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Rediscovering Red: Full-Spectrum Structural Color in Colloidal Glasses SOFIA MAGKIRIADOU, Physics Department, Harvard University, Cambridge, MA, JIN-GYU PARK, School of Engineering and Applied Sciences, Harvard University, Cambridge, MA, USA, YOUNG-SEOK KIM, Display Components & Materials Research Center, Korea Electronics Technology Institute, S.Korea, GI-RA YI, Department of Polymer Science and Engineering, Sungkyunkwan University, S.Korea, VINOTHAN N. MANOHARAN, School of Engineering and Applied Sciences, Harvard University, Cambridge, MA, USA — We use colloidal glasses to develop pigments with structural color: color that arises from interference rather than absorption. This pigmentation mechanism is common in blue birds, whose feather barbs often contain glassy microstructures. When a glass is illuminated, the spatial correlations between neighboring particles can give rise to constructive interference for a small range of wavelengths. Unlike the colors arising from Bragg diffraction in crystals, the colors of these "photonic glasses" are independent of angle due to the disordered, isotropic structure. However, there are no known examples of photonic glasses with pure structural red color, either in nature or in the lab. We present both experimental evidence and a model showing that the absence of red is due to the wavelength-dependence of the single-particle scattering cross-section. We show that this problem can be solved in "inverse glasses," namely glasses composed of particles with refractive index lower than that of their medium. Although these systems are similar to those in birds, no known species uses this mechanism to create red. We use inverse glasses to make full-spectrum, angle-independent structural colors. This will enable the use of colloidal glasses as a new type of long-lasting, non-bleaching pigment.

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