▸ figures drawn so casually that they are qualitatively wrong,

▸ restricted results without mention of the restrictions,

▸ erroneous statements and results and

▸ omission of topics basic to fluid mechanics. The third and fifth types are most frequent but there exists more erroneous statements and results than are acceptable in a textbook in this didactically well travelled field.

To omit examples would, of course, be unfair to the authors. One of the errors is the occasional omission from the vorticity dynamic equation of its (physically) most interesting term, the one that represents vorticity amplification by vortex line growth. On page 243 this effect is apparently suppressed by the mere act of transforming to Cartesian coordinates! Another error is the claim that "the basic mechanism for transition from a laminar flow to a random-type turbulent flow has been explained." In fact it is not explained at all; apparently the authors are unaware of the difference between laminar instability and transition to turbulence.

Perhaps the most common restriction that is often used in this book without mention is the "barotropic" one, that is, that density be a unique function of pressure. It is explicitly brought out only in the one section where the more general case is finally discussed—well along in the book.

Two welcome chapters are those on particle fluid dynamics (essentially suspensions) and hydrodynamics of superfluids, the latter especially, because of the scarcity of introductory surveys in that area. It is not obvious, however that their presence compensates for the shortcomings in the presentations of the classical fluid mechanics material.

STANLEY CORRSIN
The Johns Hopkins University
Baltimore, Maryland

European Technology, The Politics of Collaboration

Roger Williams
214 pp. Halsted, New York, 1973.
$13.00

The topic of this book is an exasperating one. Most of us would like to consider Western Europe as a cultural, economic and political unit rather than a collection of sovereign states preserving their own parochial interests. Past and recent history, however, point toward the latter alternative.

We are disappointed by the apparent lack of European collaboration on the political, technical and scientific level apart from a few outstanding examples to the contrary in the scientific field, such as CERN (European Center for Nuclear Research), EMBO (European Molecular Biology Organization) and to some extent ESRO (European Space Research Organization). The lack of success of EURATOM, the air bus, the European Institute of Technology and of many other attempted as well as non-attempted efforts of collaboration are only too well known and deplored. The reactions of European governments to the recent oil crisis have further strengthened these feelings.

However, things are perhaps not quite as bad as they seem on the surface. There exist successful collaborative efforts that are less in the public eye, because they are not government initiated. They come from the many multinational companies in Europe who have in fact introduced a certain measure of international collaboration. A few examples are Philips in electronics, Brown Boveri in the steel industry, ITT in communication, Nestlé in food industry. In many cases, as for example, in the field of computers and electronics, this collaboration was instigated by the participation of US firms. Also one should not overlook that the much maligned oil companies succeeded in preventing crippling oil shortages in Holland and Denmark, when the Arabs imposed a special embargo upon those two countries.

The book under review deals with many aspects, private and governmental, of European cooperation and with the problem of competition with the United States in science and technology. The famous "technology gap" is discussed at length. The most succinct explanation of this gap is found in a quotation of H. G. B. Casimir:

> "Abolish the Federal Government of the US. Divide the country into its several states and make sure each has a mildly different system of taxation, a different currency, different banking and insurance laws, and different customs regulations. Regroup American minorities into as many distinct language areas as possible and in any case not less than 15, and try to make sure that whenever possible there is at least one competing minority language requiring dual language schools. Oh yes, you will need 40 and 50 distinct patent systems. Do this and the technology gap between the US and Europe will fill up rapidly."

This gap also is sometimes overestimated. In various respects, especially where high science-based technology is less important, Europe is in fact more advanced than the US; this is the case in railroad development, tire production (the radial steel-belted tire is a European invention), hydroelectric power stations, and—strange as it seems—nuclear breeder reactors.

Unfortunately Roger Williams's book is not very useful for somebody who is not knowledgeable in these questions. It is written for the initiated, with too few clear summaries, with too many quotations, and very much from the British vantage point. The author refers to many projects by their code names—CESAR, MESH, CIFAS, TNPG—without saying what they signify and in those cases where he does say it, he gives a commercial and not a technical description of the projects, although the author supposedly was trained as a physicist in his early days. I cannot recommend this book to anyone who wants a lucid introduction into the problems of European technology. There is however one extenuating circumstance: I have not yet seen another book on the subject that is better.

