

**LIQUID CRYSTAL INSTITUTE**  
and  
**CHEMICAL PHYSICS INTERDISCIPLINARY PROGRAM**  
  
**KENT STATE UNIVERSITY**

**ANNUAL REPORT**

July 1, 2002-June 30, 2003  
Oleg D. Lavrentovich, Interim Director

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## Director's Report, 2002-2003

In the first full year beyond the 11-year National Science Foundation Science & Technology Center grant for Advanced Liquid Crystalline Optical Materials (ALCOM), the Liquid Crystal Institute and the associated Chemical Physics Interdisciplinary Program (LCI/CPIP) have seen many changes and faced many challenges. We experienced a sharp transition in the scheme of funding for our research (and thus education) from stable long-term continuing NSF support available to 17 faculty members at KSU to individual short-term grants. This annual report details **successes** and analyzes the **challenges** that LCI/CPIP faces in carrying its mission which has always been three-fold: **Research, Education, and Service**.

### Research

LCI/CPIP continues to maintain its leadership in liquid crystal science as recognized by the international community and evidenced by publications in journals such as *Nature Materials* and *Physical Review Letters*. Our representatives are trusted with leading roles in international professional societies -- Peter Palffy-Muhoray, Vice-President of the International Liquid Crystal Society, L.C. Chien, organizer of SPIE Symposia -- and editorial boards of research journals -- Peter Palffy-Muhoray, *Molecular Crystals and Liquid Crystals* and O.D. Lavrentovich, *Physical Review E*.

We continued to deepen our traditional research in liquid crystal displays (LCDs) and composite materials. We collaborated with Samsung Electronics Ltd. in Korea, the largest producer of active matrix LCDs in the world, to establish research projects for future display technologies. In January, 2003, Samsung President Sang Wan Lee came to Kent to sign a letter of intent. In March, five KSU scientists traveled to Korea to define the research projects. We actively collaborated with U.S. industry, securing sponsored research funding from companies such as Anteon Corp. (Palffy-Muhoray), Viztec, Intel, Dupont, Displaytech, Rockwell, and Hana Microdisplay Technologies (Bos), Boulder Nonlinear Systems, Cornerstone Research Group (Chien), Kent Displays (Yang), CoAdna (Jakli), AlphaMicron (Lavrentovich). Note that many of these companies (Kent Display, AlphaMicron, Hana, CoAdna) are spin-off companies based on LCI technologies or established by LCI researchers. Thanks to extremely successful liquid crystal research, Kent State University ranked No. 4 nationwide in technology transfer in 2002-2003, ahead of Stanford University, MIT, Princeton University and others.

We are actively moving into new research directions, both fundamental and applied, using liquid crystals for optical beam steering and beam deflection, lasing elements in lasers, liquid crystal elastomers for artificial muscles, flexible displays, sensors and pathogen detection systems. Phil Bos continues to lead million-dollar projects on beam steering. The projects, supported by DARPA and NASA, are conducted in collaboration with companies such as Lockheed-Martin and Rockwell Science Center. Beam steering research leads to new applications such as communication between satellites, countermeasures against micelles, barcode readers in the stores, vehicle movable headlights, etc.

We are currently seeking an outstanding, world-renowned physicist in theoretical condensed matter physics to fill the Eminent Scholar position awarded by the State of Ohio. The program is designed to recruit academic leaders to strengthen and expand existing university research and economic development and to improve workforce education and training. We see this scholar playing an important role in advancing our research programs and building broad collaborations.

We deepened our fruitful collaboration with the colleagues in other KSU departments, which includes sponsored collaboration on biosensors with the Department of Biological Sciences (Woolverton), and the Infrared Spectrometer Project with the departments of Chemistry (Gericke, Fulghum, West), Mathematical Sciences (Gartland) and Physics (Gleeson).

The State of Ohio approved a \$1.6M equipment grant to build the Flexible Optical and Electronic Device Manufacturing Facility at the LCI. This project is another demonstration of our successful collaboration with faculty from other departments (R. Twieg, Chemistry) and with local industry (Hana, AlphaMicron, Kent Displays and others). Governor Taft presented a check to LCI Director John West during a ceremony at the LCI, June 9, 2003. A cleanroom engineer will be hired to oversee the purchase of equipment and to initiate facility operation.

### **Education**

Since 1994, the teaching and advising of CPIP graduate students became an additional responsibility of the senior LCI personnel, who attained faculty rank in CPIP. In 2002-2003, we taught and advised approximately 40 students, four of whom were awarded PhD degrees.

