Abstract Submitted
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The shape of strings to come: How topological defects twist, bend, and wrinkle filament bundles[1] ISAAC BRUSS, GREGORY GRASON, Univ of Mass - Amherst — Topological defects are crucial to the thermodynamics and structure of condensed matter systems. For instance, when incorporated into crystalline membranes like graphene, 5- and 7-fold disclinations produce conical- and saddle-like geometries respectively. A recently discovered mapping between the inter-filament spacing within a deformed bundle and the metric properties of curved surfaces, suggests previously unexplored parallels between the two, specifically in regards to how 2D patterning promotes 3D shape transitions. This discovery is poised to describe the structure of a host of filamentous materials–both biological and microfabricated–that exhibit distinctive shapes and packings. Motivated by the filamentous analogs to the conical and saddles shapes found in thin membranes, we investigate for the first time the interplay between defects in the cross section of a bundle and its global structure, using a combination of continuum elasticity theory and numerical simulation of cohesive bundles with a fixed packing topology. Focusing primarily on the instability response to disclinations, we predict a host of new equilibria structures, some of which are without direct parallel to the analogous membrane, including torsional wrinkling, radial kinking, and helical winding.

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