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Effects of multiple scattering on structural color in disordered colloids[1] VICTORIA HWANG, ANNA STEPHENSON, VINOTHAN N. MANOHARAN, Harvard Univ — Disordered packings of colloidal spheres can show structural colors that are independent of the angle between light source and observer (E.R. Dufresne et al, Adv. Mater. 2010, XX, 16). This phenomenon arises from constructive interference of scattered light, but the disordered structure produces homogeneous colors, in contrast to the angle-dependent, or iridescent, colors of colloidal crystals. Although the color can be understood qualitatively through single-scattering models, these systems also show weak multiple scattering where neither single scattering nor diffusive transport assumptions are valid. To understand the effect of multiple scattering on the color, we perform polarization experiments to characterize multiple scattering in structurally-colored samples. We find that multiple scattering dominates at short wavelengths. In the observed reflection spectrum, this contribution adds to the single scattering from individual particles and from interference between scattered waves. Because multiple scattering reduces the saturation of color, we seek to minimize its effects for applications. To do this, we calculate the transport length of disordered colloids using Mie theory and use microfluidics to find the regimes of sample thickness that lead to optimal color saturation.

[1]Xerox University Affairs Committee, NSF GRFP 2015200426

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