Computational Mathematics Seminar Series

## A Finite Element Scheme for a Phase Field Model of Nematic Liquid Crystal Droplets

**Shawn Walker, Louisiana State University**

Associate Professor

Digital Media Center 1034
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**Abstract:**

We present a phase field model for nematic liquid crystal droplets. Our model couples the Cahn-Hilliard equation to Ericksen's one constant model for liquid crystals with variable degree of orientation. We present a special discretization of the liquid crystal energy that can handle the degenerate elliptic part without regularization. In addition, our discretization uses a mass lumping technique in order to handle the unit length constraint. Discrete minimizers are computed via a discrete gradient flow. We prove that our discrete energy Gamma-converges to the continuous energy and our gradient flow scheme is monotone energy decreasing. Numerical simulations will be shown in 2-D to illustrate the method. This work is joint with Amanda Diegel (post-doc at LSU). Near the end of the talk, I will discuss 3-D simulations of the Ericksen model coupled to the Allen-Cahn equations (with a mass constraint). This work is joint with REU 2017 students (E. Seal and A. Morvant).

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**Speaker's Bio:**

Shawn Walker received his Ph.D. from the University of Maryland, College Park. He held a postdoctoral position at the Courant Institute (New York University), and joined the LSU faculty in 2010 in the computational mathematics group. He is now an associate professor in the mathematics department at LSU. He researches numerical methods to solve complex physical problems that arise in fluids and material science. He has won two NSF grants for work on developing numerical methods for partial differential equation (PDE) models of multi-physics and geometric evolution problems using finite element methods, as well as mesh generation, and PDE-constrained (shape) optimization. He also won an NSF CAREER award on "Numerical Methods For Liquid Crystals And Their Optimal Design" to develop advanced computational methods to better understand liquid crystal physics and enable material science applications of liquid crystals.

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**This lecture has refreshments @ 03:00 pm**



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