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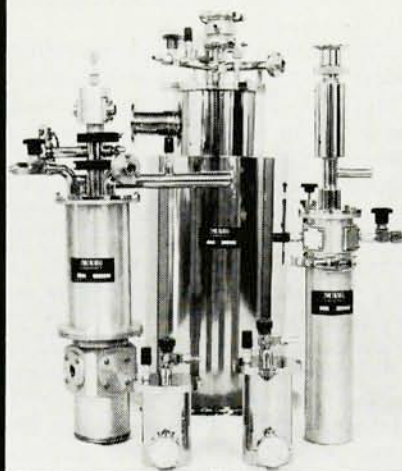
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reach both students of history and students of science, for he believes there to be a lack of understanding between the two disciplines. This lack, he says, arises from too little knowledge, on the one side, of the possibilities of physics and chemistry and, on the other, of the needs and questions of archaeologists.

However, it is difficult to imagine exactly for whom the book is in fact written. Although the coverage of topics (mainly limited to physics applications) is comprehensive, the book is short and the contents are compressed to the point where most illustrative examples—surely a major attraction in such a topic—have been squeezed out. Yet the basic physics of each technique in turn is painstakingly explained. Perhaps the author aims to provide something for everyone: The professional physicist can enjoy learning how familiar techniques are applied in unfamiliar situations (for example, how nmr is applied to the detection of buried sites); the physicist-to-be can learn basic physics (such as how to combine errors) using intriguing data from the real world. But only a most persevering and brave archaeologist is likely to penetrate far into what is essentially a text in applied physics. Overall, my own impression is of an irritating lack of balance.

This criticism apart, I do think there is much of interest in this book concerning the way physics is brought to bear on investigating human material remains. It covers a wide scientific range, from reversals in the Earth's magnetic field to radiocarbon production from cosmic rays; from the accumulation of radiation damage in crystal inclusions in pottery to Mössbauer spectrometry. Leute's description of the physical basis of each technique is careful and reliable, often invoking much fundamental physics (for example, de Broglie waves are used to explain how electron microscopy functions). The writing, presumably his own translation from the German, is somewhat idiosyncratic, but this more often enlivens than obscures the sense.

The book has three main sections: prospecting, dating and the characterization of inorganic materials. Most of the really useful techniques are covered (for example, 21 dating techniques are considered), and although Leute attempts to explain their successes and pitfalls, there is too little space to give illustrative examples, which might have conveyed the relative importance and reliability of the different methods. Dating methods in particular suffer

from the dangers of validation by circular argument, and it is insight at this level that is especially lacking. The description of analytical methods, which includes such recent applications as Auger spectrometry and laser microprobes, again reads like a compendium of potential techniques looking for interesting employment (although the occasional anecdote about how analysis detects forgeries is welcome refreshment).

The study of our past brings with it a simplified perspective, both on a way of living that has now disappeared and on our present existence, with its much more elaborated economic and cultural behavior. It is a pity that in Leute's book you can't see the forest for the trees. But in their own right, the trees are interesting enough, and physicists should enjoy reading about how their subject can be used to enrich—rather than destroy—our present civilization.

R. E. M. HEDGES

University of Oxford, UK

The Starflight Handbook

Eugene Mallove and

Gregory Matloff

Wiley, New York, 1989.

274 pp. \$19.95 hc

ISBN 0-471-61912-4

A century of so will probably have to pass before humanity will be ready to launch small, robotic probes on reconnaissance missions to nearby stars, and then it may be another two centuries (or more) before interstellar colonists will even be able to think about leaving the solar system. As with aviation and interplanetary flight, starflight will not become a reality until the enabling technologies are in place—and for starflight, the list of needs is long. Only when we can routinely build very large structures in space and, off Earth, operate power stations equivalent to a solar collector roughly the size of the Moon will we be able to make more than symbolic excursions into the interstellar deep.

Some people doubt that humanity will ever develop a starflight capability, usually basing their arguments on the fact that, in terms of power-generation capacity, our late-20th-century, global society is still three or four orders of magnitude short of what is required to support starflight. However, as Robert Rood of the University of Virginia is fond of pointing out, judging starflight in 20th-century terms is roughly equivalent to judging the feasibility of the Boeing 747 in terms of the power-generation capac-

ity of William the Conqueror's England. (Indeed, by this one measure, William was a bit closer to building a 747 than we are to traveling to the stars, since the thousands of English waterwheels collectively generated about as much power as the engines of a single 747.) As our capabilities in space develop, starflight will become more and more feasible, and I suspect that in terms of time we are closer to starflight than William was to trans-Atlantic flight. Nonetheless, we are still a few lifetimes from the reality.

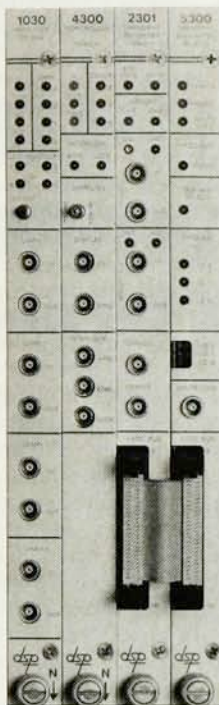
Fortunately, the not-so-small community of starflight aficionados is undeterred by the fact that "metal bending" is still a long way off. They are driven by the same fascination that fueled pioneering thinking about aviation and spaceflight; indeed, it is the venerable British Interplanetary Society that provides a forum for much of the ongoing work. Eugene Mallove and Gregory Matloff have made extensive contributions to the starflight literature, and their new book provides both an introduction and a summary of the current state of research.

