Book Reviews

A Branch of Basic Science

Physics of Hot Plasmas. Scottish Universities' Summer School, Newbattle Abbey, 1968. B. J. RYE and J. C. TAYLOR, Eds. Oliver and Boyd, Edinburgh, and Plenum, New York, 1971. xvi, 456 pp. + plates. $32. Scottish Universities' Summer Schools in Physics, vol. 9.

Plasma physics should at least provide plentiful source material for future historians and sociologists of science. Passing its formative years in the classified shadow of the H-bomb, it may have been the first branch of basic science to come of age outside an academic environment. Soon after the Geneva conference of 1958, governments around the world declassified their controlled thermonuclear fusion programs, and the cooperation which quickly developed among the United States, the Soviet Union, western Europe, and Japan in this area was one of the few happy furloughs from the Cold War. Now, applications to weapons research, real or imagined, show dismal signs of driving the subject underground again. Academic plasma physicists in all but a handful of universities are still, intellectually, poor relations, scattered over half a dozen engineering departments in addition to departments of physics and astronomy. It is not likely that anyone outside the field now listens to a plasma seminar or reads a plasma paper with more than a very modest degree of comprehension.

This confused state of affairs is not easy to understand, especially in view of the fact that plasma physics concerns the state of upwards of 99 percent of the matter in the universe and has in it what are probably the greatest possibilities for both benefit and harm to mankind of any single branch of modern physics. One of the several subtly connected factors that may help to explain the muddle is a situation that has resulted from treating a branch of basic science as if it were a branch of technology. The fact that plasma physics was akin to kinetic theory, to fluid mechanics, and to electromagnetic theory, together with the fact that each of these was already worked out to a sophisticated level, led to the erroneous conclusion that all that remained to do was to join them up and make thermonuclear reactors. But life turned out to be more complicated, and the whole to be greater than the sum of its parts. Though it has been clear for some time that far more basic understanding of the collective behavior of charged-particle systems will be needed before one can control a plasma in economically interesting parameter regimes, this insight has yet to be integrated into either the way plasma research is funded or the way most of it is done. Programs have every incentive to justify themselves in terms of unlikely short-run goals and to ignore the long run, where the stakes are real, and far higher. For example, it is hard to think of any *other* energy source for the post-A.D.-2000 world than controlled fusion; but the day when that source becomes available may not be hastened much by scheduling reactor technology meetings when the first self-sustaining fusion reaction is still a few orders of magnitude away.

This book is a modest but admirably solid achievement in the neglected enterprise of distilling what has been learned about plasmas into a coherent enough form to be assimilated into the mainstream of physics. The proceedings of the 1968 Scottish Universities' Summer School, it consists of a dozen review articles on plasma kinetic theory, waves and stability, numerical methods, turbulence, "collisionless" shock waves, laser-produced plasmas and laser diagnostics, "high density" plasma devices (such as the theta pinches and Focus), and refractivity measurement techniques. A few of the articles, such as the workmanlike assembly of experimental material on shocks by J. W. M. Paul, contain substantial amounts of previously unpublished results. The careful survey of linear Vlasov stability theory by E. G. Harris is one of the best combinations of lucidity and accuracy available on that subject. There is little emphasis in most of the articles on the "relevance" of plasma physics to practical pursuits. The tone throughout is low-keyed, and there is little or none of the aggressive salesmanship that has been a bane of plasma physics. One can only envy the "forty-three students, eleven lecturers, and seven other participants" who were permitted to ponder the subject for two weeks in Newbattle Abbey under such conditions.

A mild irony of the situation is that during the summer school the International Atomic Energy Authority Conference on Controlled Fusion, a much fancier affair, was taking place in Novosibirsk. This was apparently thought by the organizers to be a handicap in arranging a program at the summer school. An interesting puzzle for the historian or sociologist of science looking at these documents a century hence may be to try to decide where the action really was.

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A Classical Physicist

The Life of Wilhelm Conrad Röntgen. Discoverer of the X Ray. W. ROBERT NITSKE. University of Arizona Press, Tucson, 1971. xii, 356 pp., illus. $8.50.

In this work Nitske presents an encyclopedic compilation of data on Röntgen's life which allows the reader to judge not only Röntgen the scientist but also Röntgen the man. Here is the struggling student, the aspiring professor, the loving husband, the faithful friend, and the energetic traveler in addition to the experimenting physicist. But most important, the overall presentation places into context the physical philosophy and procedures of this first winner of a Nobel Prize in Physics.

Röntgen, even though he lived well into the 20th century (he died in 1923), remained to the end a classical physicist in the 19th-century mold. He frequently worked alone, built much of his own equipment, and took grudging pride in his lack of funds. He was cautious in speculation. He repeated experiments over and over again to convince himself of the correctness of his observations and then wrote his reports in a modest, objective style emphasizing tested and proven results. One suspects that he would