Jointly with Physics faculty (Gleeson, Sprunt) we applied for a Congressional Appropriation grant for the Center for Liquid Crystal Science and Education (West, Palffy-Muhoray, Jakli, Lavrentovich) and with the Chemistry department we involved undergraduate students in summer research sponsored by NSF Research Experience for Undergraduates (Twieg, Gericke, Palffy-Muhoray, West, Lavrentovich).

Among the many benefits of emerging large-scale collaborations with Samsung will be the establishment of a Samsung Scholarship for CPIP graduate students.

### **Service**

LCI/CPIP continued to serve the research and industrial community through the Industrial Partnership Program (Bos), Synthesis Facilities (Neubert and Chien) and Characterization Facilities (Lavrentovich). We provide free services (electron and atomic force microscopic analysis, cleanroom time, etc.) to faculty from other departments, such as Physics and Chemistry.

In the broader context of the economic development in the State, LCI/CPIP is literally creating high-tech jobs in Northeast Ohio. Not only have LCI/CPIP senior researchers (Doane, Palffy-Muhoray, Yang, Kelly) created liquid crystal related companies but they also employ dozens of specialists trained at the LCI/CPIP.

### **Challenges**

This year brought many changes in the LCI personnel. LCI Director John West (1997-2003) was promoted to Interim Vice President for Research and Dean of Graduate Studies. We are currently searching for a permanent LCI Director. Dr. Mary Neubert, Senior Research Fellow, retired after 30 years at the Liquid Crystal Institute. During her tenure she was well-known around the world for her excellent work in the synthesis of liquid crystalline materials. She has been invited to present an overview of the chemical synthesis efforts at the LCI at the Gordon Research Conference in 2003. Elaine Landry retired in 2002 as LCI Business Manager. Elaine began as Assistant to Director Dr. J. William Doane. Brenda Buck, LCI Public Relations Coordinator, was promoted to replace Elaine as Business Manager.

Since the introduction of CPIP in 1994, LCI/CPIP personnel have experienced increasing pressure to maintain and expand the LCI/CPIP as a long-recognized cluster of excellence as well as the addition of new duties (developing and teaching a new academic program). More recently, it became necessary to make the transition from ALCOM Center support to individual grants. These increased responsibilities have not been accompanied by personnel growth. The

personnel problem is critical; after the retirement of Dr. Neubert, the LCI is left with only one Senior Research Fellow (Jakli); CPIP has not added any new faculty since 1995-1996 academic year and currently has only 5½ tenured faculty (Bos, Chien, Palfy-Muhoray, Lavrentovich, Yang, Kelly ½), which makes it difficult not only to conduct effective research, service and teaching, but even to represent the CPIP on College and University committees. LCI/CPIP lacks the critical mass to expand. The current number of senior personnel is lower than the expectations of July 1, 1993 memo from D.R. Turnidge, Associate Dean of Arts & Sciences, to Dr. J.W. Doane, LCI director at that time:

The following chart for the next three years may be closer to reality than what we were looking at yesterday.

	<u>YEAR</u>	<u>SRE</u>	<u>CPIP</u>	<u>TOTAL</u>
0	93/94	9	0	9
1	94/95	6	3	9
2	95/96	5	4	9
3	96/97	5	5	10
4	97/98	5	6	11
5	98/99	5	7	12

Comparing the 98/99 projections to the current staff, LCI/CPIP falls short by 5 ½ members (or 3 ½ members if the vacancies are included).

02/03                      1 + 1 vacant                      5 ½ + 1 vacant                      6 ½ (+ 2 vacant)

Throughout the year we also experienced a reduction in technical personnel who were supported on the ALCOM grant. Our facilities such as cleanroom, characterization, synthesis and prototyping, require skilled technical personnel; however, some critical positions, e.g., Characterization Facilities specialist, are not supported by the LCI budget. We plan to address the issue by looking for both internal and external funding sources.

The field of liquid crystal science continues to expand. Researchers at Philips described the technique of “painting” a flexible plastic display in *Nature* publication (May 2002); in 2001, Sarnoff created the first flexible plastic thin-film transistor liquid crystal display which can handle the demands of displaying video content ([www.sarnoff.com](http://www.sarnoff.com)). The very fact that the LCI/CPIP senior personnel, being only a small fraction of KSU faculty, secures about 16% of the extramural research funds at Kent State, indicates that the LCI/CPIP deserve further investments.

