THE THEORY OF THE CHRISTIANSEN EXPERIMENT

WHEN an isotropic solid, *e.g.*, glass, is powdered and placed inside a flat-sided cell which is then filled with a liquid with a refractive index equal to that of the powder for some wavelength λ_0 in the spectrum, beautiful chromatic effects are observed. This phenomenon is the well-kcown Christiansen effect and is made use of for making filters. The cell becomes transparent for a restricted region of the spectrum in the vicinity of λ_0, while the rest of the incident light appears as a halo surrounding the light source. The range of wavelengths regularly transmitted by the cell diminishes as its thickness is increased and is also influenced by other conditions of the experiment. Although many papers have been published both on the experimental and theoretical aspects of the Christiansen filter, there appears to be no recognition of the fact that the behaviour of such a filter should be determined by the principles of wave-optics. Sir C. V. Raman has considered the subject afresh and has shown that the effects exhibited by a Christiansen filter can only be explained in terms of wave-optics.

The basic concepts underlying the new approach to the problem are the following:— The powder—liquid mixture contained in a Christiansen cell is an optically heterogeneous medium, and its functioning depends on the fact that while this heterogeneity vanishes for λ_0 for which the two refractive indices (μ_1 of powder and μ_2 of liquid) are identical, it persists for adjoining wavelengths and disturbs the regular wave propagation in their cases. To find the effect of the cell on the passage of the incident light beam, the total thickness of the cell is conceived as divided up into a sufficiently large number of individual layers, each of which diverts part of the energy of the incident wave-train away from its original path in the form of diffracted waves. The wave-train finally emerging from the cell is that which had its intensity cut down in this manner by the cumulative effect of the successive layers through which it has passed. The diffracted radiations originating at the individual layers and emerging from the cell give rise to the halo observed in the experiment.

Approaching the problem from the point of view indicated above, Sir C. V. Raman has derived the following theoretical formula for the distribution of intensity in the spectrum of the transmitted light, the variables involved being the wavelength of the light λ, the average size of the particles of the powder $\triangle$, the thickness of the cell z, and the difference in the refractive indices of the powder and the liquid for the wavelength under consideration $(\mu_1 - \mu_2)$

$$I = I_0 \, e^{-k^2\pi^2(\mu_1 - \mu_2) z \cdot \Delta^2/\lambda^2}$$

The characters of the halo observed around the light source are also discussed in terms of the diffraction theory. The Raman theory explains the facts of observation in a very simple manner and gives results in satisfactory accord with the available experimental data. However, the appearance of λ^2 in the above formula has yet to be demonstrated by fresh quantitative data.

R. S. K.

* Abstract of a paper presented by Sir C. V. Raman at the Scientific Meeting of the Indian Academy of Sciences held on the 30th June 1949 at the Indian Institute of Science. The full paper has appeared in the June 1949 issue of the *Proceedings of the Indian Academy of Sciences*.

DR. CHANDRASEKHAR

THE Russell Lecture, considered the most important astronomical lecture in the Americas, was delivered in Ottawa on June 21st by Dr. S. Chandrasekhar of Yerkes Observatory, Wisconsin. The lecture was one of the highlights of the 81st meeting of the American Astronomical Society, held in Ottawa, and invitation to deliver it is regarded as the highest honour this Society can bestow. Dr. Chandrasekhar is recognised as one of the world's leading authorities on mathematical physics. The subject of the lecture was "Turbulence—A Physical Theory of Astrophysical Interest".