One need not be intent on diving into the specialist literature to get use and enjoyment out of *The Starflight Handbook*. With actual starflight still far in the future, Mallove, Matloff and their fellow would-be voyagers have had freedom to wander over the entire terrain of physics and engineering in their search for viable propulsion concepts. In the process they have devised a number of intriguing combinations of forces, structures and energy sources, and an analysis of any one of the schemes would make a good term project for college-level physics or engineering majors. As Mallove and Matloff discuss, most of the schemes have difficulties of one sort or another—obvious and otherwise—and part of the fun is finding them and then devising fixes.

From my perspective the book has only a couple of minor shortcomings. The text is ostensibly written for people with no mathematical background—equations are set off in boxes. However, in a number of places the text contains unexplained concepts that are not likely to be accessible to those readers who ignore the boxes. Writing for two audiences is always a tricky matter, and Mallove and Matloff may not have succeeded. Lastly, in the opening chapters the authors make a valiant, but ultimately unsatisfactory, attempt to answer the question, Why would anyone actually want to build a starship? Not only did I find their emphasis on

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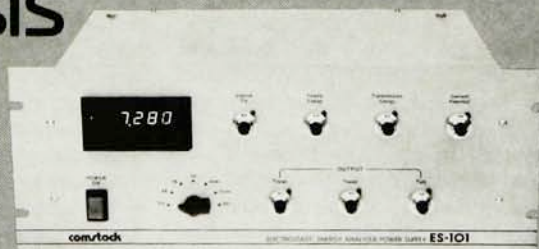
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starships as lifeboats unconvincing but, after reflection, I was forced to conclude that the exercise is about as worthwhile as going back to the 11th Century to convince William that eventually 747s would be built. Except in the broadest possible terms, neither he nor we can really have proper perspectives over such long stretches of time. It is easy to understand why attempts to provide rationales are made: It would be nice if no one thought we were crazy. But that is hardly possible, so we might as well ignore all but the technical criticisms and get on with the fun.

ERIC M. JONES

Los Alamos National Laboratory

Science as Power: Discourse and Ideology in Modern Society

Stanley Aronowitz

U. of Minnesota P.,

Minneapolis, 1988. 384 pp.

\$35.00 hc ISBN 0-8166-1658-2;

\$14.95 pb ISBN 0-8166-1659-0

It is difficult today to uphold the belief, popular several decades ago, that science grows independently of larger social processes. Pharmaceutical firms contract with university biotechnologists; senators fight to have the SSC built in their respective backyards. Scientists themselves are divided over questions of military and medical policy; the "republic of science" is not as free from political interest or control as once was thought.

Stanley Aronowitz's new book explores the problem of science and power, especially as it has been addressed in 20th-century philosophy and social theory. The thesis of the book is that science not only has "liberated us from the brute struggle of nature" but has also "imprisoned us in a logic of dominance and degradation." Aronowitz's goal is "to challenge science's power," to supplant positivist science theory with a more critical vision, recognizing science as a substantial and growing political force in society.

Separate chapters deal with the history and philosophy of modern physics, the science of sociology and recent debates in biology. An interesting chapter on Soviet science theory compares Eastern European obsessions with the "scientific-technological revolution" with positivist, technocratic accounts of science in the West.

One problem I had with this book (apart from numerous typographic

errors) is that there are probably better ways to explicate the problems of power in and around the sciences than by rehearsing the views of Jürgen Habermas, Herbert Marcuse, Georg Lukács, Louis Althusser and Antonio Gramsci. One needs to explore concretely how political priorities shape the priorities of science, how particular scientific ideologies (hereditarian biology, for example, or indeterminist physics) emerge from specific historical contexts. Hints of how this might be done appear from time to time in Aronowitz's text. He points out, for example, that one-third of the nation's 11 000 physics graduate students are in the single subfield of solid-state physics, and that few of these students will have difficulty getting jobs, unlike their colleagues (for example) in cosmology. But important and controversial questions—the philosophical import of quantum mechanics, preventive vs curative traditions in medicine, the problem of biological reductionism—are covered too quickly for my taste, and relatively simple points are sometimes lost in the author's neo-Marxist sociological jargon.

The message of Aronowitz's text is a sound and important one, however. Aronowitz warns that those who "would not speak of Chernobyl or Three Mile Island should also keep silent about the wonders of technology." Even so, he agrees with Marcuse that the emancipatory potential of science must not be ignored in favor of a one-sided critique: Science is power to fulfill as well as to obliterate human hopes and aspirations. The task of the political philosopher of science is to elaborate alternatives, to suggest how the theory or practice of science might be different. The problems of power in and around the sciences are many and profound, and philosophers and social theorists have only begun to give adequate attention to them.

ROBERT N. PROCTOR

*New School for Social Research
New York, New York*

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