LCI/CPIP remained strong and successful in 2002-2003; we applied for 34 new grants and were awarded over \$3.7 Million with nearly \$2.3 Million in additional grant funding pending at the end of the fiscal year. I would like to thank John West who led the Institute and CPIP throughout the successful 2002-2003 year. In 2003-2004, we plan to strengthen the LCI/CPIP unit through hiring an Ohio Eminent Scholar and Senior Research Fellow, by introducing the Liquid Crystal Research Seminar and by further enhancing our collaborations with other departments in the area of liquid crystals and soft matter.

Oleg D. Lavrentovich, Interim Director



## Achievements and Recognition

### Books

L.C. Chien, Editor, *Liquid Crystal Materials, Devices and Applications IX*, Proceedings of International Society for Optical Engineering, SPIE **5003** (2003).

M. Kleman and O.D. Lavrentovich, *Soft Matter Physics: An Introduction*, 638 pp.; Springer Verlag: New York (2003).

### Electronic Media

A. Jákli and P. Palffy-Muhoray launched and co-edit new on-line document server, "Electronic Liquid Crystals (E-LC).

### Conference Chairs

L.-C. Chien, Organizing Committee, 1<sup>st</sup> World Congress on Biomimetics and Artificial Muscles, December, 2002, Albuquerque, NM.

L.-C. Chien, Symposium chair, "Liquid Crystal Materials, Devices, and Applications IX," International Society of Optical Engineering and Electronic Imaging Science and Technology Annual Meeting, Santa Clara, California, January 21-25, 2003.

O.D. Lavrentovich, Vice-Chair, Gordon Research Conference on Liquid Crystals, June 2003.

### Students

Dr. Andrew Primak, Glenn Brown Prize for Outstanding Dissertation by the International Liquid Crystal Society for his research, "Nematic to Smectic-A phase transition," awarded at the International Liquid Crystal Conference, Edinburgh, UK, July 3 (2002).

Ivan Smalyukh, winner of the International Liquid Crystal Society Multimedia Award at the 19<sup>th</sup> International Liquid Crystal Conference 2002, Edinburgh, UK, 30 June-5 July, 2002 for the web site on Fluorescence Confocal Polarizing Microscopy. Mr. Smalyukh's oral presentation, was entitled, "Fluorescence Confocal Polarizing Microscopy."

### Regional

S. Kumar, NorTech Innovation Award for flexible LC displays based on the phase separated composite technology, 2002.

O.D. Lavrentovich, NorTech Innovation Award for liquid crystal-based biodetection technology, 2002.

### International

Peter Palffy-Muhoray, Vice President, International Liquid Crystal Society; Regional Editor, *Molecular Crystals and Liquid Crystals*

S. Kumar, Member, Editorial Boards of *Liquid Crystals*, *International Journal of Material Disordered Systems*, *International Journal of Modern Physics B*, *Modern Physics Letters B*.

Oleg D. Lavrentovich, Co-editor, *Liquid Crystals Today*; member of editorial board of *Physical Review E*.

### **Awards**

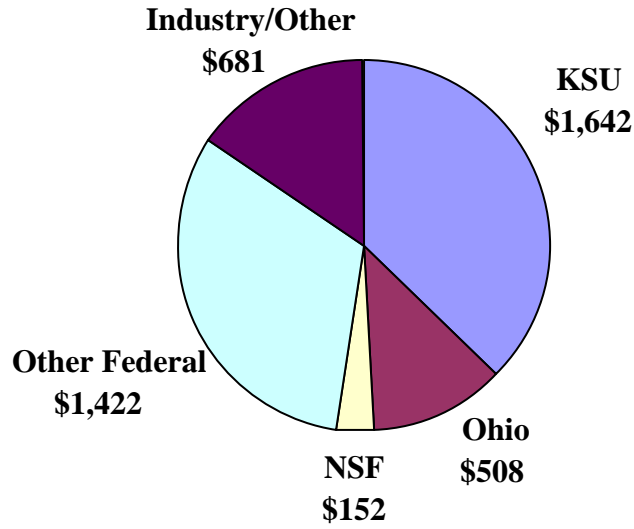
Mary E. Neubert, 2002 Fredericksz Medal, the highest honor from the Former Soviet Union Liquid Crystal Society, given to one physicist and one chemist annually; awarded to non-Former Soviet Union LC Society members only by a special decision of the society's board.

Robert J. Twieg, 2002 Kent State University Distinguished Professor.

