COLLOQUIUM

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Tubular crystals: How helical motion of defects plastically deforms cylindrical lattices

Abstract

When a system has two-dimensional crystalline order but is wrapped over a cylinder-like surface, the lattice directions become helices. This type of ``tubular crystal" packing occurs in biology at many scales, from biofilaments to viral capsids to botany, as well as in carbon nanotubes and in colloidal crystals. Shape changes in the tubular surface generally require changes in the crystalline tessellation of the surface. This change can be accomplished step-by-step through the motion of defect pairs through the tubular crystal. I will discuss the physics of plastic deformation in tubular crystals by the unbinding and separation of pairs of dislocation defects. Through theory and simulation, this work examines how the tube's radius and helicity affect, and are in turn altered by, the mechanics of dislocation glide motion. The system's bending rigidity plays an important role, and can resist, arrest, or even reverse the deformations of tubes with small radii. I will also discuss the equilibrium shapes of tubes containing dislocations, in which defect positions act as degrees of freedom in the deformed tube geometry.

3:30-4:30 p.m., Friday, September 28th, McLane Hall 162