# "Photoisomerization Induced Mesophase Transitions in Mixtures of Crystalline Liquid Crystalline Azobenzene with Photocurable Mesogenic Monomers"

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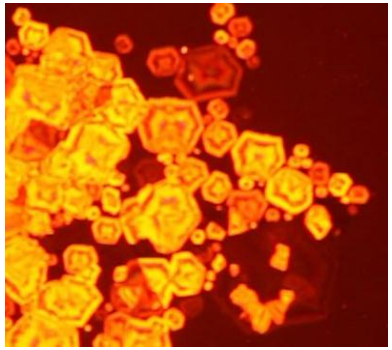
A novel crystal motion phenomenon was discovered at deep supercooling of azobenzene chromophore single crystals, which has never before seen or known in the field of crystal solidification. The modes of self-propelled motions include slow swimming and cascading nucleation and rapid motion (or shooting). The instability of solution concentration gradient in turn drives spatial variability of surface tension, known as the Marangoni effect, which is responsible for this novel crystal self-motion. Of particular interest is the development of polymorph single crystals generated by thermal gradients leading to various supercooling depths. Other notable outcomes include:



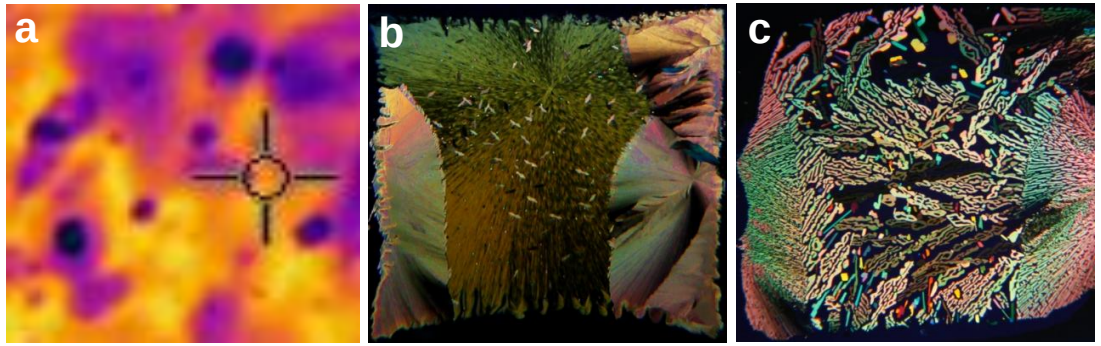
*Cascading nucleation and motion*

*Directional motion away from existing crystal growth fronts*

## *Highlights of Research Outcomes and Collaborations:*

- Cascading nucleation events of azobenzene single crystals in photo-curable and nematic solutions; wherein a hexagonal single crystals nucleate, shoot away from nucleation points, and trigger subsequent nucleation events in the surrounding solvent
- Directional motion of the azobenzene single crystals driven by the cis-trans photoisomerization; *In collaboration with Professor Dmitry Golovaty, Mathematics Department, University of Akron*
- Ripple formation in stratified surface of liquid crystalline azobenzene caused by *cis-trans* photoisomerization; *In collaboration with Professor Quan Li, Liquid Crystal Institute, Kent State University*
- *Single crystal polymorph developed under thermal gradients that correlated with thermal imaging, mapping the temperatures at which each polymorph grows that showed striking resemblance to polymorph of metformin pharmaceutical crystals*

*Students: 1 Ph. D. student (Dr. Namil Kim) graduated in 2010 and Tom Sutter plans to graduate with Ph. D. in Spring 2013. 4 NSF-REU students (Garret O'Malley, Harris Lam, grant Riley, and Kaitlin Sweeney, received research training under this grant support.*




*(a) Thermal image corresponding to (b) optical micrographs of azobenzene showing single crystal polymorphs that develop on diacrylate spherulite after 2.5 min and then (c) after 10 days in the crystal + liquid coexistence region. Thermal gradients were induced by spraying with a compressed $CO_2$ liquid.*