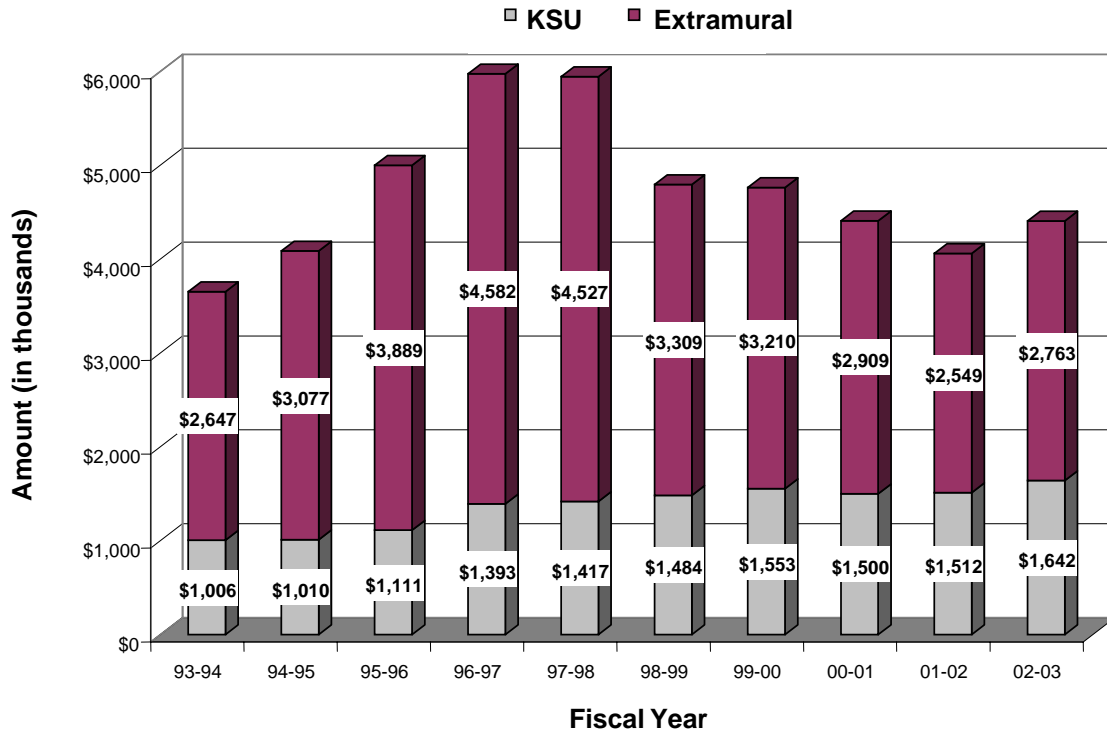
O.D. Lavrentovich, 2003 Advisor Excellence Award for advising Kent State University's SPIE Student Chapter of the International Society for Optical Engineering, KSU 25<sup>th</sup> students Honors and Leadership Awards Ceremony, April 21, 2003.



### Major Funding Sources (In Thousands)



### Expenditures 1993 - 2003 (In Thousands)





# LCI Highlights

## Samsung

The Liquid Crystal Institute and Samsung Electronics, Korea, the largest liquid crystal display manufacturer, signed an agreement in January, 2003, to further the development of flat-panel liquid crystal displays and expand Samsung's presence in Northeast Ohio. In March, 2003, scientists from the LCI (Phil Bos, L.C. Chien, Oleg Lavrentovich, John West) and Physics (Satyendra Kumar) traveled to Korea to meet with Samsung researchers to discuss collaborations. The \$200,000 agreement will provide support for research projects and train graduate students in the Chemical Physics Interdisciplinary Program. Samsung executives hope their collaboration with LCI will give them a research edge over their competitors and LCI scientists hope the collaboration will attract high-tech liquid crystal industry to the area.



John West and Samsung President, Sang Wan Lee at signing ceremony at LCI in January, 2003.



LCI scientists met in Korea with Samsung AMLCD researchers in March 2003.

## Ohio Eminent Scholar Award

The Liquid Crystal Institute was awarded a State of Ohio Eminent Scholar Award to hire a world renowned scholar in soft condensed matter theory. The \$750,000 grant will be increased with university money to set up an endowment of \$1.5 million. The program is designed to strengthen and expand existing university research, apply research to economic development and improve workforce education and training. The Eminent Scholar will also be a professor in the graduate Chemical Physics Interdisciplinary Program. Kent State joins Case Western Reserve, Ohio State and Miami universities in the Ohio Eminent Scholars Program. A search is underway and we hope to have the position filled by the start of Academic Year 04-05.

