Books

Realities of Space Travel: Selected Papers of the British Interplanetary Society. Edited by L. J. Carter. 431 pp. Putnam & Co. Ltd., London, England, 1957. £1.15. *Reviewed by J. J. Coupling.*

These 24 selected papers of the British Interplanetary Society, by 16 authors, cover almost all aspects of space travel. They suffer from the usual faults of collections. At one moment we are at a beautiful level of simplicity and first principles, and at the next we are confronted with aerodynamic and thermodynamic equations which spring from nowhere to confound us. In most chapters we encounter metric units, but English units are used in some. The book does not have the uniformity, balance, and economy of the work of a good single writer.

I think that we have to put up with this in these days of space travel. Perhaps only an individual with the prodigious energy and acumen of Willy Ley can keep reliably informed concerning all parts of the subject, and even he cannot pursue in detail every matter covered in this book. Too, the contents of this book represent largely the original work of the members of the British Interplanetary Society. They perform a laudable function in thinking about and writing about the various aspects of space travel diligently, if not always brilliantly, and the Society is invaluable as a focus for such activities.

Here the interested novice can learn some of the basic facts of rockets, rocket engines, and interplanetary orbits. He can go on to the consideration of winged re-entry of the atmosphere. He can become acquainted with satellites and learn something about their possible uses and a little about the Vanguard program. He can read about the limitations of chemical rockets and some of the possibilities of atomic rockets. He can inform himself concerning meteor hazards, cosmic rays, weightlessness, food, and air purification. There are chapters on the Inyokern and Woomera test stations, and one on the history of European rocketry after World War I.

Who am I to judge material in so wide a field? I do have favorites, though. It seems to me that H. Preston-Thomas gives a very sensible discussion of the use of extremely low-acceleration ion rockets in interplanetary flight, and that N. J. Bowman treats the problem of dehydrated food and chemical air purification versus growing algae for food and air very clearly. It is good to have Dornberger's historical notes on rocketry. The material on the moon and Mars is interesting, but this sort of thing has appeared before.

Some of the chapters are informative but rather pedestrian. In some cases it seems to me that there is more to be said. Nothing is said, for instance, about sailing between planets by light pressure. More could be said in the cases of ion rockets and relativistic effects. In the latter case, the large fraction of the mass which must be consumed to reach a velocity at which time contraction is noticeable is not properly noted, nor is the possibility of using interstellar hydrogen as fuel discussed. Current arguments concerning time contraction in accelerated motion are not mentioned either, though the pertinent chapters antedate most of these.

In all, there is much in the book that is interesting and useful. One can easily imagine a better book, but none of the scope of this volume has appeared.

Philosophy of Science: The Link Between Science and Philosophy. By Philipp Frank. 394 pp. Prentice-Hall, Inc., Englewood Cliffs, N. J., 1957. $5.75. *Reviewed by Philip J. Davis, National Bureau of Standards.*

After quoting Ortega y Gasset to the effect that the average scientist is a "learned ignoramus, which is a very serious matter, as it implies that he is a person that is ignorant, not in the fashion of the ignorant man, but with all the petulance of one who is learned", Professor Frank begins his book which is dedicated to breaking down the present barriers between science, metaphysics, and philosophy. The current situation where "the great majority of today's physicists have been successfully trained to keep their special fields as separate from philosophy as they can" is unsatisfactory inasmuch as it relieves them of the necessity of locking horns with some of the knottiest political, moral, and spiritual problems that the world has faced.

The book proceeds on several levels. On the first level, Frank gives us a description of the making and breaking of scientific theories since the Greeks. Euclid vs. Lobatchewsky, Aristotle vs. Galileo, Ptolemy vs. Copernicus, Newton vs. Einstein, particles vs. waves, destructibility of matter vs. indestructibility, the rise and fall of causality. This is perhaps the most familiar aspect of the book, but what is noteworthy here is the clarity with which the dynamics and the logic of the process are exhibited.

