essarily classical language. Pais succinctly summarizes the core of the long Bohr–Einstein dialogue on quantum physics: "Bohr's usage of *phenomenon* was unacceptable to Einstein." Bohr, however, persisted, extending complementarity into the areas of psychology, biology and human cultures.

Pais reveals a very different side of Bohr when he discusses Bohr's involvement in polity. Here we see Bohr as a highly successful fundraiser for the construction, extension, outfitting and maintenance of his institute on Blegdamsvej, from its official opening in 1921 through its entrance into the new fields of biology and nuclear physics in the 1930s and beyond. [See PHYSICS TODAY, November, page 93.] Without this work, Bohr's institute could not have become a mecca for so many young theoretical physicists, including numerous refugees from Nazism and Fascism after 1933; he would not have been able to support adequately the small annual conferences he began organizing in 1929; and he would not have been able to establish flourishing experimental programs in atomic spectroscopy, biology and nuclear physics.

We also see Bohr as active and dedicated president of the Kongelige Danske Videnskabernes Selskab from 1939 until his death in 1962. Again, after the Second World War, Bohr's great organizational talents were called upon in the founding of CERN, Nordita and a new laboratory and new extension of his institute at Risø near Roskilde. But his main concern during and after the war was the radically changed international political climate brought about by the development and use of the atomic bomb. His "Open Letter to the United Nations" in 1950 made him, in Pais's characterization, a pioneer of *glasnost*.

These three dimensions of Bohr's life—physics, philosophy and polity—are Pais's major themes. But he interposes and relates to them a vast amount of supporting commentary. He includes, for example, a moving chapter on Bohr's travels and the sad events occurring between 1933 and 1937: the death of his sister Jenny, the suicide of Paul Ehrenfest, the brutal events in Germany, the death of Bohr's oldest son, Christian, in a sailing accident and the death of Ernest Rutherford, who had become a second father to Bohr and from whom Bohr learned how to lead a group of young researchers in the furtherance of common scientific goals.

Pais reveals Bohr as an indefatigable worker, a humane man of rare intuition, insight and power of concentration, an extraordinary teacher (but divinely bad lecturer) and a revered public figure who after 1932 lived with his wife and family in the palatial Carlsberg Residence of Honor. (Yet he never ceased inviting young physicists there and to the Bohrs' country retreat at Tisvilde.) Pais personally experienced all of these aspects of Bohr. His biography beautifully embodies Bohr's spirit and that of Copenhagen. It is certain to find a wide and appreciative audience.

## The Weak Interaction in Nuclear, Particle and Astrophysics

**K. Grotz and H. V. Klapdor**
*Adam Hilger, Bristol, UK (US dist. AIP, New York), 1990. 461 pp. $120.00 hc ISBN 0-85274-312-2; $39.00 pb ISBN 0-85274-313-0*

In this book Klaus Grotz and Hans Volker Klapdor have succeeded in their objective of exhibiting the important role of the weak interaction in nuclear physics, particle physics, astrophysics and cosmology. The book describes the nature of the weak interaction and its role in the development of elementary particle physics. The book also relates the central importance of the properties and interactions of neutrinos to the resolution of current issues in astrophysics and cosmology.

The authors devote two chapters to nuclear beta decay and the weak interaction in nuclear physics; these chapters emphasize how double-beta-decay experiments in nuclear physics test the nature of the neutrino and the structure of grand unification theories. The authors devote one chapter to the Glashow–Weinberg–Salam theory of the electroweak interaction; one chapter to the weak interaction in the framework of grand unification theories; and another to the effects of the weak interaction in astrophysics, including its role in triggering a supernova explosion. The authors have also included a chapter on grand unification theories and cosmology and an intriguing chapter on neutrinos, which play a key role in grand unification theories.

This book is unique in the sense that it illuminates the diverse problems associated with the weak interaction in a variety of disciplines. It developed naturally from the research background of the authors, who have had several publications dealing with the nuclear-beta-decay strength distribution and its connection to some fundamental problems in nuclear and particle physics, astrophysics and nuclear technology. Currently, Klapdor is engaged in a major collaboration that is searching for neutrino mass using the world's largest germanium-76 gamma-ray spectrometer, located under Gran Sasso Mountain in Italy.

Although the authors do not claim to provide a comprehensive and self-contained account of all the topics treated, they do discuss the scientific issues and problems associated with the weak interaction. The authors invoke elements of quantum field theory to interpret experimental facts, but they assume a prior knowledge of only electrodynamics and quantum mechanics. This English translation of the original German edition includes an update of topics to early 1990. It is a welcome and unique addition to the literature and will prove useful to researchers and students in these disciplines.

RICHARD MADEY
*Kent State University*

## Introduction to the Physics of the Earth's Deep Interior

**Jean-Paul Poirier**
*Cambridge U. P., New York, 1991. 264 pp. $69.50 hc ISBN 0-521-38097-9*

Mineral physics is finally coming of age. Despite decades of scientific activity, we mineral physicists have known what to call ourselves for little more than 10 years, and no book has yet served to define the field. *Introduction to the Physics of the Earth's Deep Interior* by Jean-Paul Poirier provides an important summary text and helps solidify the relationship between condensed-matter physics and Earth science.

