

Helping to bridge two cultures

Physics and its Fifth Dimension: Society

Dietrich Schroeer

378 pp. Addison-Wesley,
Reading, Mass., 1972. \$4.95

Reviewed by William J. Mullin

René Dubos in his book *Reason Awake* (Columbia U. P., 1970) has issued a call to scientists to undertake some much needed mission-oriented research to provide solutions to the ills that beset society. As Dubos notes, an eminent panel formed by President Kennedy to probe the dangers pointed out in Rachel Carson's *Silent Spring* recommended much further study of these dangers. And yet not one of those panel members has since done any work in this area himself. Scientists, as a form of escapism, pay lip service to the dire needs of society today but are actually doing little to help it. Indeed many, using the argument that basic research is inherently non-mission-oriented, avoid such research as a matter of principle.

The dilemma of the day as outlined in the previous paragraph is a result of one of a multitude of interactions, both friendly and hostile, that have occurred between science and society. The analysis of such interactions by means of numerous concrete examples is the goal of the book *Physics and Its Fifth Dimension: Society* by Dietrich Schroeer, who is assistant professor of physics at the University of North Carolina. This book has won for Schroeer the AIP-US-Steel Foundation Science Writing Award in Physics for 1972. Most certainly the award is well deserved. The book unifies an incredibly broad range of topics in such a way that a reader of any background must come away with a new perspective on the problems of physics and society.

Schroeer's approach to the subject might be called thematic. That is, despite the diversity of his many topics, which range from art to atomic bombs and from Greek science to Nike-Zeus missiles, he is able to find a key that

relates the subject to a general overview. There are several main themes, of which two stand out; the first is the idea of "two cultures," the scientific and the "humanistic," and the second is John Ziman's definition of science as "public knowledge."

While C.P. Snow developed the idea that there was a communication breakdown between two intellectual camps, it is Schroeer's view that this cultural split is not new but has existed since the Greeks. The scientific culture has a mechanistic world-view; its members tend to take things apart and study the pieces separately. The humanistic culture on the other hand looks at nature as a whole organism; this is the "organismic" approach. When analyzed in these terms it seems natural that there should be a conflict and a difficulty in communication between the two cultures.

Ziman's definition of science as public knowledge or consensus provides Schroeer with a convenient way of observing when the scientific spirit has been subverted.

Many chapters in the book use the two cultures and the consensus themes as a basis of explanation. An extensive historical survey extending from ancient and Greek science, through rationalism and romanticism, to the modern era is based on these ideas. For example, the Greek Pythagorean school represents the mechanistic or quantitative approach, whereas the Aristotelian school used an organismic view that asked the question "why" instead of "how." Ultimately Greek science failed, in part because secrecy made public consensus impossible. Incidentally it is pointed out that Archimedes was an early scientist who became a military consultant in the war of Syracuse against Rome. He was killed when Syracuse fell; for, "scientists were not yet considered part of the booty."

As would be expected, Galileo and his encounter with the Church is treated here. But the treatment seems to have some new twists, as in the examination of Bertold Brecht's anti-Galile-



Preserved by physics. This 14th century wooden Madonna and Child has been preserved by monomer impregnation and radiation polymerization. The applications of physics in art are discussed in Dietrich Schroeer's book, *Physics and Its Fifth Dimension: Society*.

an play *The Life of Galilei*. Like Brecht in the play, Schroeer is fond of modern analogies with the past; he notes that the day after Galileo offered his telescopes to Venice for military use he was given a salary raise and tenure. Does that sound familiar?

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the treatment of Goethe and the Romantic period. The Age of Rationalism followed Newton because his clockwork-mechanism approach became the philosophy of the day. Romanticism was an attempt to return to the organismic world-view of Aristotle. Goethe is shown as having tried to span this culture gap by development of his physics. His optics attempted to view the observer and light as a kind of unity, that is, in an organic way; the attempt failed. Goethe's character Faust attempts to go beyond a mechanistic view in his search for meaning to life. A modern analogy is perhaps the scientist, such as Robert Oppenheimer, who goes beyond his usual pursuits, contracts for "Faustian power" and ultimately finds he must pay according to a demonic justice.

The more recent interactions of science and society treated by Schroeder include ideological control of science, art, radioactive dating, the development of nuclear weapons, nuclear medicine, science funding, science in the universities, NASA, the energy crisis and several others. Attempts at ideological control of science in Nazi Germany and also some examples from the USSR and the US are examined. We learn not only how x rays have affected the analysis of paintings but also how the Bauhaus school attempted to integrate technology into their arts. The anti-ballistic-missile issue is examined as an example of scientists moving out of the areas of consensus and engaging in political debate. The total range of subject matter treated with considerable grasp is really startling.

The style and typography of the book makes it easy reading. What physics is presented is quite readable by a nonscientist. The chapters each have introductions and summaries and are broken up into small units that make the structure of the author's analysis apparent. There are extensive bibliographies and provocative questions at the end of the chapters, so the book is useful as a text (its intended purpose). Necessarily, the treatment of any one of so many subjects is short, but because of the thematic approach the analyses effectively avoid superficiality. Indeed, despite Schroeder's misgivings stated in the first chapter one might see the book as a small bridging of the two-cultures gap. He has taken apart a great variety of topics to examine their inner workings but has managed to gain an organismic or "big picture" view of the entire range of science-society meetings.

As a final note we may return to the point brought up in the first paragraph of this review. Does the scientist bear such a responsibility to society that he must turn to the job of solving society's

technological problem? Dubos feels he must turn to such tasks: Society has supported science strongly in the past, and now scientists must pay for their Faustian power by working according to criteria and for goals set up by society. Schroeder comes to a somewhat different conclusion. While he realizes that science support may be judged on the basis of criteria external to science, he reasons that social responsibility involves a scientist acting in a nonscientific way, that is, in directions concerning which there can be no consensus. The scientist is not then responsible for the crises of technology. It would seem to follow that he would be untrue to his profession to follow Dubos's call. I follow Schroeder's logic, but my humanistic inclinations are that, if there is indeed a conflict here, Dubos is the one who is correct.

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Statistical Physics

Yakov P. Terletsii

N. Fröman, trans. 279 pp.
North-Holland, Amsterdam,
Holland, 1971. \$18.00

Except for minor changes and additions, this book is a translation of Yakov P. Terletsii's *Statisticheskaya Fizika*, which was published in Moscow in 1966. The contents evolved from a course given by the author to Moscow State University students whose program, at that time, contained a concurrent course in quantum mechanics. Accordingly, quantum statistics is delayed until the next to the last chapter and constitutes about 14% of the text.

After brief sketches of thermodynamics and probability, ensembles are discussed and applied to classical models of gases, solids and radiation fields. Chapters 3 and 4 contain discussions of correlations, fluctuations, Brownian motion, Onsager's reciprocity relations, the Einstein-Fokker-Planck equation, and Nyquist's formula; and Chapter 5 deals with the Boltzmann equation, the *H* theorem, entropy and irreversibility. One returns to equilibrium in Chapter 6 where the quantum distributions are used to obtain the conventional results for heat capacity, black-body radiation, and ideal Bose and Fermi gas behavior. Stimulating essays on negative temperature, the second law of thermodynamics, and on possible macroscopic violation of classical thermodynamics make up the final chapter.