could take the whole of physics for their field of activity and make lasting contributions to a wide variety of problems. Of all these, Lord Rayleigh seems the closest to us today, partly because he outlived the others and partly because in the enormous range of his scientific activity he touched on so many problems which have had great importance for contemporary physics.

It is therefore with particular satisfaction that we greet the appearance of this reissue of Rayleigh's collected scientific papers, which have been long out of print. The first edition was published by the Cambridge University Press in six volumes, the first five of which came out during Rayleigh's lifetime, in 1899, 1900, 1902, 1903, and 1912, respectively. The sixth was published in 1920, the year following his death. The present reprint covers all six volumes, but is bound in three for convenience. It must be confessed that they form very substantial volumes indeed and are a trifle awkward to handle.

Considerable interest is added to this reprint through the incorporation in Volume One of a 16-page supplement containing photographs relating to Rayleigh as well as reproductions of certain pages from his laboratory notebooks. Most of the latter are now in the possession of the Air Force Cambridge Research Laboratories in Bedford, Massachusetts, with copies deposited in Imperial College, London, and in the Niels Bohr Library of the American Institute of Physics. John N. Howard, chief scientist of the Air Force Cambridge Laboratories and editor of *Applied Optics*, has contributed to Volume Three a brief but highly useful bibliographical note with references to sources of biographical information about Rayleigh.

Practically everything that can be said about Rayleigh has already appeared in print in numerous places. Yet as we turn the pages of these volumes we cannot cease to wonder at the remarkable versatility of an individual who could move with such ease from questions in electricity to problems in acoustics, and from theoretical calculations of considerable complexity to ingenious experimental devices and arrangements. In a style that is clarity itself but also thoroughly relaxed the author seems almost to be conversing with the reader about his difficulties and how he overcame them. It is amusing to note that Rayleigh felt himself bothered in 1874 by a problem that we consider peculiarly characteristic of the science of our time, as this quotation from his review of Isaac Todhunter's *History of the Mathematical Theories of Attraction and the Figure of the Earth from the Time of Newton to that of Laplace* (1873) amply testifies:

> Scientific men must often experience a feeling not far removed from alarm, when we contemplate the flood of new knowledge which each year brings with it. New societies spring into existence, with their Proceedings and Transactions, laden with the latest discoveries, and new journals continually appear in response to the growing demand for popular science. Every year the additions to the common stock of knowledge become more bulky, if not more valuable; and one is impelled to ask, Where is this to end?

We today may perhaps feel like echoing Rayleigh's question: "Where, indeed?"

The 446 scientific papers included in these volumes constitute a veritable gold mine for the historian of late 19th and early 20th century physics. Practically every scientific contribution made by Rayleigh, with the sole exception of his monumental *Theory of Sound* (1877) either appears here in full or is abstracted. As in the original edition, though the papers are printed in chronological order irrespective of subject, in the final volume the contents are summarized and classified according to subject, thus making it comparatively easy to locate any paper of the author in any one of the twelve fields among which the articles are distributed. The valuable index of names has also been preserved from the first edition.

The volumes are a model of book production from the standpoint of paper, typography and illustrations.

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Dean Lindsay is the author of an historical and biographical introduction to a reprinted edition of Rayleigh's Theory of Sound.

Space-group theory

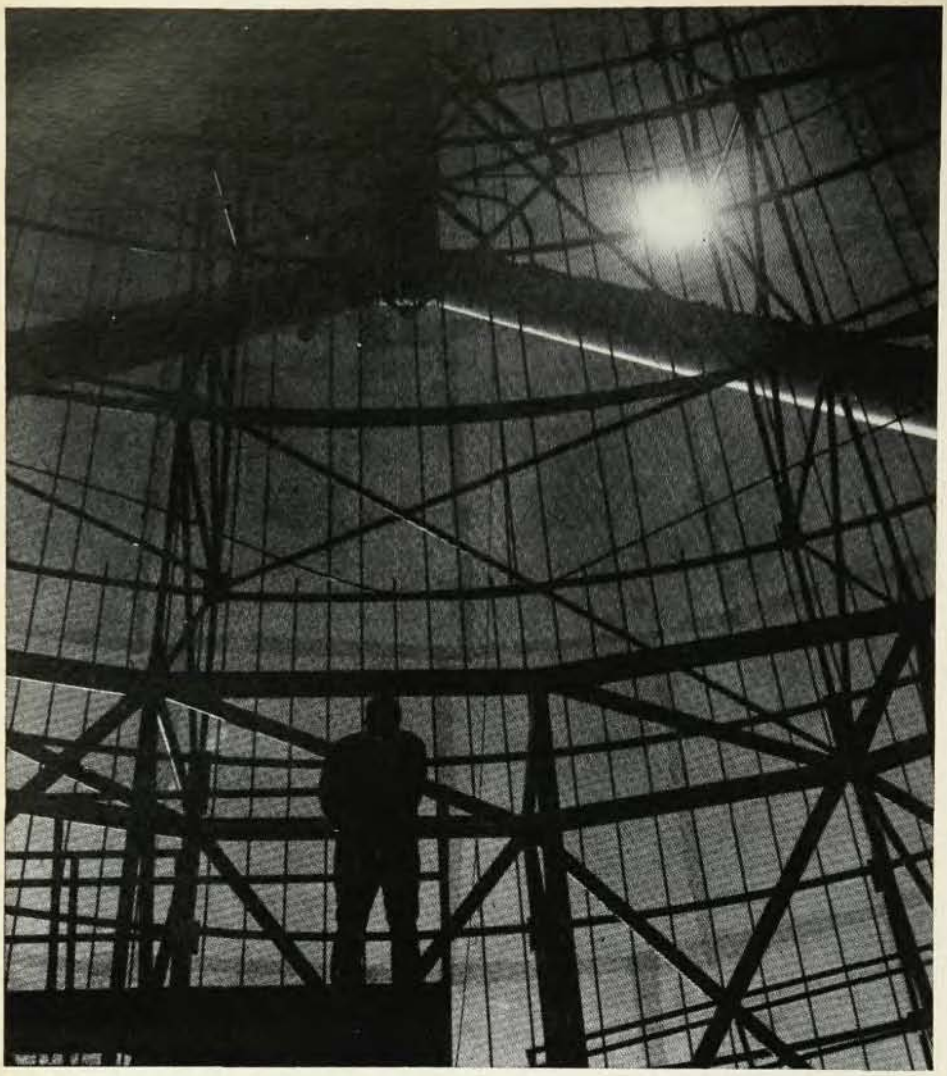
AN INTRODUCTION TO MATHEMATICAL CRYSTALLOGRAPHY. By M. A. Jaswon. 125 pp. American Elsevier, New York, 1965. $6.00.

