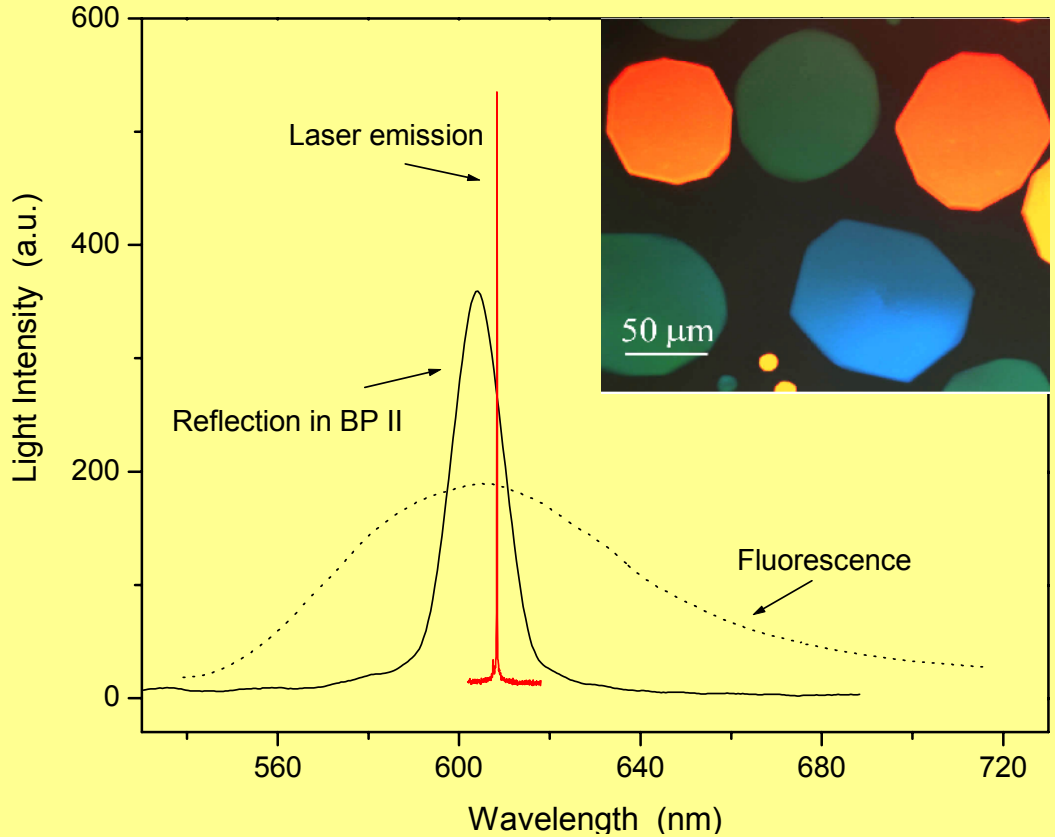
Lasing in Cholesteric Liquid Crystalline Elastomers

Peter Palffy-Muhoray, Kent State University, DMR-0132611

Research: Cholesteric liquid crystals are self-assembled photonic band gap materials capable of low threshold lasing without any external laser cavity. Distributed feedback lasing in has been demonstrated in 1-D and 2-D band gap structures.

The cholesteric liquid crystal blue phases BP I and BP II and are periodic in 3-D. Using BP II samples, we were able to demonstrate distributed feedback lasing in a 3-D band gap structure for the first time. One interesting feature is that emission occurs simultaneously in three orthogonal directions.



W. Cao, A.Munoz,P. Palffy-Muhoray and B. Taheri, Nature Materials **1,** 111 (2002)

Lasing in Cholesteric Liquid Crystalline Elastomers

Peter Palffy-Muhoray, Kent State University, DMR-0132611

Knowledge Transfer:
Recently discovered mirrorless lasing in liquid crystals has attracted considerable attention. A number of research groups starting work in this area have sent visiting graduate students to Kent State University to work with the group of P.P-M.

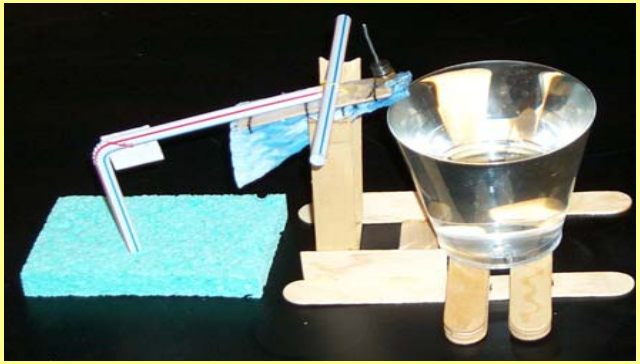
M. Moreira (P.U.C. Rio) is studying the use of cholesteric lasers as optic fiber-based remote sensors. The remotely pumped sensor encodes the sensed information in the lasing wavelength. A. Marino (U. Naples) is investigating the dependence of laser threshold on dye concentration and sample thickness.

Graduate student Michele Moreira, (PUC Rio, Brazil) measuring temperature dependence of lasing wavelength for sensing.

Graduate student Antigone Marino, (U. Naples, Italy) preparing cholesteric sample for lasing threshold measurements.

Lasing in Cholesteric Liquid Crystalline Elastomers

Peter Palffy-Muhoray, Kent State University, DMR-0132611

Education: Nadine Abraham is a High School senior at Western Reserve Academy in Hudson, OH. After learning about research opportunities at the Liquid Crystal Institute, she spent her spring and summer breaks there designing and building a Dunking Bird of the Second Kind – a device which extracts mechanical work from evaporating water but which, unlike the conventional Dunking Bird, is not a heat engine.

Her research experiences have been reported in the *Hudson Hub-Times* (4/16/03), the *Ravenna Record Courier* (7/7/03) and *Inside Kent State* (8/11/03). The results of her research will be published in *The American Journal of Physics*. Nadine will attend University next year. She is planning a career in the physical sciences and mathematics.