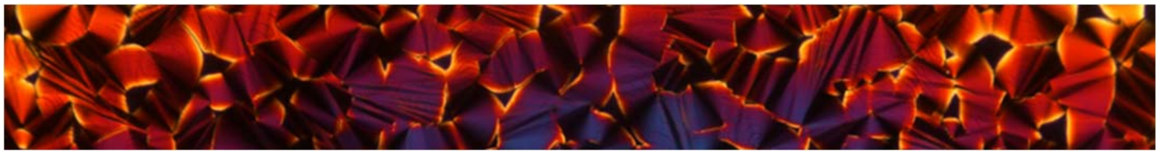

SOFT MATERIALS RESEARCH CENTER

SPECIAL SEMINAR SERIES

Smectics and colloidal crystals: theory, simulation, and experimental data of defect structures

Matthew Bierbaum

Department of Physics
Cornell University

In this talk I will describe the defect structures in two rather different material systems. In smectic liquid crystals, focal conic domains (FCDs) form equally spaced layers except along line singularities. We have leveraged our recent high performance GPU simulations of smectic liquid crystals to describe the fascinating formation and dynamics of FCDs. Using recent insights into the relationship between smectics and Lorentz transformations used in relativity, we generalize the mathematical theory of martensites to derive compatibility conditions between smectic domains. In colloidal crystals, we have invented a method for extracting stress fields from experimental images and measure the stresses around vacancy defects, dislocations, and grain boundaries. We find excellent agreement with nonlinear elasticity and existing simulations of hard spheres. Finally, in order to extend the measurement of stresses into polydisperse amorphous materials, we have developed a new featuring algorithm which extracts colloidal sizes and positions at the information theoretic limit. Using a Bayesian framework, we resolve particle locations to 1 nm, 10-30x better than standard featuring methods.

Wednesday, February 10th at 1:00 p.m. Duane Physics G126

Please note special starting time of 1pm this week!

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