

reactions, total cross sections and forward elastic scattering, baryon exchange, intermediate-energy scattering, conspiracy and evasion and so forth. The book concludes with brief discussions on finite energy sum rules and asymptotic projections (essentially a horoscope for the future based on their existing analysis). Although the book is by no means complete even in the limited area the authors tackled, it is a relevant reference book to have—at least for the serious student in high-energy physics.

San Fu Tuan
University of Hawaii

Tongues of Conscience: Weapons Research and The Scientists' Dilemma

By Robert W. Reid

352 pp. Walker and Co., New York, 1969. \$7.50

Modern warfare has been made devastating by the systematic application of principles of science and technology. A tangled skein of applications and motives ties the production of new knowledge to the invention of weapons of war and techniques for their application. Those scientists who engage in fundamental research usually lack control over ultimate end use of products of their ingenuity, while those who engage overtly in weapons development may later see their participation in a markedly different light as the circumstances of their nation's military involvements change.

Tongues of Conscience describes the recent history of the involvement of scientists with weapons development ranging from the explosives work of Alfred Nobel to recent developments in chemical and biological warfare. The title is drawn from William Shakespeare's *Richard III*:

"My conscience hath a thousand
several tongues
And every tongue brings in a several
tale
And every tale condemns me for a
villain."

Many of the tales that are told in this book have been told before and the impressive feature about gathering them together in one volume is perhaps the remarkable circumstantial parallelism between the military involvements of scientists and engineers 70 years ago and those of scientists and engineers today. What is different is perhaps the pervasiveness of modern weapons technologies and the major consequences that their use implies for noncombatants.

This book is quite complete. It is also very sketchy. The author is Robert

W. Reid, a British science writer and broadcaster, who gives only enough detail in each example to bring out its principal historical significance. There is little detailed analysis of the character or behavior of the individuals involved and their motivations, attitudes, and so forth. The book contains essentially no moralizing or preaching. It is also rather short on useful lessons or advice. It should be particularly useful reading for younger scientists to whom the living participants in various cases are now legendary figures and the details of pre-World War II scientific involvement in military matters are perhaps unrealized or unknown. A book that places such involvements in historical perspective has particular value now because of recent vigorous criticism of on-campus activities related to the military at virtually every college and university.

The book contains considerable documentation and numerous illuminating direct quotations. A remark of Alfred Nobel in 1892 provides a theme that recurs, though without special emphasis, throughout the book:

"Perhaps my factories will put an end to war even sooner than your Congresses. On the day that two army corps can mutually annihilate each other in a second, all civilized nations will surely recoil with horror and disband their troops."

This remark and many similar subsequent comments by scientists concerned with the production of weapons, demonstrate quite directly that able technologists can still be poor social psychologists or political prophets.

The dilemma of the scientist is perhaps more properly the dilemma faced by all intellectuals when they must consider the question of participation or nonparticipation in the operation of our society. The complexities of modern life and the failures of intuition and experience in predicting and controlling its details give the individual very few clues as to whether his act of participation is benign or malign. It can not be expected that this dilemma will be simply resolved. Rather, high technology appears to have brought with it a growing social chaos and a high degree of alienation of many parts of the citizenry from both science and technology. Yet those who know the power of technology appear still to feel that the answers to the dilemmas related to science and technology will arise only through more science and more technology.

It is highly unlikely that the fundamental decisions to implement weapons of war, such as are described in *Tongues of Conscience*, will be markedly influenced by the views of scientists

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Edited by Helmut J. Schwarz, Rensselaer Polytechnic Institute, East Windsor Hill, Connecticut, and Heinrich Hora, Rensselaer Polytechnic Institute and Institut für Plasmaphysik (Max Planck Society), Germany

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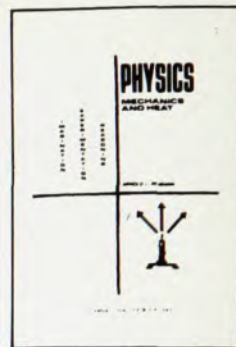
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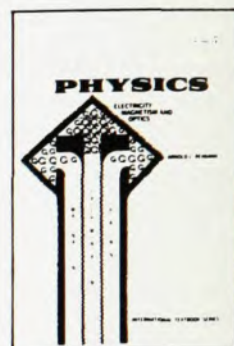
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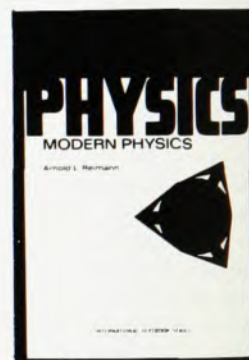
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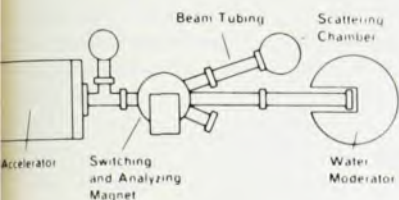
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and engineers. Rather, such decisions are political and military and will continue to be resolved in the political and military sphere. Scientists, faced with the simple fact that he who forges the arrows does not control the bow, will thus have individually to decide whether to continue at forging arrows. Reid's account of past examples does little to simplify the task.

Joel A. Snow

Head, Office of Interdisciplinary Research
National Science Foundation

Solid State Physics

Ryogo Kubo,
Takeo Nagamiya, eds.

840 pp. McGraw-Hill, New York, 1969.
\$19.50

Some years ago, a newspaper article on the rise of solid state identified its start with the 1940 book *The Modern Theory of Solids* by Frederick Seitz. Since then, the field has amply arrived, and the books in English have multiplied a hundred fold, diversifying over the feasible specializations, levels of treatment and categories of reader.

Is it possible to write a present-day equivalent of the Seitz classic? A comprehensive physicist's solid-state text needs to convey a ramified universe of experimental fact and an elaborate theoretical structure, and then present them interwoven in a duly speculative and critical spirit. This has, of course, grown to a very formidable undertaking. This book, the joint work of six Japanese physicists including the two named above, may be considered in this category. In quality of organization and exposition, unfortunately, much of it is disappointing.

The book is divided into five sections. "Structure and Electron Theory of Solids" is about one third of the whole in length and mainly a conventional solid-state course in itself. It covers the solid types and crystal structures, lattice modes, electron states and dynamics, electron transport phenomena, superconductivity and nuclear resonance. Then follows "Electronic Phenomena in Nearly Perfect Crystals," which deals with defects, localized states and electron statistics, trapping and recombination, photoeffects and electron scattering; "Magnetism," one quarter of the whole and the longest, and perhaps the most advanced of the specialized sections; "Dielectrics" and "Crystal Lattice Defects." These are correctly described on the dust jacket as "loosely coupled." They were first published separately in 1955 as Iwanami *Modern Physics* monographs, and were combined in 1961 into the original *Solid State Physics*, which was revised for a second edition in 1966 and again for the present translation into English.

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