Book Reviews

Peter Kapitsa, on Life and Science. Addresses and essays collected, translated, and annotated with an Introduction by Albert Parry. The Macmillan Company, New York, N.Y., 1968. vi + 271 pages. Price $7.50.

Although Russia has never had very good luck in her choices of Czars, Czarinas, Premiers, etc., and their corresponding governments, she has, on occasion, managed to attract some outstanding foreign scientists (for example, Leonhard Euler (1707-1783), the Swiss mathematician), and also to produce native-born talent of a high order in physics and chemistry. All this in spite of the fact that Russia was often resisting military attack from her neighbors, or Russian people were shooting each other. In modern times we know best the chemist Semenov, and the two physicists, the late Lev Landau and Peter Kapitsa (1894-). The book before us is of special interest because Kapitsa is an outstanding physicist-engineer and because he spent the long period (1921-1934) in Rutherford's laboratory in Cambridge, England. He became well known in the West, and presumably, also in his native Russia. He bridges the gap between the secretive Russians and the West. He is especially known for first attaining magnetic fields of 300 000 G, and for devising a method for producing liquid air with a small turbine instead of the more cumbersome apparatus depending on the Joule-Thompson effect.

On the personal side, Kapitsa was a son of an engineer in the Czar's army. His early education was in Russia until 1921. His first wife and two children seem to have perished during the revolution. In England he was married again to a Russian girl, the daughter of a Russian Government official. He has two children by his second marriage. He is said to be a "White Russian." I am not sure how a "White Russian" differs from a Cossack, a Georgian, a Slav, or a Tartar, or from a lot of other kinds of Russians mentioned in the books. If anthropologists ever get around to tackling really up-to-date problems, I hope they will furnish us with color photographs of all the different kinds of Russians, including some special ones as Professor Kapitsa. (Note sly dig at anthropologists.)

Although Kapitsa bridges the gap between Russia and the West, he doesn't "tell all" in his essays and speeches. So Professor Albert Parry, in an introductory chapter, attempts to give the best founded speculation. Whether Kapitsa was, in 1934, refused permission to return to England after being lured under false pretenses to visit Russia we are not sure. It seems likely. Whether Kapitsa refused to work on Russian nuclear bombs, we can't be certain; he certainly had all the background for such work. But there is some reason to believe that he was under house arrest during that period. The Russians are forever arresting people and shooting them or sending them off to Siberia. Even Landau was put in a Russian prison during part of the war on the assumption that he was a German spy; he was Jewish. Kapitsa persuaded Stalin to let Landau out of jail. The introductory chapter by Professor Parry is better than most Who-Dunit yarns.

The next 120 pages are given over to translations of several addresses given by Kapitsa at various times. They deal with four scientists whom Kapitsa regards as especially important. They are, Benjamin Franklin (1706-1790), Mikhail Lomonosov (1711-1765), Ernest Rutherford, and Paul Langevin. Most will agree that Franklin, Rutherford, and Langevin were of outstanding importance, but only a few may have heard of Lomonosov. My 1911 *Britannica* lists him as a Russian poet and man of science; he doesn't seem to have ever been arrested, but he almost got into serious trouble with the clerics of his time when he insisted that infants should be baptized in warm water instead of in the "natural" cold water of winter time; he ascribed part of the high infant morality in winter to the practice of baptizing them in cold "natural" water, which led to bad colds and worse. Lomonosov appears to have been a remarkable man, even though for a time he was in error for not knowing or understanding about Newton's famous experiment with two pendulums of the same length but of different materials which he, Newton, hung in his doorway. Langevin had troubles with the fascists during World War II, and was put under arrest for a time by the Germans.

The remaining several essays and speeches deserve careful attention by Americans especially. In them Kapitsa deals mainly with the organization of scientific laboratories in Russia and the work done by them. Although he appears to be convinced that in a socialist regime there is offered the best opportunity for setting up laboratories for work in pure science and in applied research and development, he freely admits that the research done in capitalist countries, especially in America, is more fruitful than that done in Russia. He tries to figure out how Russia could do better, and he makes several suggestions to this end. (In America if a given setup or organization doesn't work out in practice by strictly capitalist methods, then we try a socialist or semisocialist method without turning a hair. In Russia this pragmatic approach is apparently forbidden.)

Kapitsa is troubled by the fact that most Russian physicists now go into theoretical physics and avoid experimental work. For how does one claim a thesis for work done by several experimenters all working on the same subject, as for example when all are working on a problem involving a large synchrotron in the experiments? Or how does the director of a sputnik project have any chance to win a Nobel prize when he may not be a physicist?

Kapitsa deplores the lack of discussion and debate in Russian seminars and scientific society meetings. (He would be overwhelmed by the size of some American Physical Society meetings.)

