Random Organization, Hyperuniformity and Photonic Bandgap

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A periodically sheared non-Brownian suspension undergoes collisions which allow the particles to explore new configurations. Below a critical strain the system evolves and arranges itself until collisions no longer occur and an absorbing state is reached. A simple model "Random Organization" well describes the process. We have studied similar phenomena in granular systems where limit cycles rather than reversible paths are found as absorbing states. Recent work by Hexmer and Levine show that at criticality absorbing state systems produce hyperniform particle correlations.

switch gears

Hyperuniform systems have particle number fluctuations which decrease more rapidly with window size than do random systems. Torquato and Steinhardt suggested that hyperuniformity rather than periodicity is responsible for spectral gaps in wavelike materials. We have constructed Hyperuniform disordered systems (HUDS) on a cm (microwave) and micron (IR) scale and find large isotropic photonic bandgaps. Further we have shown that such HUDS photonic materials can be modified to allow arbitrary waveguides, switching and resonant cavities.