The geometrical theory of the Schmidt camera, a reflecting telescope with a shaped transparent disk that distorts the incident field to "precorrect" for spherical aberration of the mirror, is given in Chapter 3. The final chapter treats plate-diagram analysis, a geometrical ray technique which essentially represents each surface of a lens system by an equivalent spherical surface plus an astigmatizing corrector plate (the plate being imaged in the part of the system which precedes it).

The content of the monograph, as it pertains to certain advances in the theory of instrumental optics during a twenty-year period ending in 1953, is excellent; and it will prove useful to specialists in the field to have the original work of the author, as well as accounts of work by Zernike, Wolf, Hopkins, Wayman, Burch and others, under one cover. However, the title is somewhat too inclusive since, for example, no mention at all is made of the concurrent advances in rigorous treatments of diffraction problems or in the "new ray optics" based on asymptotic solutions of Maxwell's equations.

It is regrettable that the work is so well aimed at specialists. The absence of introductory material may make it quite difficult for an outsider, say in radio astronomy, to attempt to carry over useful optical techniques to related problems of antenna design; in fact some sections read like patchworks of journal articles with the introductions deleted. The most readable chapter is that on the Schmidt camera and this is due largely to its excellent introductory discussion and its clear statement of the problem involved.

Reports on Progress in Physics. Volume XVII. Edited by A. C. Stickland. 280 pp. The Physical Society, London, England, 1954. Nonfellows, £2, 10s.; fellows, 27s. 6d. (Postage 1s. 6d.) *Reviewed by E. R. Cohen, North American Aviation, Inc.*

The seventeenth volume of this annual publication is made up of eight survey articles which well represent the present varied frontiers of physics.

C. J. Bouwkamp of the Netherlands contributes an extensive survey of classical diffraction theory which includes among other topics the Wiener-Hopf technique for the solution of integral equations, the rigorous formulation of Babinet's principle, and a discussion of spheroidal wave functions in diffraction theory. J. A. Chalmers reports on atmospheric electricity and B. H. Briggs and M. Spencer survey movements in the ionosphere obtained by radio methods.

C. W. Allen discusses the physical condition of the solar corona as it is understood today, and traces the development of this understanding from 1942, when Edlén identified "coronium" as highly ionized states of A, Ca, Fe, and Ni, thus providing the basis for a reasonable physical model. Atomic valance states and chemical binding are discussed by W. Moffitt and antiferromagnetism is covered by A. B. Lidiard.

Nuclear physics is represented by two reviews which span the range of activity in this field; E. Teller discusses the origin of cosmic rays, and M. H. L. Pryce surveys the evidence on nuclear shell structure.

The production of the book, as is usual in this series, is excellent; physicists in general have been acquainted with the *Reports* for so many years that such an observation is however probably superfluous. Individual articles reprinted from the *Reports* are available at prices which vary according to their length. Information on this may be obtained directly from the offices of the Physical Society of London.

Optical Properties of Thin Solid Films. By O. S. Heavens. 261 pp. (Butterworths Scientific Publications, England) Academic Press Inc., New York, 1955. $6.80. *Reviewed by S. F. Singer, University of Maryland.*

The large strides which have been made recently in the techniques and applications of thin films have gone hand in hand with the developments in vacuum technique and electron microscopy. The former has been used to improve the methods of film deposition while the latter has been used to obtain information hitherto unobtainable about the physical properties of films. The subject of thin films has become increasingly important also because of its practical applications in optics. While partly transparent, highly reflecting metal films were used in the Fabry-Perot interferometer over 50 years ago, the technique has developed to an amazing extent so that films of very great complexity and of controlled thickness can now be deposited quite accurately. The construction of complicated multi-layer systems of films, both metal and dielectric, has now become a common adjunct in physical research. Thin films find their applications in anti-reflecting systems which may use a single film, a double film, or even a triple film. The effectiveness of this technique is remarkable: an instrument with 20 untreated optical surfaces would have a light transmission of only 32% but with the use of the three layer anti-reflecting system this figure could be increased to 98% for the visible spectrum. In other applications high efficiency reflecting systems are of importance. Here advances have been made by the use of systems of dielectric layers having different indices of refraction. These are applied in controlled thicknesses, generally $\lambda/4$ optical thickness. Such all-dielectric reflecting films can give considerable improvement in the performance of certain instruments, e.g. a Fabry-Perot interferometer. It results in a small fringe width and, therefore, an improved resolution. Also, the transmitted light intensity is much greater than it would be with the use of a metal film reflector, e.g. a silver film. Of particular interest in many fields of spectroscopy and astrophysics is the use of deposited films to construct interference filters. These multilayer films cannot yet compete with polarization filters when it comes to extremely narrow band widths, but they should be useful for a band width of about 20 Å, while a polarization filter can be built for a band width of the order of one Å.

