abstract

Workshop on Topology: Identifying Order in Complex Systems
Topic:

Speaker:

Affiliation:

Date:

Time/Room:

Topological defects pervade a wide range of physical systems, from superconductors to smectic liquid crystals. The behavior and interactions of such singularities impart many materials with a wealth of rich behavior. Just as flux vortices in the Abrikosov phase of type II superconductors allow magnetic field to penetrate the sample, so too do screw dislocations relieve the frustration between flat layers and macroscopic chirality present in the smectic. An explicit deconstruction of surfaces into their topological constituents provides a unique language with which to describe the properties of many diverse systems. Extracting the underlying topology of a surface boils down to an exercise in complex analysis. Linear systems often produce harmonic surfaces which possess height functions satisfying the two dimensional Laplace equation. Elliptic functions, generalizations of trigonometric functions, are the generic solutions of this problem. Merely specifying the zeroes and poles in a phase field completely defines the topology of the resulting surface. The properties of elliptic functions vastly simplify both the analytic and numeric calculations of the energy. This analysis is used here to describe two different systems: a system of pores connecting layers of a bicontinuous lamellar system described by Riemann's minimal surfaces and the hierarchical structure of the helical nanofilament phase of bent core smectics.