With an interdisciplinary research agenda, mineral physics is rooted in the tradition of high-pressure physics as practiced during the first half of this century by Nobel laureate Percy Bridgman. A voice was given to the field in 1952 by Francis Birch, who identified a scientific program in his paper "Elasticity and Constitution of the Earth's Interior." Because what we know best about the Earth's deep interior is the variation with depth of densities and sound velocities, an understanding of the compositional and thermal state and of dynamical processes (plate tectonics and the generation of the Earth's magnetic field) must be based on a physical link between elasticity, thermodynamics and theories of interatomic interactions. More generally mineral physicists are drawn to the development of theories for all physical properties of minerals, such as elasticity, viscosity, melting and electrical and thermal conductivities.

As noted in Poirier's introduction, mineral physicists were historically isolated: One might have been either a geologist in the company of physicists, who had little patience for classical physics and complicated mineral structures, or a physicist among geologists, who were underwhelmed by phonon dispersion curves and an emphasis on alkali halides as simple analogs for Earth materials. During the 1970s the development of the diamond-anvil high-pressure cell created new opportunities for dialogue between physicists and Earth scientists. Unlike earlier work with awkward, large hydraulic systems, diamond cells could be incorporated in laser spectrometers or synchrotron beam lines. The two-fold compression of matter accessible in the diamond anvil cell is sufficiently large to change matter fundamentally: For example, under high pressure insulators can become metals. The discovery that, at high pressure silicates transform to a perovskite phase—a structure with a long heritage in condensed matter circles—has further strengthened interdisciplinary ties. Only during the past decade has mineral physics emerged as an explicitly identified field of interest in the hiring of new faculty.

As a practitioner in this emerging field I welcomed the publication of Poirier's book. This fairly short introductory text fills a previously vacant niche. Those of us teaching graduate courses have heretofore resorted to personal notes and reprints. Here for the first time in one publication are sketches of the most important aspects of mineral physics related to an understanding of the Earth's deep interior. Poirier describes the book as a "primer," although to use it, a student needs a background that includes undergraduate-level statistical mechanics, thermodynamics and condensed-matter physics. Poirier skims so quickly through the derivations that students seeing the material for the first time will need help. I find it necessary to augment the text in my lectures and with my own problem sets.

The reference list is extensive and appears to encompass most of the important work through 1989. The literature is cited with no editorializing. Several current controversies are noted but not analyzed in any detail. Surprisingly few errors mar the generally excellent presentation. Poirier writes with the authority of an active scientist. (His recent work extends from materials science to condensed-matter physics and the Earth sciences.) Because Poirier develops the general framework by which theory and laboratory data are used to generate constraints on models of the Earth, a broad audience (both within and beyond the Earth sciences community) will be intrigued with this book.

J. Michael Brown
*University of Washington, Seattle*

## The Exploratorium Science Snackbook: Teacher Created Versions of Exploratorium Exhibits

**Exploratorium Teacher Institute**
*Exploratorium Publications, San Francisco, Calif., 1991. 260 pp. $19.95 pb ISBN 0-943451-25-6*

If you are a fan of the San Francisco Exploratorium or its clones elsewhere, you will enjoy reading the *Snackbook*, a collection of experiments based on more than 100 Exploratorium exhibits. The book should be particularly useful as a resource for science teachers in a precollege setting, as it contains detailed instructions on how to construct classroom versions of the exhibits. Each "snack" can be used in the classroom as a demonstration, a laboratory excercise or an exhibit.

For each snack a drawing of the original exhibit and a photo of the classroom version is provided, along with assembly instructions, discussions of the underlying principles and suggestions on what to do and observe. The *Snackbook* was written by a collection of teachers of grades six through twelve, and as a result the explanations are accessible to those without a deep background in mathematics or physics. Regrettably, there are fundamental errors in some of the explanations. For example, in the description of why a ball stays in a vertical airstream, the text says that the use of Bernoulli's principle is unnecessary, because the phenomenon can be more simply explained by Newton's law of action and reaction (which could of course just as easily "explain" why the airstream repelled the ball rather than attracted it).

The *Snackbook* covers a wide range of subjects, as is appropriate for precollege science courses, but the primary focus is on topics from physics and perception, especially various types of illusions. I came across only a handful of snacks dealing with mathematics, chemistry and the life sciences.

Most of the snacks, especially those that have surprising results, should have great appeal for students. Some of the snacks require a bit of simple construction, and a few involve apparatus that may not be found in some science classrooms, such as a vacuum pump. A number of the snacks, such as the "antigravity mirror," are just plain fun even if the science being illustrated may be minimal.

Overall, the *Snackbook* succeeds in its goal of presenting a collection of simple and lively demonstrations in an informative way, and it should be well received by pre-college science teachers. College and some high school physics teachers may find the level of the discussion a bit too qualitative, although they too will be interested in reading many of the snacks. All of the physics-related demonstrations are described elsewhere in more complete collections of physics demonstrations (see for example, G. D. Freier and F. J. Anderson, *A Demonstration Handbook for Physics*, AAPT Publications, 1981; Ronald Edge, *String and Sticky Tape Demonstrations*, AAPT Publications, 1981; or Robert Ehrlich, *Turning the World Inside Out and 174 Other Simple Physics Demonstrations*, Princeton U. P., 1990).

Robert Ehrlich
*George Mason University*

## The Laser in America, 1950–1970

**Joan Lisa Bromberg**
*MIT P., Cambridge, Mass., 1991. 310 pp. $30.00 hc ISBN 0-262-02318-0*

This is one hell of a good book! Joan Bromberg has blended her literate and disciplined historical skills with technical sophistication to produce an exciting yet responsible review of a spectacular epoch in American science. Of course, because most of the principal actors in the early laser drama are well known to me as former colleagues or teachers, I may be more sensitive to this material than many readers.

I found particularly interesting Bromberg's treatment of the intense and pivotal passion play involving