PHOTONIC LIQUIDS: TRANSPORT OF LIGHT IN STRONGLY CORRELATED PARTICLE ASSEMBLIES

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In the presence of long-range electrostatic repulsion, dense suspensions of roughly 100nm sized particles display surprising optical properties. We find that short range structural order may enhance the scattering strength while at the same time the total transmission shows strong wavelength dependence, reminiscent of a photonic crystal. Close to Bragg-like resonances we find strongly anisotropic transport of light, reflected by a measured negative scattering anisotropy parameter g.
Our observations can be modeled quantitatively based on a full structural characterization of the colloidal suspensions using light and small angle neutron scattering (SANS) combined with numerical calculations. Interestingly, the observed interplay between order and disorder and the scattering properties of these systems are strikingly similar to those discussed in an early proposal for strong localization of light. The tunable optical properties furthermore suggest potential applications such as transparency switches or filters.