THE DIFFRACTION OF LIGHT BY HIGH FREQUENCY SOUND WAVES: PART I.

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1. *Introduction.*

As is well known, Langevin showed that high frequency sound-waves of great intensity can be generated in fluids by the use of piezo-electric oscillators of quartz. Recently, Debye and Sears[1] in America and Lucas and Biquard[2] in France have described very beautiful experiments illustrating the diffraction of light by such high-frequency sound-waves in a liquid. Amongst the experimenters in this new field, may be specially mentioned R. Bär[3] of Zürich who has carried out a thorough investigation and has published some beautiful photographs of the effect. The arrangement may be described briefly as follows. A plane beam of monochromatic light emerging from a distant slit and a collimating lens is incident normally on a cell of rectangular cross-section and after passing through the medium emerges from the oppsite side. Under these conditions, the incident beam will be undeviated if the medium be homogeneous and isotropic. If, however, the medium be traversed by high-frequency sound-waves generated by introducing a quartz oscillator at the top of the cell, the medium becomes stratified into parallel layers of varying refractive index. Considering the case in which the incident beam is parallel to the plane of the sound-waves, the emerging light from the medium will now consist of various beams travelling in different directions. If the inclination of a beam with the incident light be denoted by θ, it has been found experimentally that the formula

$$\sin\theta = \pm \frac{n\lambda}{\lambda^*}, \quad n \text{ (an integer)} \geq 1 \qquad \ldots \qquad \ldots \qquad (1)$$

is in satisfactory agreement with the observed results, where λ and λ^* are the wave-lengths of the incident light and the sound wave in the medium

[1] P. Debye and F. W. Sears, *Proc. Nat. Acad. Sci.* (Washington), 1932, 18, 409.

[2] R. Lucas and P. Biquard, *Jour. de Phys. et Rad.*, 1932, 3, 464.

[3] R. Bär, *Helv. Phys. Acta*, 1933, 6, 570.