tracing of historical arguments, one finds more or less two themes: "Value" comes through in neoclassicism as an immutable substance, conserved in exchanges; and "utility"—the sum of everyone's preferences—is the variational quantity that plays the role of what physicists would describe as a Lyapunov function.

A refined version of this notion is the Arrow–Debreu theory, but Mirowski speaks with considerable heat of everyone from Walras to Tobin, with a special chapter, dripping with irony, dedicated to "Paul Samuelson, Scientist." Mirowski argues that there is in fact no viable theory of value and that utility is not a unique quantity.

His view of physics is that it is transformed 19th-century economics, only recently breaking free of the "straightjacket" of conservation of energy with our "new" ideas about cosmology, chaos and the quantum theory. This view of trends in physics is perhaps that of popularizers and philosophers, several of whom are quoted, but it is not physics as the working physicists do it. In fact, quantum mechanics would have had to be invented as the ideal vehicle for symmetry principles and the resulting conservation laws, if it had not existed. We move on regularly to greater symmetries and more comprehensive conservations, from which we derive our equations of motion. Chaos theory is, paradoxically, a triumph of deterministic dynamics, and modern cosmology is an attempt to extend the whole structure farther than we had ever hoped.

We physicists may share a little guilt in misleading the unwary public, in that the writings of such enthusiasts as John Wheeler and Alan Guth, which emphasize the radicalism of new ideas, can be taken out of context to indicate controversy where none exists. In fact, statistical mechanics is with us for the foreseeable future, and the ideas of John Bell, which Mirowski sees as radical, merely confirm quantum mechanics. It is even possible for David Mermin to *complain* about the universe being boring quantum mechanics all the way down (PHYSICS TODAY, November 1990, page 9).

My experience as a part-time economist in a group at the Santa Fe Institute is that the same first-rate economists who erected the neoclassical structure are often those most concerned about its weaknesses and most eager to find ways to model the kind of effects that break it down—effects such as the dependence of preferences on history and mis- (or dis-) information, destabilizing effects such as costs that decrease with volume and the complex web of technological dependence of one product on another.

Mirowski's is an extraordinarily scholarly book, replete with the detailed intellectual history of the growth of modern economics. One must concede to him that excessive claims concerning the neoclassical structure have been made—usually by followers rather than leaders in the theory—for both the generality and the value for policy guidance. I might myself, in writing a polemic, have focused even more than Mirowski did on the dangers of basing public policy (growth at all costs or monetarism, for instance) on a flawed theoretical framework. Mirowski might have made the book much more readable by avoiding the temptation to score every possible point in favor of succinct and clear expression. One feels that the scholarly matter is expressed in excessively emotional rhetoric and in an inappropriate vocabulary. The final effect is, indeed, to shed "more heat than light."

PHILIP W. ANDERSON
Princeton University

Foundations of Applied Superconductivity

Terry P. Orlando and Kevin A. Delin
Addison–Wesley, San Diego, Calif., 1991. 584 pp.
$53.95 hc ISBN 0-201-18323-4

The discovery of high-temperature superconductors has spawned scores of textbooks. Most of the classic texts have been reissued, and many new ones have appeared. This bandwagon effect makes one suspicious of the entire enterprise. In the case of Terry Orlando and Kevin Delin's new book, this suspicion is unjustified: They have produced an excellent text that takes a fresh approach to the field.

In the wake of the BCS theory many excellent books appeared in the 1960s, that were naturally highly concerned with the microscopic aspects of superconductivity: These books concentrated on showing that the properties of superconductors could be deduced from the microscopic theory or from the Ginzburg–Landau theory (with suitable references to the fact that the Ginzburg–Landau theory could be derived from microscopic theory). Orlando and Delin point out that this is not strictly necessary. Just as many of the properties of normal metals can be understood in terms of simple models, many of the properties of superconductors can be understood without microscopic theory. Orlando and Delin wish to make the subject accessible to advanced undergraduate engineers. They succeed at this. The book is also good for an introductory course for advanced undergraduate or graduate physics students and provides fresh insight for physicists working in the field, such as myself.

The book looks at successively more sophisticated models for superconductors, starting with perfect conductivity and perfect diamagnetism, and ending with the Ginzburg–Landau theory. Applications are presented as soon as the appropriate theoretical base is established. For example, transmission lines are discussed in terms of the two-fluid model, well before the authors introduce the quantum nature of superconductivity.

A lot of good physics can be done this way. Vortices are discussed in some detail, and practical matters such as vortex pinning and flux flow are included. The authors make it clear where their approximations break down, and results from Ginzburg–Landau or BCS theory are given when the simple models are incorrect. The same careful phenomenological approach is used to discuss Josephson junctions. When the Ginzburg–Landau theory is introduced—in the last chapter—it is also presented carefully and correctly; worked examples demonstrate how to use the theory.

A great deal of care is taken throughout the book. The usual difficulties of the subject—minus signs, the difference between B and H, gauge choices and so on—are all nicely dealt with. There are many completely worked examples, and each chapter has a large variety of excellent problems.

This is not a book about fundamental theory, but a book for engineers and physicists who work with superconducting materials and devices. Combined with one of the more traditional texts, it gives a great deal of information about superconductors. I recommend it very highly.

