need for a companion introductory text devoted to pulsed EPR. As in the earlier edition, the emphasis remains on isolated paramagnetic species and the interactions with the surrounding environment.

The new edition consists of 13 chapters plus 7 appendices. The authors have wisely relegated the discussion of instrumentation to an appendix, combining it with the original appendix on experimental methods. Unfortunately, their rewrite does not provide an accurate reflection of contemporary continuous-wave EPR spectrometer design, since there is no discussion of the advantages of either digital synchronous demodulators and signal processing or digital magnetic field control and sweep, although