Nuclear power has also been attended by the imperatives of high visibility, technical complexity and public focus.

Another factor that journalist Carter does not address is the role of the media, which tend to magnify and exploit dramatic situations, especially when negative. Carter blames worldwide public opposition for the "fading" of nuclear power. Despite the Windscale, Three Mile Island and Chernobyl incidents, the primary factors have been depressed economic conditions, regulatory ratcheting, lower oil prices and some energy conservation.

Carter writes that the need for plutonium fuel and breeder reactors might never be enough to outweigh the risks of nuclear proliferation and terrorism associated with reprocessing. He states baldly, "For plutonium fuel to enter routine use and commercial traffic . . . presents risks that are quite beyond our powers to assess." Granted, Carter's insight into public perceptions of nuclear hazards is helpful in understanding this problem. But where he enters the technical world and posits that "waste management and disposal are not made easier by fuel reprocessing," he is on weak ground.

Carter's "essential argument" is that "the safeguards and containment imperatives are more likely to be satisfied in an effective and convincing manner if spent fuel is disposed of as waste." Although his case is strong for monitored retrievable storage, he fails to prove that what must be stored is spent fuel rather than processed waste.

Carter implies that because of 1% "discrepancies" in plant inventory, reactor plutonium not yet processed could be stolen and fabricated into an atomic bomb. Though strictly true, this is journalistic hype. The material is so intensely radioactive that stealing it would be very dangerous; it would be necessary to process it by complex means into a form suitable for an explosive; and this subgrade material would have to be configured into a fission explosive, which itself is a highly complex task. Technical experts now tend to back off from overstated claims that a band of terrorists could easily fabricate a workable nuclear explosive.

Carter calls proper attention to the public and political dangers of a plutonium explosive hoax, yet he ignores the experience gained in 40 years of routine plutonium shipments: Fifty thousand nuclear weapons are spread around the world. The plutonium shipped in nuclear commerce is much less of a weapons hazard. In fact, Carter later acknowledges that proper transport of spent fuel can be less of a public risk than shipment of "materials ubiquitous in ordinary commerce (such as gasoline, propane and liquid chlorine)."

An escape from much of the "not in my backyard" syndrome is sub-seabed disposal. Its importance in resolving the international dilemma is not given enough space in the book (nor in governmental funding).

Carter observes that site selection has a direct bearing on many sectors of the public, who should be included in the process. Just because public-interest and environmental-interest organizations have had varying degrees of opposition to nuclear power, they should not be disenfranchised from site selection. For these reasons, a better audience for this book would be policymakers, who have to balance conflicting interests.

One of the book's more helpful conclusions is that Yucca Mountain, Nevada, might qualify as a potential site for permanent but retrievable nuclear waste storage, subject to participation of independent and respected experts and affected parties—including nuclear-control groups, states that accumulate spent fuel, ratepayers and public utility commissions, utilities and the nuclear industry, and environmental and antinuclear groups. Through this process, the US has a "common ground for consensus on progress in establishing a geologic repository," one for which the risks to the public from storage of radioactive waste can be made "very low."


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## Search for a Super-Theory: From Atoms to Superstrings

**Barry Parker**
*Plenum, New York, 1987. 292 pp. $21.95 hc*

*ISBN 0-306-42702-8*


Albert Einstein defined for all time the limits of theoretical physics when he wrote: "Pure logical thinking cannot yield us any knowledge of the empirical world. All knowledge of reality starts from experience and ends in it." The casual reader of Barry Parker's new book may be forgiven if he loses sight of Einstein's important dictum. The general reader is probably not interested in wrong turns and blind alleys, but Parker's emphasis on current theories rather than experimental history does make the development of elementary-particle physics seem

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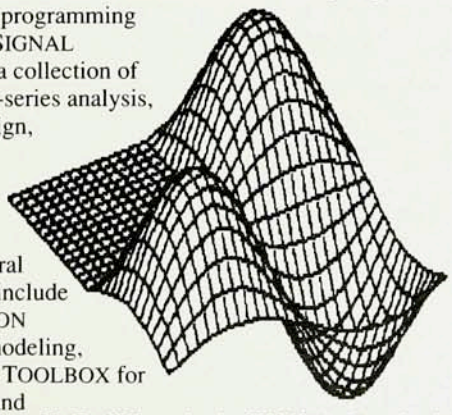

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more inevitable and less astonishing than is actually the case.