The present volume reviews the work which has been

done on thin films and discusses what is known about their structure. A good description is also given of the formation of thin films in the laboratory. The main part is given over to the optical properties of thin films: the calculation of their optical properties and the measurement of optical constants. It is most valuable to have all these arts and techniques assembled in one place, both for the specialists in thin film optics and for the physicists who may need to prepare and calculate thin film depositions for his particular research application.

Static and Dynamic Electron Optics. By P. A. Sturrock. 240 pp. Cambridge University Press, New York, 1955. $5.50. *Reviewed by L. Marton and H. Mendlowitz, National Bureau of Standards.*

There are a number of previous texts in English on electron optics, but this is the first that is devoted completely to theoretical electron optics. Although the title might imply that the subject matter is limited to electron optics only, there are some applications made to the optics of charged particles other than electrons, especially in the case of high-energy machines.

The author divides his presentation of the subject into two main topics. The first is a study of static electron optics (time independent fields) and the second investigates dynamic electron optics (time dependent fields). The treatment of the latter topic is the first appearing in an English language textbook and is a welcome addition to the literature.

The treatment of the various problems in electron optics can be best described as an elegant approach to classical mechanics which employs the variational principles and those convenient functions derived from them. The author obtains from the Hamilton-Jacobi approach to mechanics all the required information germane to geometrical electron optics. This is accomplished via the parallelism to Fermat's principle in light optics. He shows the relation of the canonical momentum of the particle to the refractive index in light. The treatment of particle accelerators (where the fields vary with time) is actually carried through by extending the author's elegant method on static field optics. The time coordinate is not considered as an independent parameter, as is usually done, but is treated as a dependent variable which is a function of the distance along the trajectory. In this manner, he goes on to discuss the high-energy machines such as synchrotrons, linear accelerators, and the strong focusing devices.

The book is offered to all interested in electron (and charged particle) optics, but because of the elegant treatment of the various problems, only those who are interested in and somewhat familiar with the Hamilton-Jacobi approach in classical mechanics will find that they can utilize the methods in the book without a great deal of effort. The average experimentalist interested in the design of an electron microscope lens or a beta-ray spectrograph will not find that he can immediately translate the formulas in the text to his usual routine design parameters without familiarizing himself with this new approach given by the author. In some cases the reader might find some parts of the text difficult because of the "frugal-style" of the author. Elaboration on difficult points and repetition of terminology can, in some cases, be more of a virtue than a vice, especially in dealing with symbols which can sometimes be interpreted as variational operators or as differential operators.

In summary, we feel we can recommend the book to the theoretical worker in electron optics because it gives the author's approach to various problems which have been dealt with elsewhere, for the most part, in a different manner. In the static field case, many of the field properties are discussed by others in optical terms such as aberrations and focal distances, etc. In the case of time-dependent fields, the parameters are discussed elsewhere in mechanical terms such as orbit, stability, oscillations, etc. The author treats both problems in a somewhat similar fashion in terms of parameters which are derived from his "characteristic functions". His examples on beta-ray spectrographs and on the high-energy machines help bridge the gap between the various approaches.

The printing and binding of the book are good examples of the outstanding craftsmanship which we expect from Cambridge University Press.

Lentilles Electroniques (in French). Volume 1 of Optique Electronique. By P. Grivet, M. Y. Bernard, and A. Septier. 184 pp. Bordas, France, 1955. Paperbound. *Reviewed by Charles J. Cook, Stanford Research Institute.*

Lentilles Electroniques, first of a three volume set which embraces the field of particle accelerators, mass and velocity analysers, microscopes, etc., is restricted to a discussion of the optical properties of electrostatic and magnetic lenses.

After introducing the general components and operating techniques of electrostatic electron microscopes, the authors present practical experimental methods used to plot the fields of electrostatic and magnetic lenses. The body of the text, however, is devoted to the optical properties of these lenses. The rules of geometrical optics are developed for both types of lenses. The similarities and differences between optical glass lenses and charged particle lenses are pointed out in a most interesting and illuminating chapter. Then, after a rather complete consideration of the aberrations and distortions introduced by various systems, the properties of some of the more popular symmetrical lenses are discussed. The final short chapter introduces strong focusing.

The text is written in a freely flowing style that is easy to read, and is evolved in a manner that imparts a very strong feeling of intimate familiarity with each subject discussed. This impression probably stems from the successful integration of the theory underlying charged particle lenses with corresponding experimental results and practical lens applications. Each subject