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Investigating thermoresponsive pNIPAM microgel systems using Super-Resolution Microscopy

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Super-resolution microscopy is an imaging technique that enables improved resolution in the order of tens of nanometers, thus allowing the visualization of structures at the nanometer scale. Particularly, direct stochastic optical reconstruction microscopy (dSTORM), has emerged as a powerful tool for examining the internal structures and dynamics of complex colloidal and polymeric systems.

Of particular interest are poly(N-isopropyl acrylamide) (pNIPAM) microgel particles which are 3D porous polymer networks that undergo a volume phase transition upon temperature increase. The porous network and the thermoresponsive properties make pNIPAM microgels valuable for a wide range of applications, such as drug delivery systems, sensors, soft robotics, and 3D bioprinting, to name a few.

This thesis aimed to use dSTORM to investigate the behavior of individual pNIPAM microgels *in situ* by monitoring their responses to temperature changes and investigating complex pNIPAM structures with encapsulated DNA molecules as model drug delivery systems. Our results highlight the versatility and robustness of dSTORM as a high-resolution technique for advancing research in colloidal systems and gene therapy through detailed single-particle analysis and precise monitoring of molecular interactions and structural changes.

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