Refractive-Index Dispersion Formulas, Old and New¹ CARRIE E. BLACK, University of Vermont, WILLIAM KARSTENS, Saint Michael’s College, DAVID Y. SMITH, University of Vermont and Argonne National Laboratory — A multitude of dispersion formulas, many empirical, have been proposed to approximate the refractive index of transparent materials. The commonly used Cauchy and Sellmeier formulas are based on classical elastic models. They also follow from more fundamental linear-response theory: The generalized Cauchy formula follows from expansion of the Kramers-Kronig relations in a Laurent series. It is exact, but may involve many terms. In contrast, the Sellmeier formula follows from approximating the continuous ir and uv absorptions of the material with a spectrum of isolated lines. A superior representation involves a partial series expansion of the dispersion relations followed by approximation of the remainder using a discrete spectrum. The distinction between this and prior formulations is that the isolated-absorption approximation is made at the last possible step. We have tested this new dispersion formula on typical optical glasses and found it gives an improved representation of the index.

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