Scaling law of Brownian rotation in dense hard-rod suspensions[1]

SHENG CHEN, Michigan State University, WEN YAN, Flatiron Institute, TONG GAO, Michigan State University — Self-diffusion in dense rod suspensions are subject to strong geometric constraints because of steric interactions. This topological effect is essentially anisotropic when rods are nematically-aligned with their neighbors, raising considerable challenges in understanding and analyzing their impacts on the bulk physical properties. Via a classical Doi-Onsager kinetic model with the Maier-Saupe potential, we characterize the long-time rotational Brownian diffusivity for dense suspensions of hard rods of finite aspect ratios, based on quadratic orientation auto-correlation functions. Furthermore, we show that the computed non-monotonic scalings of the diffusivity as a function of volume fraction can be accurately predicted by a new *tube* model in the nematic phase.

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