fields required for an authoritative review. Consequently, the reviews that have appeared have been more of the nature of guides to the literature than critical studies.

Fortunately, there is a reasonable solution; the subject very naturally divides into two parts; one concerned with the optical theory of the scattering from discrete particles of various well defined shapes, and the other concerned with the scattering from groups of small interacting particles, such as dense gases, liquids and concentrated solutions. The first is primarily a branch of physical optics, while in the second the optics is elementary but the statistical mechanics may be very difficult. (The field in which both disciplines are important, the scattering from interacting systems of large particles of high refractive index, has not yet been studied to any extent.) We may therefore expect to see books emphasizing one side or the other of the subject, and written for particular groups of readers.

Van de Hulst's book falls in this category. The book is explicitly restricted to single scattering by independent particles; coöperative effects, such as occur in imperfect gases or solutions, are ignored, as are also effects of multiple scattering in a cloud of otherwise independent particles. Within this designated field it is exhaustive, containing not only a critical review of the older literature, but also many new results published herein for the first time. In fact, this book is distinguished not only by being the first devoted exclusively to its branch of the subject, but also by being written by a recognized authority who is himself responsible for much of the recent progress in this field, in particular, its astronomical applications.

It is impossible to do justice to the contents of this book in a short review. However some idea of the special problems discussed can be obtained from the following incomplete list: scattering from free electrons, small spheres, ellipsoids and spherical shells (here "small" refers to the wave length as a standard), scattering from large spheres, ellipsoids and cylinders of small refractive index, rigorous scattering theory for spheres of any size and refractive index (Mie theory), special formulas for very large dielectric particles, optics of raindrops, raindrops at microwave frequencies, optics of metallic particles, and many others. This reviewer frequently found it amusing to open the book at random and start reading at that point. Some of the facts that thus came to light may be worth passing on: Although the rigorous formulae for the scattering by a perfect sphere were written down by G. Mie in 1908, they become so complicated for large spheres that their consequences have not yet been fully worked out even in this day of automatic computers; in particular the diagrams of intensity *vs.* angle of scattering become so complex that it is impossible even to interpolate between existing calculations; thus approximate theories are necessary, as, for example, for the rainbow. (The usual theory of the rainbow is only a first approximation based on a combination of diffraction theory and geometric optics, and its extension is difficult.) Any large object scatters *twice* as much light as falls on its actual surface, the extra scattering can be thought of as diffraction of the light passing near it, since by Babinet's principle the total amount of the diffracted light is just equal to the amount of light actually absorbed from the beam. Thus a swarm of meteorites passing between us and the sun will appear twice as dense as it actually is, unless the diffraction effect is allowed for. The "glory" is a natural phenomenon occasionally observed when a person standing on a mountain top or in an airplane sees his shadow projected by the sun on clouds or mist. Under favorable conditions he will see the shadow's head surrounded by several brightly colored rings; these are manifestations of a peculiar scattering by the water drops in the mist. (One wonders what role this phenomenon may have played in the history of religious inspiration!) The theory of the glory is not yet in a satisfactory state; it appears to rest on the theory of "edge waves" of light that creep completely around the shadowed side of the water drops and eventually return toward the observer's eye. Edge waves are also important in the transmission of radio signals and earthquake waves around the earth, and their theory is still under development. Space prohibits discussing further interesting facts, such as those concerned with the meteorological uses of radar, or the polarization of starlight presumably caused by interstellar dust.

Applications to chemistry are discussed briefly. These include the molecular weight formula, the colors of colloidal solutions, and polarization effects in suspensions of elongated particles. The molecular weight formula itself is given a rather cursory treatment, although the theoretical background for it is thoroughly explored in the rest of the book. The discussion of the optics of colloidal solutions, such as the explanations for the red and blue colors of gold sols of different particle sizes and the beautiful effects obtainable with monodisperse sulfur sols, is more extensive. Some of the recent work on aerosols is also mentioned.

The author has made a real effort to keep to the elementary level of exposition throughout, with emphasis always on the physical situation at the expense of mathematical details. A very complete list of references to the original literature should make it easy for any one interested in the details to find them. Important results, however, are given in full. The text can be read with understanding by any one who has, or is willing to acquire, some knowledge of elementary wave optics.

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Progress in Low Temperature Physics. Volume II. Edited by C. J. GORTER, Professor of Experimental Physics, Director of the Kamerlingh Onnes Laboratory, Leiden. Interscience Publishers, Inc., 250 Fifth Avenue, New York 1, N. Y. 1957. xi + 480 pp. 16.5 × 23 cm. Price, $10.75.

The phenomenal growth, in recent years, of the number of articles describing results of scientific research has made it possible for an individual to attempt to read and understand only a small fraction of the papers which are of interest to him. This has led to the publication of what might be called "review books," usually edited by an outstanding authority, and consisting of a number of uncorrelated chapters each written by one or more specialists and describing recent work in a narrow field. Such a book is "Progress in Low Temperature Physics, Volume II." It contains fourteen chapters written by twenty-two contributors. There are five chapters on the properties of liquid and solid helium, including adsorbed films; four chapters on electronic phenomena in metals and semiconductors; and a chapter each on paramagnetic relaxation, the orientation of atomic nuclei at low temperatures, physical properties of the rare earth metals, the representation of specific heat data, and the temperature scale in the liquid helium region. In general the articles are authoritatively written and through copious references to the scientific literature adequately describe the more important recent work in each special subject. Also, in general, they are written in the style of a scientific paper and addressed to the specialist and are no substitute for the conventional monograph or textbook for a reader who desires a systematic exposition of a subject. Exceptions to the last remark are the chapter by D. Shoenberg on "The de Haas–van Alphen Effect" and that by C. Domb and J. S. Dugdale on "Solid Helium." The oscillatory variation with magnetic field of the magnetic susceptibility of a metal, discovered by de Haas and van Alphen, gives important information concerning the energy levels of electrons in a metal near the Fermi surface and Shoenberg gives a very clear discussion, both of the experiments and of their theoretical significance. Ordinarily one thinks of the liquid as the glamor-phase of helium but the excellent chapter on solid helium makes clear some of the fascinating attributes of Cinderella Solid. The chapter by H. C. Kramers on "Liquid Helium Below 1°K." demonstrates that the reasons for the remarkable properties of liquid helium are beginning to be understood.

With the present general availability of cryogenic facilities experimenters in many branches of physics and chemistry are extending their measurements to the temperature range of liquid helium and below and the designation "Low Temperature Physics" no longer serves to specify an area of common scientific interest aside from certain features in the techniques of producing and maintaining low temperatures. The present volume reflects this diversity of interest. The appropriate chapters of the book will be of great use to those engaged in or beginning research in one of the special fields treated.

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