Parker's single-minded pursuit of the "modern theory of elementary particles" provides little insight into the interplay of competing ideas and the even more complex interplay between theory and experiment that is apt to interest the professional scientist. He also provides little insight into the fascinating personalities who have dominated physics in the 20th century. Although the thumbnail sketches of the many physicists discussed are generally accurate, there is no coupling of their characters with their contributions to physics. For example, the general reader might conclude that Wolfgang Pauli and Niels Bohr were very similar in character and that their contributions to physics were also similar and indeed parallel. By effectively eliminating the people Parker has dehumanized modern physics.

On the positive side, this book is wonderfully organized, with the many strands that have contributed to the modern picture of elementary particles coming together logically and clearly. All the physics explanations are clear, concise, accurate and directly to the point. But what could have been an excellent review for both expert and general reader unfortunately is marred by a large number of small errors, which will annoy the careful reader: The electron's charge-to-mass ratio, not its mass-to-charge ratio, is about 2000 times that of hydrogen; Ernest Rutherford is the towering figure of early 20th-century experimental physics; in a cloud chamber with a magnetic field the amount of curvature gives a good estimate not of the mass of a particle, but of its momentum; on the discovery of the muon the late I. I. Rabi asked, "Who ordered that?" not "Who needs them?"; $\Lambda^0$ particles do not decay via the strong interaction; according to Murray Gell-Mann the total strangeness in any strong interaction is conserved; and the basis for Sheldon Glashow's introduction of a charmed quark was not the distinctness of the electron and muon neutrinos.

There are also a number of unfortunate typos that will confuse the reader: The quark doublet $\binom{d}{u}$ appears several times where $\binom{u}{d}$ is intended, and thus the parallelism with the second and third generations, $\binom{c}{s}$ and $\binom{t}{b}$, is obscured; the standard model has the group structure $SU(3)\times SU(2)\times U(1)$ and not $SU(2)\times SU(1)\times SU(3)$; and in proton decay via the exchange of an X particle between a u quark and a d quark, $d\rightarrow e^+$, but $u\rightarrow\bar{u}$ and not u, so that the decay is $p\rightarrow\pi^0 e^+$. Every one of these errors could have been corrected with only minor emendations to the text by a careful editor with some knowledge of high-energy physics. On page 248 there appears a plot of straight-line Regge trajectories with unlabeled axes. Merely adding labels that indicate this is a plot of $J$ (spin) versus mass squared and a sentence that says the dots represent known particles would make Parker's otherwise excellent explanation clear to all.

From chapter 11 until the end all of the material is speculative, for there have been no experimental results to test supersymmetry or any of the new ideas currently in vogue. All this material is clearly and concisely presented.

In summary, this book provides an excellent introduction for the general reader to the search for a unified description of the forces and the elementary particles of nature. It could have been an excellent overview for the expert as well if only it had been edited carefully.

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# NEW BOOKS

## Acoustics

**The Audio Dictionary.** G. D. White. Univ. of Wash. P., Seattle, 1987. 291 pp. $30.00 *hc* ISBN 0-295-96527-4; $14.95 *pb* ISBN 0-295-96528-2. *Reference*

**Speech Physiology, Speech Perception and Acoustic Phonetics.** *Cambridge Studies in Speech Science and Communication.* P. Lieberman, S. E. Blumstein. Cambridge U. P., New York, 1988. 249 pp. $49.50 *hc* ISBN 0-521-30866-6; $14.95 *pb* ISBN 0-521-31357-0. *Text*

## Atomic Physics

**Advances in Chemical Physics.** *Advances in Chemical Physics 68.* I. Prigogine, S. A. Rice, eds. Wiley, New York, 1987. 412 pp. $89.95 *hc* ISBN 0-471-84901-4. *Monograph*

**Atomic Collisions and Spectra.** U. Fano, A. R. P. Rau. Academic, San Diego, Calif., 1986. 409 pp. $82.50 *hc* ISBN 0-12-248460-6; $29.95 *pb* ISBN 0-12-248461-4. *Text*

**Atomic Physics, Vol. 10.** Proc. Conf., Tokyo, August 1986. H. Narumi, I. Shimamura, eds. North Holland, New York, 1987. 463 pp. Dfl 150.00 ($66.75) *hc* ISBN 0-444-87057-1

**Complex Chemical Reaction Systems: Mathematical Modelling and Simulation.** *Springer Series in Chemical Physics 47.* Proc. Wksp., Heidelberg, FRG, August 1986. J. Warnatz, W. Jäger, eds. Springer-Verlag, New York, 1987. 409 pp. $54.50 *hc* ISBN 0-387-18364-7