

Japanese culture.

For the Japanese scientists, that gulf must have appeared most concrete when, on 24 November 1945, on orders from Groves's office, Douglas MacArthur's occupation forces destroyed the five cyclotrons, none of which were in working order, then available to the Japanese nuclear physics community. The Japanese scientific community, already numb from the reality of postwar occupation, saw this as a portent of an impoverished future.

It is at this point that *Science Has No National Borders* picks up the story of the postwar struggle of the Japanese scientific community to re-establish itself in the new Japanese social order that was to emerge in 1951, at the end of the American occupation. A key element in the task of rebuilding was the relationship established between the postwar leaders of Japanese science and the American physicist Harry Kelly.

During the war Kelly had been one of the thousands of physicists working on radar at MIT's Radiation Lab. Just weeks after the cyclotron incident, which brought an outraged protest from American physicists, Kelly (who himself considered the destruction of the cyclotrons an unfortunate by-product of the war) was recruited to serve in the economic and scientific section of MacArthur's postwar occupation bureaucracy. He thought his job was to have a quasi-security cast to it, helping the occupation forces sort out those Japanese scientific projects that might have military potential from those that did not. Instead he found himself serving as liaison between the US military authorities and the leaders among the Japanese scientists.

Although he had had little previous contact with Japanese culture and did not speak the language, Kelly had sound instincts on ways to overcome suspicions on both sides, coupled with sound managerial and leadership skills. Without much ado he redefined his job to be adviser to the Japanese scientific community in their quest to adapt prewar imperial institutions and habits to the new, postwar democratic society that the American occupational government was shaping. Kelly initially thought he would spend three months in Japan, but he stayed for four years. And even after returning to the United States in 1949 he continued to assist Japanese scientific organizations in their efforts to reestablish their legitimacy within Japan as well as the international scientific community.

Although he remains a relatively

obscure person to most Americans, in Japan Harry Kelly's memory is honored and revered to this day. This slim volume, translated from Japanese and adapted for an American audience, tells us why and begins to explain our debt to Kelly and his work.

STANLEY GOLDBERG
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Physical Origins of Time Asymmetry

J. J. Halliwell, J. Pérez-Mercader
and W. H. Zurek
Cambridge U. P., New York, 1994.
515 pp. \$100.00 hc
ISBN 0-521-43328-2

Physical Origins of Time Asymmetry is the proceedings of a five-day workshop that took place in Mazagon, Spain, in the early fall of 1991. It brought together an extremely interesting set of thinkers (most of whom would describe themselves as theoretical physicists) to discuss the concept of time. Many of the speakers—Charles Bennett, Murray Gell-Mann, Stephen Hawking and John Wheeler to name a few—are extremely well known, while others are not, but all appear to have participated actively in the conference.

This is very definitely not a book about time asymmetry as seen in particle physics experiments: The topic is barely mentioned and is a negligible effect for most of the purposes addressed. The book is rather an examination of the deep question of how time asymmetry arises as a statistical phenomenon despite underlying time-symmetric interactions. As such, the question goes back at least to Maxwell and Boltzmann, who laid the scientific foundations for the consideration of the problem.

Some idea of the breadth of the topics discussed may be gleaned from the six chapter headings: information, computation and complexity; statistical origins of irreversibility; decoherence; time asymmetry and quantum mechanics; quantum cosmology and initial conditions; and time and irreversibility in gravitational physics. There is also a very interesting and charmingly written introduction by Wheeler.

As Roland Omnès comments in one of the discussions: "There are three arrows of time: logical (for instance, in the treatment of information), thermodynamical and cosmological." All three are discussed in this book.

The topic of quantum cosmology has special problems because there is only one universe, and one cannot

make the usual Copenhagen interpretation of a separate classical apparatus in the measurement process. The new ideas that have been generated in attempting to deal with this subject are one of the main topics of the proceedings.

This is obviously not a book to be used for a course, nor is it a book to be studied in a systematic way. It does, however, provide an in-depth introduction to a fascinating set of inter-related topics about the nature of time. It is written at a level that is sure to be stimulating to a sophisticated theorist while still accessible to a young graduate student.

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The Fundamental Particles and Their Interactions

William B. Rolnick
Addison-Wesley, Menlo Park,
Calif., 1994. 466 pp. \$60.25 hc
ISBN 0-201-57838-7

Writing an introductory particle-physics text is not an easy task. The subject is so rich both theoretically and experimentally that it is difficult to strike the appropriate balance between detail and breadth of coverage. William Rolnick attempts to achieve this balance in *The Fundamental Particles and Their Interactions*, and for the most part he succeeds.

The book is intended for entry-level graduate students and advanced undergraduates and was developed from the author's lecture notes for a survey course in particle physics. The book has a user-friendly style that makes an often intimidating subject seem less so. Important ideas are shown in boldface when they are introduced, helping to focus the reader's attention. Copious footnotes expand and sometimes offer amusing commentary on the text (although I sometimes found them a distraction). While almost all important concepts are discussed, some calculational details are omitted; for example, Feynman diagrams are used only in an illustrative manner.

The book is divided into four parts, the initial two devoted to theoretical considerations. The requisite background material is first presented, including introductions to quantum mechanics, relativistic field theory and group theory. Most students taking a particle physics course have already studied the quantum me-