1125-65-2123 **Wujun Zhang*** (wujun@math.rutgers.edu), Hill Center, 110 Frelinghuysen Rd., Piscataway, NJ 08854, and **Shawn Walker**. *Finite element methods for nematic liquid crystals with variable degree of orientation.*

We consider the simplest one-constant model, put forward by J. Ericksen, for nematic liquid crystals with variable degree of orientation. The equilibrium state is described by a director field $\mathbf{n}$ and its degree of orientation s, where the pair $(s, \mathbf{n})$ minimizes a sum of Frank-like energies and a double well potential. In particular, the Euler-Lagrange equations for the minimizer contain a degenerate elliptic equation for $\mathbf{n}$, which allows for line and plane defects to have finite energy.

We present a structure preserving discretization of the liquid crystal energy with piecewise linear finite elements that can handle the degenerate elliptic part without regularization, and show that it is consistent and stable. We prove Γ-convergence of discrete global minimizers to continuous ones as the mesh size goes to zero. We develop a quasi-gradient flow scheme for computing discrete equilibrium solutions and prove it has a strictly monotone energy decreasing property. We present simulations in two and three dimensions to illustrate the method's ability to handle non-trivial defects. Our results include electric and colloidal effects. This work is joint with R.H. Nochetto and S. Walker. (Received September 19, 2016)