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Newton, Abbe, and the relation between refractive index and dispersion WILLIAM KARSTENS, Saint Michael's College, DAVID Y. SMITH, University of Vermont and Argonne National Laboratory — Chromatic aberration in lenses is corrected by combining glasses with different index/dispersion characteristics. The correction is based on an empirical linear relation between index and dispersion, a rule known qualitatively for many years that was given definitive form by Abbe and Schott in 1886. Despite a long history, its physical basis has remained obscure. Here we show it is a consequence of the spectral shape of the glasses' UV absorption by expanding the Kramers-Kronig relation for the index in a series of absorption-spectrum moments. To first order, the index is determined by the inverse-first moment, the dispersion by the inverse-third moment. For a complex glass, these moments may be rewritten as sums of UV-absorption moments for the glass-former and the glass-modifiers. The total index is then a sum of glass-former index plus a term proportional to the dispersion introduced by the modifier ions. The index *vs.* dispersion plot gives families of straight lines originating at the host-glass index/dispersion point. A line's slope is determined by the inverse-third moment of the modifier absorption, its length by the modifier concentration. Newton's erroneous conclusion that achromatic lenses could not be made was based on the limited range of glasses available to him, all of which fell on a single index-dispersion line.

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