Fakultät für Mathematik und Physik
Albert-Ludwigs-Universität Freiburg

Physikalisches Institut

PHYSIKALISCHES KOLLOQUIUM

AM 02. DEZEMBER 2019 UM 17 UHR C.T.

IM GROßEN HÖRSAAL

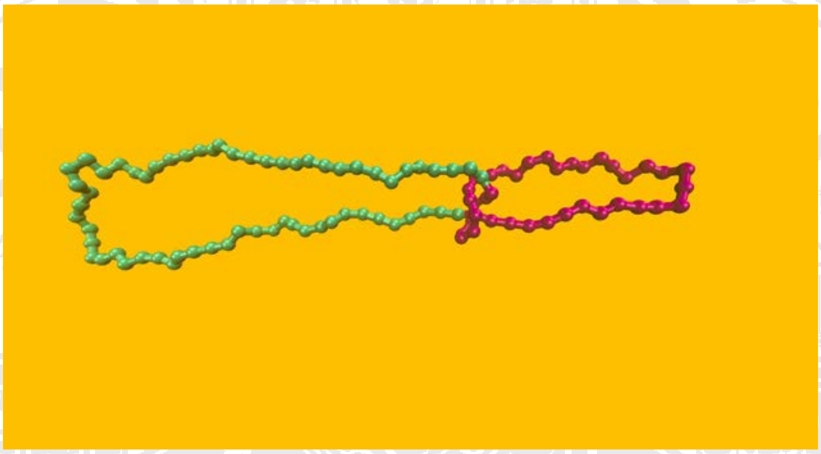

Fig.: A knotted ring polymer carrying a 3_1-knot under shear flow.

EQUILIBRIUM AND FLOW PROPERTIES OF RING POLYMERS

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Modifications of the topological state of polymers are extremely interesting and relevant operations for a vast domain of scientific inquiry ranging from knot theory and polymer science all the way to materials science and biophysics, where cyclic and knotted DNA plays a key role in biological processes. Recent work has demonstrated that joining the two ends of a linear chain to form a cyclic (ring) polymer has a number of significant consequences in the structural [1,2] and rheological [3] properties of concentrated or semidilute solutions of the same. Accordingly, a number of questions arise regarding the behavior of linear, cyclic and knotted ring polymers under flow: how does the topology of the dissolved polymer affect its orientational resistance, as well as its rotation-, tumbling- or tank-treading motion under Couette flow? What consequences does shear flow have for knot localization along a sheared polymer? Can one make use of the different flow properties of various polymer topologies to build microfluidic devices that act as filters/separators of topologically different polymers? By applying hybrid (MPCD/MD) simulation techniques that take into account the hydrodynamics, we address the questions above for polymers of varying topologies, knotedness and stiffness and we analyze quantitatively the influence of polymer topology on single-polymer properties under flow [4]. Polymer properties under Poiseuille flow will also be analyzed. Suggestions for the construction of topology-separating microfluidic devices will be presented [5].

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