Another very serious difficulty that beset Kapitsa and his colleagues during the Stalin era was that somehow

"Dialectics" refuted Einstein's theory of relativity and also cybernetics. Kapitsa mentions no names in this connection, but rather bitterly blames what he calls the "Philosophers" for promoting the anti-Einstein point of view, and with considerable effect in higher Governmental circles. In fact Kapitsa seems to have been under house arrest during the Stalin era on this account. But Kapitsa stuck by his guns that theory must always be verified by experiment, and if so verified it may not be invalidated by "Philosophers" on other grounds. In fact, experiment often comes first and the theory is built up on the experimental data. (This must have been the case when physicists invented the wheel, trained the horse to carry a rider, and first discovered agriculture.) If the "Philosophers" had not been overridden, it is difficult to see how Russia could have made her own nuclear bombs. Maybe there will come a time when men will weary of ideologies that have no basis in the facts of the world; then the Kapitsas will be relieved of extra burdens and jail sentences. Experiments are hard enough to do without surplus hazards.

Kapitsa was also faced with the difficulty that engineers and technicians were not able readily to follow up on a large scale his clever use of turbines in the manufacture of liquid air and oxygen, even though small scale machines were shown to work satisfactorily in the laboratory. Still another frustration was the fact that their budget might be quite generous, but the restrictions on the expenditure of the money were an unpleasant constant of life.

In spite of all the troubles described by Kapitsa, it is astonishing that the country, with an ideology that does not work very well, managed to build so much, including nuclear bombs and sputniks. Professor Kapitsa's life and story is very worthwhile reading; his was a life of great accomplishments requiring considerable courage.

As a literary effort the book is not the equal of Fanny Hill or Doctor Zhivago, but as an important part of the history of a nation it is vastly more interesting and significant.

Don M. Yost

California Institute of Technology
Pasadena, California

February 3, 1969

About the Reviewer: We welcome Professor Yost back to these columns after an interval extended by, among other matters, an indisposition from which we happily report he has recovered. To our regular readers Professor Yost needs no introduction; to our intermittent or newly acquired readers this review, so characteristic, provides an introduction.

Professor Yost expresses gratitude to Señor Pancho P. Gomez, an Idaho capitalist, for philosophical help in writing the review and to Mrs. Yost and to his secretary, Mrs. Ruth E. Hanson, for help in preparing the manuscript.

Theory of Turbulent Plasma. By A. A. Vedenov. Translated and Edited by S. Chomet. Published by Iliffe Books Ltd. (London and American Elsevier Publishing Co., Inc. (New York), $5.50 (Sept. 1968).

This book by the soviet plasma theorist, A. A. Vedenov, reminds one very much of the recent monograph with a similar title by B. B. Kadomtsev. It is less than two-thirds the size of the older work, a result which is achieved in part by omitting many applications of the theoretical results and by even briefer discussion and derivations. It is in every sense, as the flyleaf states, a "graduate text," which I interpret to mean that it certainly is not a textbook. Results fly out at one at every step without any real derivation. This can be useful for the expert since he now has a succinct summary of a large number of publications. This advantage is somewhat reduced since there is only a very limited list of references at the end of each chapter. The inexperienced researcher or graduate student probably will find the going too rough.

There are ten chapters in this monograph. Chapter 1 (8 pages) discusses "Methods of Description of Plasma." The author clearly states his initial restriction to collisionless plasma (large number of particles in a Debye sphere) but then discusses the MHD equations as the collisionless limit of the equations obtained from a conventional Boltzmann collisional expansion. I find this somewhat jarring. Chapter 2 (7 pages) covers "Plasma Oscillations" within the framework of two-fluid hydrodynamics and in very brief order. Chapter 3 (32 pages) "Plasma Stability" is obviously based strongly on the well-known review paper (1961) by Vedenov, Velikov, and Sagdeev. There are some very quick, clever derivations of many of the linear stability criteria. The style is entirely like that of the review paper. Chapter 4 (4 pages) is on the "Origin of Turbulence" and describes some general aspects based on small amplitude expansion of the equation of motion. The best chapter in the book is Chap. 5 (20 pages) on "Interaction of Plasmons with Resonance Particles." This is a discussion of quasi-linear theory. The author has made major contributions to this subject and this shows itself in the clarity of the discussion. Chapter 6 (7 pages) on "Interaction between High and Low Frequency Oscillations," Chap. 7 (8 pages) on "Plasmon-Plasmon Interactions," Chap. 8 (3 pages) on "Strong Turbulence," Chap. 9 (8 pages) on "Transport Coefficients in Turbulent Plasma," and Chap. 10 (4 pages) on "Dispersion of Electromagnetic Waves in Turbulent Plasma" all reflect the author's interests and present results in very compact form. There are four brief appendixes.

This book could be a valuable quick reference for the plasma expert and serve as an introductory guide for some graduate students. The translation seems excellent, but there are a number of annoying misprints in the equations (whether these are present in the original Russian edition is unknown to me).

Albert Simon

Department of Mechanical and Aerospace Sciences and Department of Physics
University of Rochester
Rochester, New York 14627

February 26, 1969

About the Reviewer: Albert Simon, who is a Professor in the Department of Mechanical and Aerospace Sciences at Rochester, has long been interested in plasma physics. Following association with the fusion project at the Oak Ridge National Laboratory, 1950 to 1961, he directed the Plasma Physics Division at General Atomic just prior to his present association. He spent a year with the Danish Group as a Guggenheim Fellow and has authored An Introduction to Thermonuclear Research.