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Linear aggregation and liquid crystalline ordering: from semi-flexible polymers to rigid rods[1] TATIANA KURIABOVA, Brown University, ZACH KOST-SMITH, M.D. BETTERTON, MATTHEW A. GLASER, Colorado University, Boulder — Reversible self-assembly of filamentous aggregates is ubiquitous in soft matter and biophysics. Examples include worm-like micelles, patchy colloids, chromonic liquid crystals, DNA and RNA, and protein polymers and fibrils. These rod-like aggregates can form liquid-crystal (LC) phases; the liquid-crystal order then couples to the aggregation, promoting the formation of longer aggregates in the LC phases. We study the coupled aggregation and liquid crystalline ordering of a minimal system of sticky cylinders that interact primarily by hard-core interactions but can stack and bind end to end, making use of both analytic theory and Monte Carlo simulation. Accurate treatment of aggregate flexibility is essential for quantitative comparison of theoretical and experimental phase diagrams and other properties. Our analytic model describes aggregates as wormlike chains in an effective aligning nematic field, and allows self-consistent determination of this field within a density functional theory formalism over a broad range of aggregate flexibilities. We compare the analytic results for isotropic-nematic phase equilibrium with simulations performed in our group as well as similar work from the Sciortino group [De Michele et al., arXiv:1108.6135].

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