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Phyllotactic transformations as plastic deformations of tubular crystals with defects DANIEL BELLER, DAVID NELSON, Harvard University — Tubular crystals are 2D lattices in cylindrical topologies, which could be realized as assemblies of colloidal particles, and occur naturally in biological microtubules and in single-walled carbon nanotubes. Their geometry can be understood in the language of phyllotaxis borrowed from botany. We study the mechanics of plastic deformations in tubular crystals in response to tensile stress, as mediated by the formation and separation of dislocation pairs in a triangular lattice. Dislocation motion allows the growth of one phyllotactic arrangement at the expense of another, offering a low-energy, stepwise mode of plastic deformation in response to external stresses. Through theory and simulation, we examine how the tube's radius and helicity affects, and is in turn altered by, dislocation glide. The crystal's bending modulus is found to produce simple but important corrections to the tube's deformation mechanics.

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