the general inequalities are widely used with applications in a variety of places and the particular inequalities are likely to be of interest purely for their own sakes. In the general section, proofs are usually supplied although they are usually omitted in the other part, but throughout the work the documentation is extremely thorough and the author has ransacked the minor as well as the major mathematical journals for references. He has also been able to include a number of hitherto unpublished results.

To keep the volume within reasonable limits, much has been excluded: deliberately, there is nothing about geometrical and isoperimetrical inequalities, or those connected with number theory or with special functions. Moreover, the author avoids too much overlap with Dieudonné's excellent discussion in his *Calcul Infinitésimal* (1968) and with the 1961 book by Beckenbach and Bellman.

Many items will suggest further research to complete or extend known results. For instance, there is a full account of work on the curious cyclic inequality for positive x 's,

$$\frac{x_1}{x_2 + x_3} + \frac{x_2}{x_3 + x_4} + \dots + \frac{x_{n-1}}{x_n + x_1} + \frac{x_n}{x_1 + x_2} \geq \frac{1}{2} n.$$

Mitrinovic has traced the earliest occurrence in the *Educational Times* for 1903 (in the simplest case $n=3$), but remarks that this may not be its first appearance; it would not be surprising to find it somewhere in those Victorian repositories of perverse ingenuity, the Cambridge college and tripos examination papers, though I cannot find it in Wolstenholme or Carr. Interest in it began after the last war; in 1956 it was proved for $n=3,4,5$, whereas Lighthill showed that it is false for $n=20$. In 1958 Rankin proved that it is false for all sufficiently large n , but though much has since been added, there are still nine values of n for which the question remains undecided.

T. A. A. BROADBENT

GEOMETRICAL OPTICS

Geometrical Optics

By Hans-Georg Zimmer. (Applied Physics and Engineering: an International Series, Vol. 9.) Pp. vii+172. (Springer-Verlag: Berlin and New York, 1970.) 34 DM; \$9.40.

THIS book is fairly conventional in scope, dealing with gaussian optics and third order aberration theory. The approach used is, however, most unorthodox, in that as far as possible the author avoids discussion of ray paths and the shape of wavefronts. He takes, instead, the standpoint that the function of an optical system is to transfer energy by means of tubes of light, and builds up his analysis in a manner allegedly derived from the principle of energy conservation. In effect he takes as his basic axiom that a quantity called the "linear conductivity" of a light tube is invariant in a perfect imaging process. This is stated (but not proved) to be consistent with energy conservation. The procedure is essentially equivalent to using the Lagrange invariant as the prime means of specifying an optical system. The theory of geometrical optics is then reformulated in terms of the quantity "linear conductivity".

Regrettably this approach serves only to make simple issues seem rather complicated and renders the book most unsuitable for students. Other readers may be put off by a turgid text, a stilted translation and a notation of eccentric obscurity. This is a pity, because the book contains a few interesting original ideas which deserve a better presentation.

M. E. BARNETT

SPIN DENSITY MATRICES

Spins in Chemistry

By R. McWeeny. (Current Chemical Concepts: A Series of Monographs. A Polytechnic Press of the Polytechnical Institute of Brooklyn Book.) Pp. xi+153. (Academic: New York and London, June 1970.) 79s.

CHEMICAL physicists with interests in magnetic resonance or valence theory will be familiar with Professor McWeeny's important work on spin distributions and electron density matrices in molecules. This compact and tightly argued series of lectures is particularly welcome, because it links together a variety of useful concepts in theoretical chemistry and brings out the relations between them in new ways. The theme of the book is the theoretical description of electron distributions in molecules which possess unpaired spin or orbital angular momentum, and the origin of the various spin Hamiltonians which are used to describe their energy levels in a magnetic field.

The first lecture on spin and magnetism provides a gentle introduction, and leads naturally into an interesting discussion of the principles which underlie the valence bond theory. The third lecture shows how the Dirac equation leads to magnetic interactions in the molecule, and gives an example of an effective crystal field Hamiltonian with fictitious spin and anisotropic g tensor.

The second half of the book is much more advanced and more formal in its approach. The object is to develop a very general description of electron distributions in terms of spin populations, or one and two-particle distribution matrices, which holds for any kind of molecular wave function with a definite spin and symmetry. The advantage of this approach is that the results are not tied to a particular form of wave function, such as a molecular orbital approximation. A drawback is that one has to learn a lot of difficult notation and master some deep ideas before being able to deal with even simple examples. But McWeeny should easily convince his readers that the effort is worthwhile, because of the very general and powerful methods which he devises. For example, his anisotropic spin-correlation function for triplet states and his spin-orbit coupling density are most elegant concepts. Another point which he brings out well, during a discussion of electron-nuclear hyperfine interactions, is the power of the Wigner-Eckart theorem in reducing the complexity of interactions between different electronic states. The lecture on g tensors and nuclear spin-spin couplings again shows up the virtues of the general methods. This generality should make the book of permanent value to theoretical chemists. There is an interesting appendix on the wave functions of two overlapping molecules with spin, which describes a new and elegant generalization of the Heisenberg spin-coupling idea and the Heiter-London method.

The book is clearly written in a lively style, and those who are willing to work hard should find it very useful.

A. D. McLACHLAN

SYMMETRIES AND QUARKS

Symmetries and Quark Models

Edited by Ramesh Chand. Pp. xii+406. (Gordon and Breach: New York and London, September 1970.) \$33.50; 280s.

THE last few years have seen an enormous increase in the number of summer schools, conferences and symposia in many fields, including elementary particle physics. This, combined with the aggressiveness of certain publishers, has led the conference organizers to believe that their meeting is a failure unless proceedings are issued, with a consequent flooding of the market. There is a real