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Controlling the scattering properties of thin, particle-doped coatings WILLIAM ROGERS, MADELEINE CORBETT, Harvard SEAS, VINOTHAN MANOHARAN, Harvard SEAS and Physics — Coatings and thin films of small particles suspended in a matrix possess optical properties that are important in several industries from cosmetics and paints to polymer composites. Many of the most interesting applications require coatings that produce several bulk effects simultaneously, but it is often difficult to rationally formulate materials with these desired optical properties. Here, we focus on the specific challenge of designing a thin colloidal film that maximizes both diffuse and total hemispherical transmission. We demonstrate that these bulk optical properties follow a simple scaling with two microscopic length scales: the scattering and transport mean free paths. Using these length scales and Mie scattering calculations, we generate basic design rules that relate scattering at the single particle level to the film's bulk optical properties. These ideas will be useful in the rational design of future optically active coatings.

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