On the second level, the author describes the relationship between physical theories and philosophical systems. Originally, there was a strong link in the minds of scientists between science and philosophy. But then, technology became scientific, and "the union of science and technology was responsible for the separation between science and philosophy". The "tough-minded" scientist was born. Does the theory describe the facts? Does it have predictive value? Then, this is all he wants, and away with irrelevant and obfuscating speculations which relate his science to philosophy or metaphysics or to religion or politics or ethics. Away with

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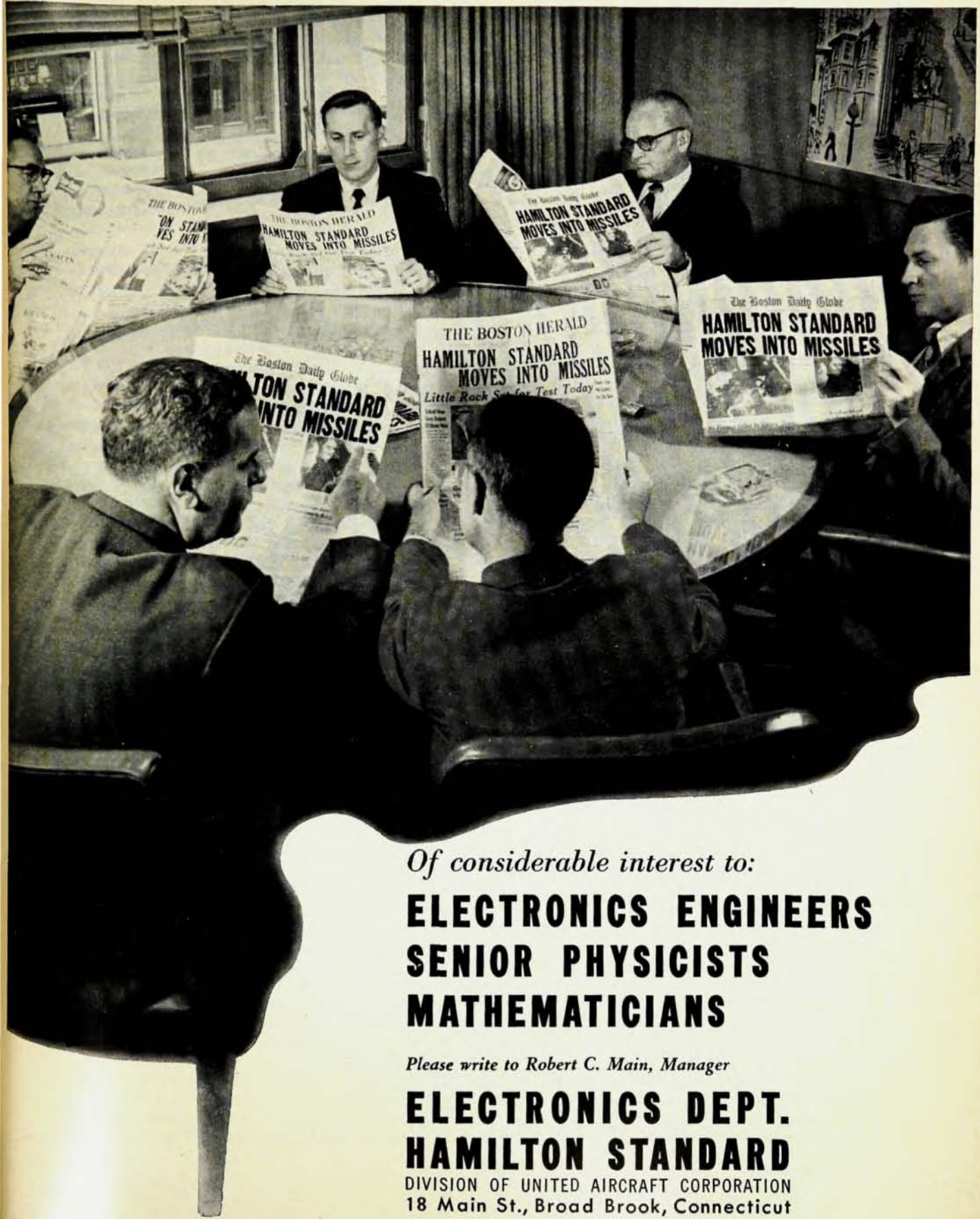

Of considerable interest to:

ELECTRONICS ENGINEERS
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the whole human element of the thing. However, this element cannot be spirited away so easily. Frank shows how it turns up time and again to embarass and put on the spot scientists who have no opinion or who may be in the grip of some childhood philosophy. For instance, is relativity theory antimaterialistic? This may be an important question depending upon the prevalent climate of opinion.