VICTOR F. WEISSKOPF
Massachusetts Institute of Technology
Cambridge

The Crystal Structure of Solids

P. J. Brown, J. B. Forsyth
172 pp. Crane, Russak, New York, 1973. $15.50 hardcover, $6.95 paperback

The flow of information from crystal-structure determinations is an essential component in understanding solid-state properties. A variety of crystallographic techniques, including such procedures as recognizing point symmetry, orienting large single crystals, and identifying materials, are rather simple to apply, and indeed they passed into general laboratory use years ago. In contrast the path leading to an accurate and full crystal structure determination is often arduous and is in some cases entirely fruitless, even with the aid of recent major advances. On completion, however, we can know all atomic positions in the unit cell and the amplitudes of each atom's vibration with an accuracy on the order of a thousandth of an ångström, detect variations in atomic ordering as small as one atomic percent, well determine the bonding-electron distribution and, if neutrons are used in a magnetic investigation, the spin distribution and relate the tensor properties of the crystal to the absolute atomic arrangement. The growing number of introductory texts seeking to explain the various steps along this path is now joined by *The Crystal Structure of Solids*.

Jane Brown, a Fellow of Newnham College Cambridge, and Bruce Forsyth, formerly of Harwell and now of the Rutherford High Energy Laboratory, have collaborated often on x-ray and neutron crystallographic problems since their student days in the Cavendish Laboratory in the late 1950's. Their slim book, intended for students of solid-state physics and materials science, sets out to provide a background in diffraction theory and technique supplemented by illustrations of the principles underlying the stability of crystal structures. The first half of the book deals very lucidly with crystal symmetry, the generation and properties of radiation with wavelength on the order of one ångström, the theory of crystal diffraction and magnetic scattering and experimental methods for measuring diffracted beams. In the brief space available to Brown and Forsyth, the choice of topics is necessarily arbitrary but their treatment succeeds in familiarizing the reader with many important crystallographic concepts. The second half starts with a simplified quantum-mechanical discussion of the crystal structure of the elements, goes on to consider underlying reasons for the stability of several simple structure types somewhat misleadingly referred to as "polar," presents a brief but discerning introduction to binary alloys and concludes by outlining a possible approach to deducing the crystal structure of a new binary alloy. Among the few errors noted were examples both of omission and commission in a table of systematic absences caused by nonprimitive lattices.

Produced by typewriter composition and photo-offset printing, the low-priced paperback edition of this book will be useful to many students.

S. C. ABRAHAMS
Bell Laboratories
Murray Hill, New Jersey

Fields and Particles: An Introduction to Electromagnetic Wave Phenomena and Quantum Physics

F. Bitter, H. A. Medicus
688 pp. Elsevier, New York, 1973. $17.95

Physics Vol. 3: Modern Physics

A. L. Reimann
459 pp. Harper & Row, New York, 1973. $6.95

These are two excellent books, both of them written primarily for students who have completed two years of college physics and who, having a solid background in classical physics, are prepared to study modern physics. The phenomena the books deal with have mainly a quantum-mechanical origin, though both books discuss other topics such as the special theory of relativity and in some depth the problem of electromagnetic radiation. In many ways these books are modern counterparts of Max Born's *Atomic Physics* (Blackie and Son, 1951).

Each of them is written by authors with previous experience in textbook writing and a serious concern with undergraduate physics education. The book by Arnold Reimann is the third in a series, the first two being introductory texts and the late Francis Bitter of MIT was an active and innovative educator.

Of the two, Reimann's book is considerably shorter and designed for a less sophisticated audience. The discussion of phenomena tends to be qualitative rather than exact, and there is very little in the way of complicated mathematics in the text. This was also true of Born's text, which however contains forty technical appendices. This is not to say that Reimann's book is superficial, for it goes into a discussion of such sophisticated topics as nuclear magnetic resonance, Mössbauer effect and neutrino physics. In all cases the discussion, though naturally brief and qualitative, appeared both accurate and informative. The style in which it is written is also a very pleasant one, easy to follow and unpedantic.

The organization of the book consists of a first section on electromagnetic radiation and special relativity. Atomic physics is then introduced and wave mechanics is developed. Then, he discusses more sophisticated applications of these techniques, both in atomic and solid-state physics.

Subsequent chapters cover nuclear physics, including fission, fusion and even the cycles for converting hydrogen to helium in stars. The final chapters are on elementary-particle physics.

In addition this pleasing book contains an extensive set of problems, with solutions in the back. All of this seems to make it well suited for students wishing to acquire a broad, if not too detailed, understanding of twentieth-century physics.

The book by Francis Bitter and Heinrich Medicus is approximately twice as long as Reimann's and pitched at a higher level. It is designed for more advanced undergraduates, though the authors appear to have also had considerable success using it as a text in sophomore physics courses.

Before going into a more detailed discussion of its merits, let me say that one of the particularly attractive features of this book is its extensive set of historical notes, including brief biographical footnotes of all the major physicists whose work is discussed in the text. There are numerous interesting photographs and quotes, such as a full-page description by Ernest Rutherford of his early alpha-particle scattering that led to the discovery of the nucleus.

The body contains a wealth of material, so that one could be selective if using it as a text for a one-semester course. The approach is at times unorthodox, such as having the Bohr model of the atom come after a wave-