Delocalization Transition in Colloidal Crystals

Scientific Achievement

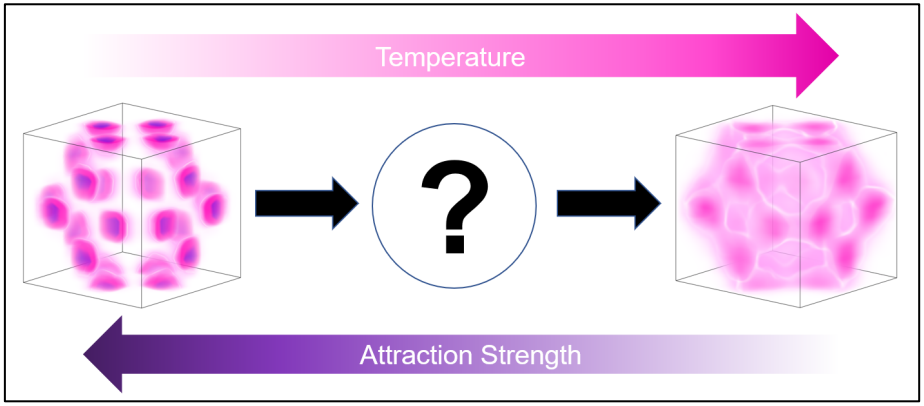
Simulations revealed the physical character of a continuous transition to a delocalized sublattice in size-asymmetric binary colloidal body-centered cubic (BCC) crystals.

Significance and Impact

Broadens the possible applications of sublattice delocalization in colloidal assemblies and provides a colloidal connection to superionic materials.

Research Details

- Mixing small and large colloids at a 6:1 ratio produces BCC crystals. The small colloids occupy tetrahedral sites at low temperatures and are delocalized at higher temperatures.
- Increasing temperature results in a smooth change to delocalization enhanced by lattice vibrations and tunable by the number of grafted chains on the small particles.



Average visitation frequency of the small particle sublattice in a BCC unit cell. The sublattice is localized at low temperatures and large number of grafted chains per small particle (proxy for interaction strength) and delocalized at high temperatures and lower number of grafted chains.

Lopez-Rios, H.; Ehlen, A.; Olvera de la Cruz, M., J. Phys. Chem. C (2021).

Work was performed at Northwestern University

U.S. DEPARTMENT OF ENERGY | Office of Science
NORTHWESTERN UNIVERSITY
NYU
PENNSTATE
UNIVERSITY OF MICHIGAN
UNIVERSITY OF PITTSBURGH
CBES Center for Bio-Inspired Energy Science