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The effect of dispersion on the interference figures of crystals

Crystallographers are familiar with the fact that the colour-lines in the figures shown by crystal-sections between crossed nicols in the polarisation microscope often deviate to a notable extent from the so-called "isochromatic lines" discussed in the text-books of physical optics. The difference is attributed to the dispersion of the optic axes, and its character enables the type of dispersion to be determined (for details, see for example Tutton's "Crystallography"). Though the phenomenon is thus well known and of considerable importance in practical work with crystals, I have found no record of any attempt to determine *theoretically* the form of the true isochromatic lines for any specified dispersion. Possibly it has been thought that the task would be too complicated and laborious to be worth undertaking. It may, therefore, be worthwhile to point out a fairly simple way of approaching the matter.

The general principle determining the observed position and colour-distribution of interference-fringes in white light is that the *group*-velocity and the group-refractive index should be considered, and not the wave-velocity and the wave-refractive index. Thus, for example, if a thick parallel plate of glass be placed in the path of one of the interfering beams of a Michelson interferometer, and white light is used, fringes may be observed when the retarding plate is compensated by increasing the air-path of the other beam; they are then less distinct but far more numerous than without the plate, and the colour-distribution is determined by the fact that the compensation for different group-wavelengths occurs for different retardations.

Taking now the case of a crystal-plate between crossed nicols, the so-called "isochromatic surface" is derived from the equation $\rho(\mu_1 - \mu_2) =$ constant, where ρ is the linear-path within the crystal and μ_1, μ_2 are the two wave-refractive indices. If, however, instead of μ_1, μ_2, we consider the group-indices $\bar{\mu}_1$ $\bar{\mu}_2$, the sections of the surface $\rho(\bar{\mu}_1 - \bar{\mu}_2) =$ constant would give the lines for which the relative retardation has specified values for any given *group* in the spectrum, and these may be expected to follow much more closely the colour-lines actually observed in the polariscope.

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