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Simulating defect structures in nematic liquid crystal shells[1]
LENA LOPATINA, ANDREW KONYA, JONATHAN SELINGER, ROBIN SELINGER, Liquid Crystal Institute, Kent State Univ, ALEX TRAVESSET, Dept of Physics and Astronomy, Iowa State Univ — Recent theoretical and experimental studies have investigated nematic liquid crystals confined to a shell between two spheres. When the shell is very thin, the structure provides an experimental realization of nematic order and defects in a 2D curved geometry. As the shell becomes thicker, the behavior crosses over to a 3D liquid crystal, with different types of defects. To study this dimensional crossover, we perform simulations of nematic order in a shell. For these simulations, we use a disordered lattice, or mesh, constructed through random sequential adsorption on the inner surface, the outer surface, and within the bulk of the shell, with a nematic director on each site of the mesh. By minimizing the energy, we determine the nematic texture as a function of the radii and thickness of the shell, and as a function of the off-center displacement of the inner sphere. The results show a crossover between half-charged vortex line defects for thin shells and boojum pairs for thicker shells, and demonstrate a new equilibrium state with two vortex lines and one boojum pair. They also show a complex evolution of the structures and energy as the inner sphere moves off-center.

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