DIFFRACTION OF LIGHT BY TRANSPARENT SPHERES AND SPHEROIDS: THE FRESNEL PATTERNS

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1. Introduction

The phenomena with which we are concerned in the present paper are those arising when a beam of light emerges after traversing a sphere of radius large compared with the wave-length of light. Our attention was drawn to them in the course of some studies on the Christiansen experiment with spherules of glass described in a recent paper in these *Proceedings*. To elucidate more fully the effects described in that paper, it appeared to us desirable to examine the optical behaviour of an individual spherule of glass immersed in a liquid of nearly the same refractive index and traversed by light from a distant point source. Very pretty colour effects were observed with white light, which obviously had their origin in the fact that the convergence of the beam after its passage through the particle was widely different for the different rays of the spectrum. This suggested the use of a monochromatic light source, *e.g.*, a sodium vapour lamp. We then noticed that the light emerging from the spherule exhibits very characteristic diffraction patterns; the nature of these depends notably on the shape of the particle, being widely different for the two most interesting cases in which it is respectively a sphere and a spheroid of revolution. The configuration of the patterns changes progressively as the plane of observation is shifted away from the spherule; the difference in the refractive indices of the sphere and of the liquid in which it is immersed determines how rapid this change is. The diffraction patterns may be observed even when this difference is not small; their changes with the shift of the plane of observation are then rapid. The dispersive powers of the glass and the liquid not being the same, the difference in their refractive indices alters rapidly with the wave-length of the light employed. As a consequence, the patterns change quickly with the wave-length. This is readily observed when the light-source is a mercury arc, even without the aid of colour filters for selecting out the different spectral rays emitted by it.