Alamos (2 November 1945), the final selection of Smith's and Weiner's book. Here, in perhaps the finest thing he ever wrote, Oppenheimer lays down the double bind that assails the political role of science and that turned his journey, from the laboratory to the corridors of power back to the museum setting of the Institute for Advanced Studies, into an emblem of the transformed/deformed nature of contemporary science itself. Here it is magnified and distorted by the "unusual" moment at which he did his work.

* * *

Robert Andersen is a visiting scholar at the Hastings Center, Hastings-on-Hudson, New York, where he is working on the politics of science and technology. He is currently writing a book on the atomic scientists, Oppenheimer included.

Atoms and Molecules (Student Edition)

M. Weissbluth
713 pp. Academic, New York, 1978. $24.50

The advent of high-powered lasers and of dedicated synchrotron light sources and the needs of research in such areas as astrophysics and fusion have led to a resurgence of interest in atomic and molecular physics. Concurrently, there have been significant advances in atomic and molecular theory, not only in the ability to make more reliable numerical predictions but also in the detailed understanding of the dynamics of atomic and molecular collisions. The nonspecialist or beginning graduate student who must read the scientific journals to learn of these advances often finds that the requisite basic knowledge is extensive. Mitchel Weissbluth, whose book has just been published in a paperback edition, intended to meet the basic needs of such a graduate student. As stated in the Preface, the book is an outgrowth of a one-year course in atomic and molecular physics in the department of applied physics at Stanford University for students who came from such diverse fields as spectroscopy, magnetic resonance, Mössbauer resonance, quantum electronics, solid-state electronics, astrophysics and biological physics. The book aims, and largely succeeds, in providing a good grounding in atomic and molecular structure and spectra using the modern analytical tools of tensor algebra and group theory.

Before discussing atoms and molecules, Weissbluth presents two very tersely written sections of necessary background material. The first provides the mathematical background on angular momentum, group theory, tensor algebra and vector fields, and the second gives the quantum mechanical background: symmetry properties, time dependence, Slater determinants, second quantization and density matrices. The discussion of atoms starts in the third part, which is concerned with one-electron atoms. Weissbluth interestingly starts with the Dirac equation and proceeds to its nonrelativistic approximation, thereby obtaining in the simplest way all of the interaction terms that are important in atomic physics. This part also includes the hydrogen atom, electric and magnetic fields, and hyperfine interactions. Part IV is concerned with N-electron atoms, including the Hartree–Fock approximation. Electromagnetic absorption and emission processes in atoms are the subject of Part V. Finally, Part VI provides an excellent brief introduction of molecular structure and spectra.

The background material, in Parts I and II, is probably too compactly written to be used in textbook fashion and includes no problems and too few examples. It does serve as a valuable summary, however, for the more experienced reader as well as for the lecturer. Weissbluth has written the parts of the book on atoms and molecules, on the other hand, in a more leisurely style. They are appropriate for a solid course on atomic and molecular structure even though they do not go into the depth required to satisfy the needs of researchers. In particular, only the simplest approximation methods for atomic and molecular wave functions are discussed, collision processes are omitted altogether, and no attempt to compare theoretical results with experiment is made. However, these are the criticisms of a researcher. Students will like this book, and their advisers and lecturers will be grateful that a book such as this exists to be recommended to them.

ANTHONY F. STARACE
University of Nebraska Lincoln

The Image of Eternity: Roots of Time in the Physical World

David Park
150 pp. U. of Mass. P., Amherst, 1980. $14.50

David Park, professor of physics at Williams College, has written a book—for physicists and nonphysicists alike—concerned with the nature of time. Refreshingly, this is not a book for the general public that "explains" in nontechnical terms what those wonderful physicists have wrought, but one in which the author poses and discusses problems that have not yet received fully satisfying resolutions. In fact, the questions raised, which go far beyond the confines of any one discipline, concern the relationship between the individual and the world, the nature of consciousness, freedom and necessity, and the role of science in our understanding of the universe. It is within this wider framework of philosophical–historical discussion that Park looks at aspects of time.

Very briefly, there is the time that occurs in Newton's laws of mechanics, a time that is modified and restructured by the theory of relativity. Then there is the time that "flows" in the consciousness of the individual, the time that has a past and a future in it, separated by that most important but ever-changing divide, the present. Closely connected to how these are related to each other is the problem of reversibility: Each event involving just a few molecules in interaction obeys reversible laws, that is to say, laws whose forms do not change if $+t$ is changed into $-t$. But matter in reasonable quantities, the matter that we encounter in daily life, obeys the second law of thermodynamics, which asserts that most developments are irreversible, that increasing time (the future) differs profoundly from decreasing time (the past).

Park explores all these topics in ten chapters, often charming and persuasive, that even include some cosmology. Technical discussions, which require at least some familiarity with algebra and with elementary physics, are relegated to four appendices.

PETER G. BERGMANN
Syracuse University

High Speed Pulse Technology, Vol. 4. Sparks and Laser Pulses

F. B. A. Frungel
448 pp. Academic, New York, 1980. $49.50

This book is a comprehensive review of techniques for generating short, intense light pulses, with emphasis on the use of these pulses to photograph very high-speed phenomena. This field, rapidly developed over the past decade, promises to make increasingly important contributions to such diverse fields as aerodynamics, materials testing, controlled fusion and photochemistry.

As he states in the Preface, Frungel aims to give a comprehensive account of light pulse research and technology from 1964 (when Volume II of *High Speed Pulse Technology* was published) to mid-1978. The book deals primarily with three types of light sources: sparks, discharge lamps and pulsed lasers. As he does in the previous volumes of the series, the author touches on a large number of topics and

makes use of extensive references; the bibliography in the present volume contains over 800 entries.