CHRISTOPHER J. LOBB
University of Maryland

The Exploratorium: The Museum as Laboratory

Hilde Hein
Smithsonian, Washington, D. C., 1990. 256 pp. $35.00 hc
ISBN 0-87474-466-0

Reviewed by Alan J. Friedman
In the 1960s a number of science

museums, either new or newly invigorated (the Boston Museum of Science, the Franklin Institute, the Pacific Science Center and the Lawrence Hall of Science, among others), sought to engage visitors in processes of science—exploration, manipulation and discovery. In 1969, physicist Frank Oppenheimer and a few colleagues opened the Exploratorium, a science museum that added to the movement a remarkable clarity and purity of concept. The Exploratorium would shun simulations and concentrate on real, full-scale phenomena. Perception would be the single concept linking the exhibits, rather than organization by traditional discipline and subdiscipline. Exhibits would offer visitors an unprecedented freedom of manipulation.

Within a decade, the Exploratorium was the most talked-about science museum in the world, and several of its exhibits were models for a rapidly expanding field. Hilde Hein, an associate professor of philosophy at the College of the Holy Cross, has written an analysis of the Exploratorium, with a focus on how Oppenheimer's personal outlook and style became manifest in every aspect of the institution he created.

Hein is particularly successful in demonstrating how consistently Oppenheimer's notions have remained, after 20 years, the defining elements of the institution. These included redundance (presenting the same phenomenon many different ways); opportunism (creating new exhibits whenever a congenial assemblage of people, materials and ideas arose); and a rough-and-ready design style that went out of its way to avoid polish or formica.

Hein argues that the Exploratorium can be understood to a very great extent as a manifestation of Oppenheimer's philosophy. She notes in her introduction that she has "given ideas priority over people." Controversies that emerged as the Exploratorium developed—such as the role of graphic artists, the policy of not listing credits for staff members who create exhibits, the minimal use of computers and the influence of fundraising on operations—are all raised only long enough to note how they related to Oppenheimer's basic philosophies. How the accompanying emotional and personality conflicts were finally resolved (an important issue in most institutional biographies) is rarely discussed.

The Exploratorium also declines to place Oppenheimer's achievements in the context of other contemporary science museums. The chapter "Funding the Museum" is particularly hard to appreciate: Were the Exploratorium's challenges and solutions exceptional or routine? Other institutions are mentioned infrequently, and information about them is sometimes unreliable: The Palais de la Découverte was in fact created almost a century after the date given; the "well-endowed" Lawrence Hall of Science typically received only 5% of its operating budget from endowment; the New York Hall of Science (this reviewer's institution) was founded in its present building in 1966, not 1984, with a subsidy from the city, not the state.

The Exploratorium certainly tackled the challenges of teacher education, inventing science activity sheets and seeking partnerships with schools with great vigor. But to appreciate its efforts it would be helpful to compare them with those of the dozens of other science museums that were tackling the same endeav-

ors, in some cases with impressive results.

Regardless of this lack of context, this book presents an important view: The Exploratorium became a "Palace of Delights" and inspired fresh thinking worldwide about how to communicate science, in large part because it carried out its founder's philosophy with uncommon conviction.

ALAN J. FRIEDMAN
New York Hall of Science
Corona, New York

Turning the World Inside Out: And 174 Other Physics Demonstrations

Robert Ehrlich
Princeton U. P., Princeton, N. J., 1990. 216 pp. $14.95 hc
ISBN 0-691-02395-6

I must confess, I'm getting tired of demonstrations. After years of teaching physics I'm reaching my limit of seeing (mostly the same old) demonstrations at every gathering of physics teachers. Perhaps I should have refused to review a book on demonstrations. But the title attracted me. When I heard "*Turning the World Inside Out*," my interest rose. I thought this was going to be a big collection of either new demonstrations or at least fascinating twists on old classics. I felt the need for freshness, so I said, "Send it along."

It turns out that the majority of the demonstrations in this book are familiar ones. The most common twist is scaling the demonstrations down to fit on an overhead projector—an admirable goal but clearly it does not turn *my* world inside out. (The title, by the way, comes from a throw-away line in one demonstration on the focal lengths of Christmas-tree ornaments.)

The structure of the book groups the 175 demonstrations into 17 traditional fields. Each demonstration is numbered and presented in a format that gives a short abstract of the demonstration, lists the equipment needed, explains how to construct the equipment and finally comments on the experiment. It is in the comments sections that the physics is brought into the demonstrations.

There is an aspect of this book that is pleasantly surprising: The author has taken the extra step of analyzing the physics behind the demonstrations. For this reason, the book is not to be taken lightly. Thus, while the introduction claims that the book is appropriate for a wide range of readers, those who have not had a solid introductory physics course will not get much out of it.

Another reason for needing a good background is to clear up some sloppiness in parts of the treatments. An occasional slip-up on a diagram isn't too crucial, but a paragraph that uses the symbol F for the centripetal acceleration in the first sentence and for the tension in a string in the last sentence requires sorting out. In addition, phrases like, "according to the right-hand rule" followed by an equation for torque—complete with cross product—give a clear signal of the book's level. And I'm still unconvinced that moiré patterns are "essentially an interference effect," as Ehrlich states in the book.

As promised on the inside cover, there are some new demonstrations. In between the Cartesian diver and the force table, a reader finds a few new games. I was fascinated by the rotation capability of a casserole-dish cover: It has a remarkably persistent angular rotation. The demonstration that uses a six-foot balance beam made from household molding pro-