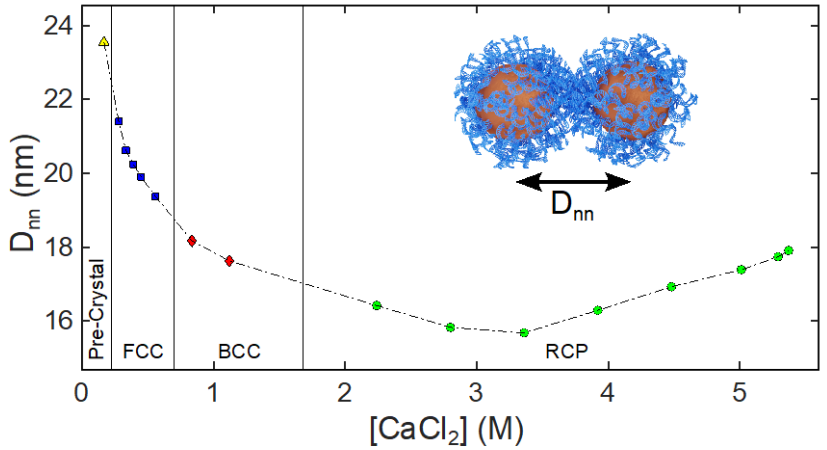
DNA-Ion Interactions Switch at High Salinity



Structural phase diagram and center-to-center interparticle separations, D_{nn}, for DNA-NPs assembled at various $CaCl_2$ concentrations, as deduced from synchrotron SAXS measurements.

R. J. Reinertsen, S. Kewalramani, F. Jimenez-Angeles, S. Weigand, M. Bedzyk, M. Olvera de la Cruz, "Re-expansion of Charged Nanoparticle Assemblies in Concentrated Electrolytes" PNAS, 121 (6) e2316537121 (2024);https://doi.org/10.1073/pnas.2316537121

Work was performed at Beamline 5-ID-D of the Advanced Photon Source of Argonne National Lab.

Scientific Achievement

Ion-ion correlations are shown to dramatically alter how added salt interacts with strongly charged nanoparticles at high salinities.

Significance and Impact

Concentrated electrolytes are highly relevant to energy storage technologies. This work demonstrates that interactions between charged objects continue to evolve considerably into high salt concentrations, and strongly modified their assembly.

Research Details

- DNA-coated gold nanoparticles are assembled into colloidal crystals with added alkaline earth chlorides.
- Small-angle X-ray scattering measurements and molecular dynamics simulations demonstrate that the effect of added salt on the structures changes with concentration.
- Solution scattering and solvent variation demonstrate that ion clustering underpins this surprising result.