The final chapters, starting with a review of the experimental basis of atomic physics, cover wave mechanics, atomic structure and nuclear physics.

The problems at the ends of the chapters themselves make interesting reading, ranging from calculations on the Massachusetts Institute of Technology cyclotron magnet and the interpretation of tables of experimental results to some very searching tests of a student's capacity to handle complicated data.

The book can be recommended with enthusiasm as an outstandingly clear explanation of fundamental principles in present-day terms. G. R. NOAKES

## THE SOLAR CORONA WITHOUT AN ECLIPSE

### Die Sonnenkorona

Von Prof. M. Waldmeier. Band 2: Struktur und Variationen der Monochromatischen Korona. (Lehrbücher und Monographien aus dem Gebiete der Exakten Wissenschaften. Astronomisch-Geophysikalische Reihe, Band 5.) Pp. 353. (Basel und Stuttgart: Birkhäuser Verlag, 1957.) 68.50 francs; 68.50 D.M.

SINCE the early 1930's a number of astronomers have followed Lyot in making regular daylight observations of the solar corona from suitable mountain-top observatories. Prominent among these has been Prof. M. Waldmeier, director of the Federal Observatory at Zurich, and to-day an acknowledged expert in this field. For nearly twenty years he has carried out an extensive programme of such measurements, working at his Observatory's mountain station above Arosa, and this is the second of a series of three books describing the results. The first two books are confined to little more than a description of the apparatus, the methods, and measures; the third will discuss the physics of the corona, presumably in a much more general way.

Since there is often misunderstanding among those without special knowledge of this subject, it may be well to emphasize that normal coronagraph observations, including Prof. Waldmeier's, do not go more than about 5 minutes of arc from the edge of the Sun's disk. Even with the most advanced electronic devices there is at present no possibility of measuring optically in broad daylight to more than a radius, say, 10–15 minutes of arc, from the solar limb. For everything beyond a few minutes of arc, out to the zodiacal light region, 25 deg. or so away, we must rely still on total solar eclipses and on radio astronomy.

This volume, then, relates to the inner corona only, but within this restricted region the amount of information provided is very considerable. Perhaps the most important feature of Prof. Waldmeier's work is that he has observed systematically, with as standardized a procedure as possible, over more than a whole sunspot period. This second volume concentrates on the brightness distribution within the corona in the light of a few bright spectrum lines, especially the green line, 5303A. of [Fe XIV], and the red line, 6374A. of [Fe X]. These lines are not only the most convenient to measure; their considerable difference in ionization-level means that the relative behaviour of the two gives us valuable information on temperature and electron-density variations.

Prof. Waldmeier provides us lavishly with tables and diagrams, so that we may follow easily the large changes in brightness and shape of the corona through the sunspot cycle, and may see also the close local relationship with sunspots and faculæ. A great deal of the work rests on simple intensity measurements at a given height in the corona, but in addition there are estimates of the greatest height to which the corona could be detected against the sky and a number of measures of isophotes in 5303A. light, made using the 5350A. line from a thallium lamp for comparison. A series of sketches of coronal condensations are also given. These are somewhat rarer phenomena, usually with a life-time not exceeding one hour, and are associated with large, active, sunspot groups, and with typical spot prominences.

Apart from the condensations, however, most of the coronal structure revealed in this work seems to be rather stable, with relatively small changes during intervals of a fortnight. It thus becomes possible, from what we see projected on the sky around the Sun, to construct a first approximation to the three-dimensional corona and to compare what we get with the activity on the photosphere beneath, although the spots, faculæ, etc., by which this activity is assessed are observed near the centre of the disk, separated by a week from the related measurements of the corona. The book gives many charts with comparisons of this kind.

This is very much an individual work. The measurements appear to have been made entirely by the author, single-handed. Literature references are to the author's papers exclusively, and little attempt has been made here to relate the observations to investigations by any other astronomer. Presumably a more general discussion and synthesis will come in the third volume. Meanwhile we have in this and the first volume an impressive collection of measurements, of great importance for anyone who wishes to become better acquainted with the still poorly understood outer atmosphere of the Sun.

R. O. REDMAN

## LOW-TEMPERATURE PHYSICS

### Handbuch der Physik

Herausgegeben von S. Flügge. Band 14: Kältephysik I. Pp. vi+349. 72 D.M. Band 15: Kältephysik II. Pp. vii+477. 112 D.M. (Berlin: Springer-Verlag, 1956.)

TO find, in an encyclopædia of physics running to fifty volumes, that two should be devoted specifically to low-temperature physics raises the question whether nowadays it is a sufficiently distinct branch to justify separate treatment. Perhaps before the War an affirmative answer could have been given; only a few laboratories were equipped to handle liquid helium, and they confined their attention almost exclusively to phenomena occurring at the lowest attainable temperatures. This attitude still persists in some laboratories, particularly the larger cryogenic laboratories in Europe, but it is beginning to seem a little out of date now that liquid helium is so readily available and its specialized techniques so easily assimilated. A more realistic taxonomy of physics is one which accepts solid-state physics as a major subdivision, comprising a wide variety of