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Quadrupolar particles in a nematic liquid crystal: Effects of particle size and shape FRANCISCO HUNG, Cain Department of Chemical Engineering, Louisiana State University — We investigate the effects of particle size and shape on the quadrupolar (Saturn ring-like) defect structures formed by a nematic liquid crystal (NLC) around nm- and micron-sized particles with spherical, spherocylindrical and cubic shapes. Our calculations, based on a Landau-de Gennes expansion in terms of the tensor order parameter Q, indicate that for pairs of nanoparticles in close proximity, the most stable defect structure is the "entangled hyperbolic" [1]. For pairs of micron-sized particles the NLC forms entangled 'figure of eight' defects [1] around pairs of spheres and spherocylinders. In contrast, we only observed unentangled defect structures around pairs of micron-sized cubic particles. For pairs of spherical and spherocylindrical particles, the transition between "entangled hyperbolic" and "figure of eight" structures occurs when the particle diameter is between 100 nm and 1 micron. Our calculations suggest that the NLC-mediated interactions between the nanoparticles are fairly strong (up to 5700 kT). These interactions can bind the particles together at specific locations, and thus could be used to assemble the particles into ordered structures with different morphologies. [1] M. Ravnik et al., Phys. Rev. Lett. 99, 247801 (2007)

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