

quantum electrodynamics, permanently useful monographs were written long ago. The time when this can be done for quantum chromodynamics is still far in the future, at least as far as the aspects concerning quark-gluon plasmas are concerned.

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The Structure of Matter: From the Blue Sky to Liquid Crystals

André Guinier

230 pp. Edward Arnold, London, 1984.
\$19.95

Science provides us with predictive mathematical theories, but, equally important, it gives us pictures of the underlying structure of the things around us. It tells us that the physical world is made of atoms, which, for many purposes, may be regarded as small charged spheres with valence electrons. Much of the success of modern science is due to the implications of this simple and powerful idea. In *The Structure of Matter*, André Guinier shows us how fruitful the atomic model has been. While restricting himself to the realm of ordinary matter—there are no plasmas or neutron-star interiors to be found here—he summarizes most of the experimental work that has been done on determining atomic structures over the last 60 years, as well as the major known links between microstructure and the macroscopic properties of materials.

Guinier makes the story of matter deceptively simple. We begin with atoms, ions and small molecules, each with a characteristic size and bonding pattern. The existence of critical points argues strongly that most matter may be divided into two types: disordered liquids and gases, and ordered solids, separated by an inevitable phase transition. The bonds in ordered solids (crystals) determine much of their behavior, with, for example, strong covalent bonds leading to hard, nonconducting materials that are difficult to melt. This and much of the rest of the story will be familiar to working physicists, but it is rarely so lucidly presented. Many of the richest rewards are in the later chapters that consider states of matter "intermediate" between order and disorder, where we learn how detergents clean, how liquid crystals tell us the time and why rubber has an elastic limit three orders of magnitude larger than that of a metal.

The book's diction, organization and wide margins copiously filled with electron micrographs, ordinary graphs and diagrams are those of an introductory text, but the overall feeling of the book

is that of a distillation of Guinier's long experience of his subject. The acute awareness of limitations, delight in detail and easy use of a formalism that has become second nature are the marks of a specialist presenting his own field.

Unfortunately, these characteristics make the book difficult to classify. Lattice-energy sums and probability distributions, while not dealt with heavily, appear whenever they are the natural means of expression of an idea, making the book too difficult for, say, a "physics for poets" course. Many who can follow the more advanced ideas may find too much review material for the book to hold their interest. Perhaps the most natural setting for this book is a materials-science or geology course, where the ideas of the basic science of matter are becoming more and more essential to applications. We may also hope that Guinier will reach one of his main intended audiences, namely pre-college teachers, thereby strengthening our ailing science-teacher training programs.

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Rates of Phase Transformations

R. H. Doremus

176 pp. Academic, New York, 1985. \$29.00

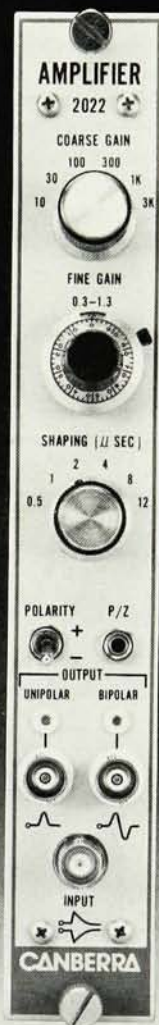
In the last few years there has been an explosive increase in research related to the dynamics of transformations from one phase of matter to another. Major topics of interest include growth instabilities, diffusion-limited aggregation, fractals and quasicrystals. None of these topics, unfortunately, are covered in R. H. Doremus's *Rates of Phase Transformations*. Doremus does cover a wide range of material, including nucleation, whisker growth, precipitation in metals and crystallization of multicomponent melts, but the above-named omissions limit the book's usefulness as a text, and serve to date it.

The book derives from a graduate course in materials engineering taught at Rensselaer Polytechnic Institute. Though it is said to be "appropriate for courses and individual study by chemical engineers, chemists, and physicists," it is unlikely to be used as a physics text. The problem is not only that current material is missing; the significant drawback is simply that the book is more suited for use in engineering than in physics. For example, empirical fitting functions are often simply presented and then used in cookbook fashion. And though references to original works are given, clearly the emphasis here is not on concepts and underlying physical principles but rather on what seems to work

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and how to apply it.

As an engineering text, however, it is quite good, taking time to work through various limitations of the solutions presented. Each chapter contains a section with problems that, while rather straightforward, nonetheless serve to amplify further the main body of the text. A useful bibliography is also provided for each of the chapters, listing relevant books, review articles and research papers. The book itself is attractively mounted and has several interesting photographs, and though a few typographical errors are to be found they are not serious. It is annoying, though, when equations are sometimes referred to as "Eq. (27)" rather than "Eq. (2.27)," for example, or when an angle is given as θ in the text and ϕ in the corresponding figure.

Though not really what one would like in a physics text, the book could serve as a handy reference for students wanting to get a quick feeling for areas that are new to them. It is brief and can be covered completely in just a couple of sittings.

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book note

Einstein in America

Jamie Sayen. xii + 340 pp. Crown, New York, 1985. \$17.95

This charming book carries the tag line *The Scientist's Conscience in the Age of Hitler and Hiroshima*, which characterizes its principal topics. It is graced by many pictures, some of which I had not seen before. As a biography this work sketches lightly Einstein's life in Europe; Jamie Sayen digs in when he reaches the fall of 1933, the time Einstein settled in the United States and in Princeton for the balance of his life. His presentation derives its significance from the moral, political and other social issues with which Einstein was involved throughout this period. Though Sayen's account reveals nothing major that is not also accessible through other channels, there are many illuminating sidelights, which Sayen undoubtedly owes to his contacts with Margot Einstein (who died this year on 8 July), with the late Helen Dukas, with Otto Nathan, with Valentin and Sonja Bargmann, and with others who contributed materials and insights. A number of translations from the original German into English by Sonja Bargmann are testimony to her sensitivity for both languages, which matches Einstein's own.

Sayen's book omits almost entirely any discussion of Einstein's work in physics, and it seems fairly obvious that he does not possess the technical