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Orientational order and topological defects on curved surfaces[1]
ROBIN SELINGER, JONATHAN SELINGER, Liquid Crystal Institute, Kent State Univ., ALEX TRAVESSET, Dept. of Physics and Astronomy, Iowa State Univ. and Ames Lab — Recent studies show a close relationship between geometry of surfaces and orientational order within the surfaces. Positive topological defects are attracted to regions of positive Gaussian curvature, and vice versa. To investigate this relationship, we develop a new computational approach to simulate orientational order on surfaces of arbitrary shape. We place xy spins on the surface in a disordered mesh constructed via random sequential absorption. We apply this approach to a sphere, a torus, and an "egg-crate" surface, $z = Asin(kx)sin(ky)$. For the sphere, we find a total topological charge of +2 as required by the Gauss-Bonnet theorem. For the torus, defects form in pairs, +1 defects on the outer edge (with positive Gaussian curvature) and -1 defects on the inner edge (with negative Gaussian curvature). For the egg-crate surface, with a coarse mesh, a +1 defect forms at each max/min and a -1 defect at every saddle point; while for a finer mesh, defects anneal away. We analyze these simulation results in terms of a continuum elastic model.

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