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The dynamics of particles with ligand-receptor contacts

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One way to glue objects together at the nanoscale or microscale is by ligand-receptor interactions, where short sticky hair-like ligands stick to receptors on another surface, much like velcro on the nanoscale. Such interactions are common in biological systems, such as white blood cells, virus particles, cargo in the nuclear pore complex, etc, and they are also useful in materials science, where coating colloids with single-stranded DNA creates particles with programmable interactions. In these systems, the ligand-receptor interactions not only hold particles together, but also influence their dynamics. How do such particles move? Do they "roll" on each others'surfaces, as is commonly thought? Or could they slide? And does it matter? In this talk I will introduce our modelling and experimental efforts aimed at understanding the coarse-grained dynamics of particles with ligand-receptor interactions. Our models predict these interactions can change the particles' effective diffusion by orders of magnitude. Our experiments, using DNA-coated colloids, verify this dramatic dynamical slowdown, but also show other dynamical features not yet captured by our models, which suggest new avenues for exploration.

Keyword-1

fluid dynamics

Keyword-2

computation

Keyword-3

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