

covery was made at the time of the strongest ever solar maximum, the great majority of measurements are recent and therefore at solar minimum.

Nevertheless, one important feature of the solar cycle variation is revealed in one of the few European contributions. Comparison of results from *Ariel I* and *Explorer IV* shows that the intensity of the inner belt increases with solar activity and, since it is known that the lifetime of trapped particles decreases, the source must increase substantially. On the other hand, the earliest suggested source, neutron albedo from cosmic rays, should not vary. Other aspects discussed by theorists led to one of the principal conclusions of the institute—that neutron albedo is a very minor source and that most of the particles come from the solar wind.

It was also appreciated that stochastic acceleration was of outstanding importance and this was emphasized in the discussions. It was seen that future progress in the comprehension of the radiation requires much greater effort in measuring disturbances in the electromagnetic field, which has been neglected in comparison with the particles. Furthermore, it is important to separate space and time variations and this requires multiple satellites, as emphasized in the excellent summary at the end of the Proceedings. One paper on plasma instabilities was included, and at the sequel at Munich this year (1967) much more of the programme will be given to waves, for it has been realized that the radiation belts provide a splendid opportunity for observing plasma behaviour. The last one-third of the Proceedings under review is concerned with radiation belts created by nuclear explosions and with the effects of trapped radiation on electronic devices and humans.

J. W. DUNGEY

## MATHEMATICAL PHYSICS

### Problems of Mathematical Physics

By N. N. Lebedev, I. P. Skalskaya and Y. S. Ufiyand. Revised, enlarged and corrected English edition translated and edited by Richard A. Silverman. With a Supplement by Edward L. Reiss. (Selected Russian Publications in the Mathematical Sciences.) Pp. xi + 429. (Englewood Cliffs, N.J., and London: Prentice-Hall, 1965.) 96s.

This is a collection of more than 600 exercises on methods of mathematical physics, with equal emphasis on both parts of the term. Solutions, covering 105 pages, are supplied for a representative fraction of the problems. The subject matter is mathematical physics of the strictly classical kind, with problems on elasticity, electromagnetism, fluid dynamics, heat conduction and diffraction of waves; there are none on quantum mechanics. The problems are classified mostly according to the mathematical methods rather than the field of physical application, with chapters on hyperbolic and elliptic equations, discrete and continuous Fourier and eigenfunction expansions, and a brief chapter on integral equations. Each chapter starts with a brief introduction, reviewing the key points to be used in the problems, and closes with a bibliography for further reading which is both carefully chosen and sufficiently short to be useful. (The translator says that the references in the original Russian version have been revised and brought up to date for the English edition.) There is a helpful supplement by Reiss on variational and related methods, contrasting in its emphasis with the original text, which concentrates on exact solutions.

A preparation not far short of degree level in mathematics with a large share of physics would be necessary to gain much benefit from the book, but anyone at about that stage who has worked through the first volume of Courant-Hilbert and wishes to develop his ability to set up problems and his dexterity to solve them could scarcely

do better than to settle down with the book for a vacation. The book should also serve as a useful source of examples for lecture courses. The production and printing are excellent.

A. HERZENBERG

## VACUUM SEALS

### Vacuum Sealing Techniques

By A. Roth. Pp. xiv + 845. (London and New York: Pergamon Press, Ltd., 1966.) 240s. net.

This relatively large book supported by nearly 1,700 references represents a collection of a large number of items dealing with vacuum technology that have been reported previously. In making such a collection, the author has necessarily had to cover a number of aspects in insufficient detail for the book to serve in itself as an immediate reference for the reader wishing to construct anything but the simplest piece of vacuum equipment. For example, the section devoted to brazing, which is an important vacuum sealing technique, is restricted to some twenty pages of the chapter devoted to permanent seals. This chapter deals with welded joints in a similar manner, but glass seals, to both glass and metal, are dealt with more fully, and some information on simple glass working is included. There are also some details of metal ceramic sealing techniques and, surprisingly in this chapter, a short section on elastomers and plastic pipes. Appropriately the chapter closes with sections on the techniques for the sealing off of glass, quartz and metal tubulations.

The next chapter is of similar length and concerns semi-permanent and demountable seals; it covers the use of waxes, epoxy resins, soft solders, solder glasses, ground glass joints, liquid seals and gaskets. A large number of the techniques described, however, would be obvious to anyone with normal laboratory experience. Also included is a considerable amount of information on the types of elastomer, metal gaskets and seatings available commercially. The task of choosing from this information could be somewhat bewildering to someone starting in the vacuum field, while it would be superfluous to the practising engineer or physicist, who will have his own preferred designs selected from components readily available to him. Chapters devoted to the transmission of electricity and mechanical motion through vacuum seals give a number of methods that can be used when limited facilities are available, together with commercially available items.

The use of metal ceramic seals for electrical lead-throughs receives only passing mention, which is unfortunate in such a book in view of their ruggedness and increasing use in the vacuum field. Transfer of materials into vacuum is almost entirely restricted to gaseous matter using components from simple laboratory apparatus to commercially available valves. The final chapter is devoted to some of the seals used in the transmitting of radiations other than radio frequency radiation.

F. BROOK

## FERTILE SOIL

### The Control of Soil Fertility

By G. W. Cooke. (Agricultural and Horticultural Series.) Pp. xvii + 526. (London: Crosby Lockwood and Son, Ltd., 1967.) 70s. net.

In writing this book, Dr. Cooke has made a most valuable and balanced contribution to the literature of soil science. It is not competitive with Russell's *Soil Conditions and Plant Growth* but complementary, because it bridges so effectively the gap between the more fundamental aspects of soil science and farm practices. As a consequence of this and also of the way that it is written, this book will