by H. M. Otte

As Jaswon points out in his preface, space-group theory was completed by 1890 and no new results can be expected. However, considerable scope remains for fresh presentations and interpretations, thus making the subject more readily accessible for important applications. In the limited space that the author allowed himself, this laudable objective is in part achieved, but the monograph—for this is what the publication really is—suffers, understandably, from many shortcomings.

The approach taken by Jaswon concentrates attention upon the motif structure, the *microscopic* arrangement of atoms which repeats itself periodically throughout any crystalline matter. An account of the 32 crystallographic point groups appears in the first three chapters, based upon intuitive geometrical considerations which are then supplemented by formal group theory and the development of a systematic notation for point-group operators. The next four chapters deal with space lattices followed by one on the Bravais space groups and three on screw axes and glide planes. At the end of each chapter there are generally a few problems involving proofs or demonstrations based on the material in the chapter.

Vector and matrix methods are used throughout the monograph; tensors are not mentioned. There are seven (untitled) appendices which include a proof that the reciprocal of a body-centered monoclinic lattice is a face-centered monoclinic lattice and a deviation of the relation between a point and its image with respect to a given mirror plane. Following the appendices is a bibliography listing only about a dozen articles and books; there is also a short index. Like the text, the bibliography seems eclectic and contains no reference to such classics as Seitz's papers [Zeit. Krist., **88**, 433 (1934); **91**, 336



BEYOND THE EARTH. Looking at the sun through the wire-mesh dish of the large radio telescope at the Air Force Cambridge Research laboratories. The heavy tripod at the top carries the telescope's receiving equipment.

(1935)] and Nye's book (*Physical Properties of Crystals*, Clarendon Press, Oxford, 1957). One is left with the impression, not altogether unintentional I suspect, that this little monograph outlines Jaswon's particular approach to the fundamentals of a subject to which he has contributed significantly. Since other approaches, equally good and in some instances possibly better, do exist, it is unfortunate that consideration is not given to them.

The reciprocal lattice itself merits only two pages, which hardly reflects its importance. The remaining sections of the chapter introduce Bloch functions, Brillouin zones and Bragg reflections, giving but the merest hint of the important applications of crystallography. More extensive treatment of such topics would have served to emphasize the particular attractiveness of Jaswon's approach and thus add usefulness to the book.

Most of the text apparently developed out of graduate lecture courses given at the Imperial College, London, and at Brown University, and probably served to supplement related courses. The concept of the book is excellent, and now that Jaswon is heading the engineering mechanics department at the University of Kentucky we hope he will have occasion to broaden its scope. The binding of the book (hardcover) incidentally, is poor, even at the price.

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Beyond the earth

INTRODUCTION TO SPACE SCIENCE. Wilmot N. Hess, ed. 934 pp. Gordon and Breach, New York, 1965. Professional edition $10.00, reference edition $29.75.

by Jules Aarons

Both the word "space" and the definitions of the word "space" appear to approach infinity. Certainly, the range of the volume *Introduction to Space Science* is semi-infinite. The reviews by the staff of the Goddard Space Flight Center of NASA range from the very neat classical review paper by W. N. Hess (the editor) on the earth's radiation belt to a detailed description of the individual experiments and sightings of each of the astronauts (Russian and American) by W. S. Cameron to the (occasionally) self-indulgent article on the origin of the solar system by A. G. W. Cameron.

Introductories have been written by two groups of scientists, one the research workers from not-for-profit institutes or from government laboratories, the second, introductories from the university professor—research worker. The research workers frequently write in teams while the university professor will do a solo. The advantage of the team introductories is that the team consists of many specialists who know only their own subjects well but who, en masse, cover a field ably. The university professor—solo writer—teacher knows his specialty quite well but is only acquainted with other topics he is covering. He tends to overstress his own field and to be unacquainted with the reëvaluations of data, obsolete papers in the literature, and experiments which did not succeed and whose negative results were not published.

The solo writer however maintains a coherence to his book and (frequently) has experience in presenting the material to students in a consistent and logical fashion. The teams may well lack coherence in units, in presenting derivations but this may be made up by the completeness of the reviews.

An example of the nonteacher's approach can be seen from the following quotation from the cogent review on the sun: "A radio telescope operating