Actually, as Frank concludes, the history of science has itself been less tough-minded than the attitude described above: "If we wish to speak in a brief and rather perfunctory way, we may distinguish between two main purposes of a theory: use for the construction of devices (technological purposes), and use for direct guidance of human conduct. The actual acceptance of theories has always been a compromise between the technological and the sociological value of the theory." We have here liberal education in the true sense from the pen of a great teacher and humanist.

Thermodynamics and Statistical Mechanics. By A. H. Wilson. 495 pp. Cambridge U. Press, New York, 1957. $9.50. *Reviewed by M. Kac, Cornell University.*

This book is intended for students of theoretical physics since the author feels that most textbooks in this field have been written primarily for chemists. However, a number of topics (chemical reactions, solutions) usually associated with physical chemistry are treated in detail. The emphasis is supposed to be on the principles but the number of applications is so large and many of them are treated so sketchily that this worthy aim is somewhat obscured.

The first four chapters are devoted to classical (phenomenological) thermodynamics and a valuable innovation has been introduced by including the Caratheodory axiomatic approach (Chapter 4). This is one of the best parts of the book and it tends to emphasize the often overlooked fact that thermodynamics is logically quite a subtle subject.

The remaining nine chapters are devoted to statistical mechanics and these follow more or less standard lines.

The more delicate portions (notably the theory of condensation) are dealt with briefly, too briefly for the reviewer's taste. Still the style is lucid and the book contains an impressive amount of information without being ponderous and verbose.

It should be useful as a textbook and a reference book and the part on phenomenological thermodynamics is truly excellent.

Physical Properties of Crystals: Their Representation by Tensors and Matrices. By J. F. Nye. 322 pp. Oxford U. Press, New York, 1957. $8.00. *Reviewed by R. B. Lindsay, Brown University.*

The literature on crystal physics is very extensive both from the standpoint of the elucidation of structure by means of x-rays and electron microscopy and that of the prediction of properties from the statistical mechanics of the solid state. The author of the present text has set himself a rather limited task and within the framework of his purpose has produced what will undoubtedly be a useful book. He examines in detail those properties of crystals which can be expressed in tensor notation and the thermodynamic relations connecting them. This means that he regards a crystal effectively as an anisotropic continuum having certain symmetry properties and pays no regard to its atomic structure.

The book consists of four parts of which the first is an exposition of tensor analysis; this, though brief, is elegant, clear, and thorough. It is followed by a much longer group of chapters on equilibrium properties of crystals including magnetic, electric, elastic, and piezoelectric behavior. This part is concluded by a chapter on thermodynamic relations, presupposing a working knowledge of thermodynamics, but serving admirably to tie together the various properties with the assistance of numerous ingenious schematic diagrams. The third part discusses transport properties including thermoelectricity but not superconductivity. There is an adequate account of Onsager's principle in irreversible thermodynamics. Part Four is a brief presentation of crystal optics. There are eight appendices including a rather substantial one reviewing the fundamentals of crystallography. A useful feature is the inclusion of numerous exercises through which the reader can test his understanding of the text. The book is suitable as a text in most universities for senior undergraduate majors in physics or first-year graduate students, but it should also be helpful for all who are engaged in research involving any phase of crystal physics.

The Science of Engineering Materials. Edited by J. E. Goldman. 528 pp. John Wiley & Sons, Inc., New York, 1957. $12.00. *Reviewed by Cyril Stanley Smith, Institute for the Study of Metals.*

"The present book is an outgrowth of a series of conferences and symposia, formal and informal, that culminated in the Carnegie Conference on the Impact of Solid States Science on Engineering Education which was held in Pittsburgh at Carnegie Institute of Technology in June 1954."

The conference and this book are manifest proof of the desire of the present generation of solid-state physicists—largely under the inspired leadership of Frederick Seitz—to interpret theoretical achievement in terms understandable by the average engineer.

The book contains 18 chapters, each written by an outstanding research man in the style which has come to be regarded as appropriate for the engineer. There is little really new in the book, but teachers of engineering who have kept abreast of their subject will be grateful for a handy reference and an outstandingly good presentation of all aspects of solid-state physics of concern to them.

There are chapters on cements, plastics, and glass—all non- or pseudo-crystalline and hence beyond the