The early chapters classify photographic methods of high-speed analysis and provide a compendium of techniques for producing the requisite short-duration light flashes. The sections describing operation of nanosecond sparks along with typical photographic setups are particularly useful. The discussions of discharge lamp design and of the system aspects of selecting and designing flash tubes will be of use to any reader concerned with optical flash photography or the optical pumping of pulsed laser media.

Later chapters describe spark light sources that have special requirements and are used to visualize high-speed phenomena such as high-speed flows, propagating cracks and moving particles. One new development described involves superradiant light pulses from electron-beam-pumped disk semiconductors. The book concludes with a long chapter on laser pulse technology.

Although the book deals with many important topics, I was disappointed to find it quite difficult to use. The overall organization is extremely jumbled. Discussions of applications (extracted from referenced journal articles) are mixed with discussions of light-pulse technology. Furthermore, material is often repeated in various sections. Finally, the references to lasers are severely outdated, with very few articles carrying dates later than 1974.

R. T. Brown
United Technologies Research Center
East Hartford, Connecticut

Ultrasonic Imaging

P. Greguss
224 pp. Focal, New York, 1980. $15.00

The intensive research on ultrasonic imaging techniques during the last ten years has yielded important and extensive applications to medical imaging of the body and, to a more limited extent, to nondestructive testing of materials. Recently, acoustic microscopy has led to new ways of observing cell structure, defects in semiconductor devices and surface structure of metals.

Since the only books so far available on acoustic imaging have been proceedings of research conferences, such as the series of books on acoustical imaging and holography published by Plenum Press, there has been a great need for a good book on ultrasonic imaging. This new book by Pal Greguss is an attempt to fill this need. It is a nonmathematical treatment that reviews almost every possible method of acoustic imaging on which research has been carried out in the last 20 years. Greguss is an early contributor to the subject of acoustic holography and has been active and well known in the field.

The book is a useful one for those wishing to obtain some insight into the variety of acoustic imaging techniques that have been tried. Its fault is that it does not sort the material adequately. While readers are introduced to the many different techniques of acoustic microscopy that have been suggested, they are not given much insight into which are successful—and will be important in the future—and which have gone nowhere. This same comment applies to many of the other acoustic imaging techniques described in this book. Although it has a 1980 publication date and appears to use references as recent as 1977, the book already seems somewhat out-of-date because this field is rapidly changing. Most of the acoustic-microscope and medical images shown and, to some extent, the techniques described appear to be several years out-of-date and refer to very early work. One gets the impression that the author has been less in touch with the field recently than he had been earlier.

Simple explanations are given successfully in the book, but where Greguss attempts to use mathematical explanations, such as in his introductory material on the influence of noise, the theory, even to someone well versed in the field, might be rather difficult to follow.

I would recommend this book to provide a quick summary of the many acoustical imaging techniques that have been developed, an excellent source of references and an easily read introduction to the field. It will be useful to people in industry working on acoustic imaging as well as to students (although it would not be a suitable teaching text and is not intended for that purpose).

Gordon S. Kino
Stanford University

Principles of Superconductive Devices and Circuits

T. Van Duzer, C. W. Turner
369 pp. Elsevier, New York, 1981. $32.50

Research in applied superconductivity at the present time divides nicely into two mutually exclusive categories: electronics and high-field superconductors. This book gives an introduction to both. Its first five chapters discuss the basic physics of superconductivity and the engineering applications in superconducting electronics; the remaining three chapters concern the theory of superconductors in high magnetic fields. A look at the table of contents confirms that the coverage is much more thorough on the electronics side than it is for high-field superconductors. For example, while Van Duzer and Turner do not go into superconducting magnets, rotating machinery or power transmission lines—the end products of high-field superconductivity—they do include considerable discussion of the corresponding products of superconducting electronics, such as magnetometers and logic and memory circuits.

The first three chapters introduce the microscopic theory of superconductivity and the electrodynamics of superconductors in weak fields. The main chapter on the microscopic theory is one of the highlights of the book. The authors have devoted considerable effort to constructing a conceptual model as they develop the mathematics. It may well be the best introductory discussion of this topic in print.

The core of the book dicusses circuit applications and Josephson tunnel junctions, the latter largely at the phenomenological level, which befits an introductory text. More advanced topics—the details of junction fabrication, the microscopic theory of junctions and nonequilibrium phenomena, whose coverage would have significantly enlarged the book—are absent. One topic, however, that should have been included is the critical current density of junctions and its importance to the dynamical properties of junctions.

The authors provide good introductions to microwave detection and mixing and to parametric interactions, as well as a rather thorough description of SQUIDs, both as magnetometers and as devices in integrated circuits. The coverage of circuits for logic and memory is quite up-to-date and goes well beyond that of the only competing book in English, L. Solymar's *Superconductive Tunneling and Applications* (1972). (Because Solymar does give a more thorough discussion of several topics, that book is not made entirely obsolete by the new one.)

The remaining chapters follow a fairly traditional development of high-field superconductivity, with only a few exceptions. Stressing the importance of magnetization in superconductivity is a useful addition in Chapter 6. Only in a final section in Chapter 7 do the authors develop condensation amplitudes across junctions, the only real link to the first four chapters. Flux penetration in thin films plays a similar role in Chapter 8, on type-II superconductivity. The addition of these last three chapters broadens the scope of basic theory in the text. For readers with a practical orientation, however, it leaves a thirst for a discussion of applications.

Van Duzer and Turner have done a commendable job in providing an intro-