Einladung zum SFB-Seminar TR6

SFB TR6
Physics of Colloidal Dispersions in External Fields

Institut für Theoretische Physik II, Seminarraum 25.32.02.51

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"Disentangling the dynamics of an entangled needle"

Entangled networks of stiff biopolymers exhibit complex dynamic response, emerging from the topological constraints that neighboring filaments impose upon each other. The relevant dynamic processes cover many decades in time, posing a tremendous challenge both to experiments and simulations. Pioneered by Edwards and de Gennes, the many-filament interaction was condensed in the picture of reptation in a confining tube. To achieve progress beyond simple scaling arguments, we propose a class of reference models for entanglement dynamics that allows us to provide a quantitative foundation of the tube concept for stiff polymers. For the fundamental limiting case of an infinitely thin needle exploring a planar parcours of point obstacles, we have performed large-scale computer simulations. Our results unambiguously prove the conjectured scaling relations from the fast transverse equilibration to the slowest process of orientational relaxation. In the highly entangled regime, the long-time dynamics becomes attainable by employing a novel simulation algorithm based on interval analysis. We determine the rotational diffusion coefficient of the tracer, its angular confinement and the tube diameter. In addition, the tube concept is extended to a theoretical description of the complete orientational dynamics including a two-step relaxation, which is > corroborated by our simulation results.