## Flexible Optical and Electronic Device Manufacturing Facility

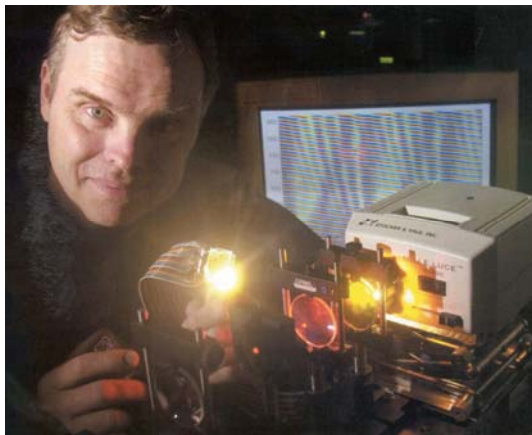
The Governor of the State of Ohio personally presented a check for \$1,640,000 to the Liquid Crystal Institute for a Wright Capital Project Fund award. The money will be used to develop a manufacturing process designed to produce liquid crystals on flexible polymer substrates for roll-to-roll processing. The new method will create lower cost, more durable liquid crystal displays that are typically imprinted on glass. The award is part of Governor Taft's "Third Frontier Project" to build Ohio's economy in knowledge-based and technology-related industries. Taft said the LCI has a history of bringing technology to the marketplace and building spin-off companies that create new jobs for Ohio. The grant will be used to purchase equipment which will be housed in the Liquid Crystal Institute.



AlphaMicron President Dr. Bahman Taheri (left) presented a pair of liquid crystal sunglasses to Governor Bob Taft during his visit the Liquid Crystal Institute in April, 2003.

## Beam Steering Technology

Due to the success of a grant on liquid crystal beam steering devices, DARPA added more than \$500,000 in funding to extend the research efforts by LCI scientists Phil Bos, Oleg Lavrentovich and John West. Two research projects involve applications for deep-space communications and



LCI Associate Director Philip Bos demonstrates the beam steering technology.

protecting military aircraft from heat-seeking missiles. Working with a Northeast Ohio company, Hana Microdisplay Technologies, the research team has created a liquid crystal display technology to direct and enable rapid-precise pointing of communication streams and data transfer using laser beams. The technology will allow operators to send voice and data information between two entities using a steered laser aimed to hit a specific point. The projects were initiated with technology development infrastructure funds from Kent State, the Ohio Board of Regents and the Ohio Department of Development.

## LCI SPIN-OFF COMPANIES

### Eyewear Technology – AlphaMicron, Inc.

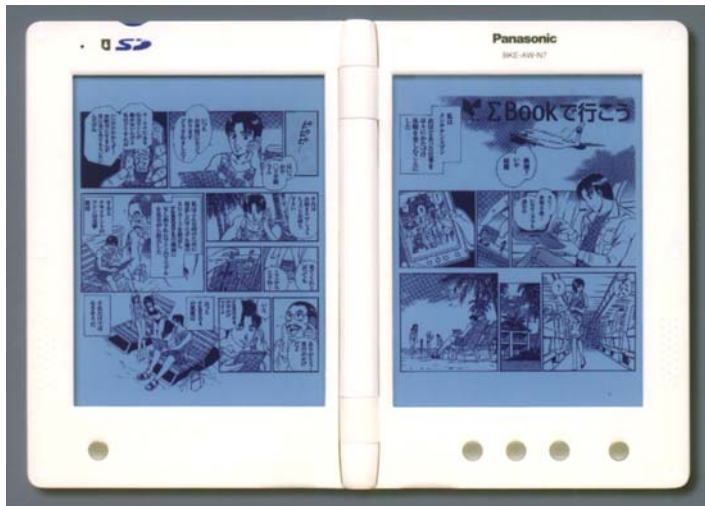
AlphaMicron, Inc., a spin-off company created by three LCI researchers, Peter Palffy-Muhoray, Tamas Kosa and Bahman Taheri, was awarded more than \$1M in a state technology action fund grant to bring their liquid crystal eyewear technology to the private sector. The technology provides a way to tint lenses which does not rely on ultraviolet light as do current photochromic glasses.



AlphaMicron's liquid crystal eyewear before and after switching the liquid crystal.

### E-Book Technology Transfer – Kent Displays, Inc.

Kent Display Inc. licensed the bistable reflective cholesteric liquid crystal technology to Matsushita and Kodak for multi-million dollars. The technology was invented by D.-K. Yang, J. W. Doane, L.-C. Chien and J. West from the Liquid Crystal Institute. Kent State University received a significant part of the license fee. Using the technology, Matsushita has developed an e-book which is high resolution, light weight and energy saving. The A4 size e-book weighs about one pound and runs for six months on two AA batteries. It will be extremely valuable in classrooms and elementary schools in China are potential customers.

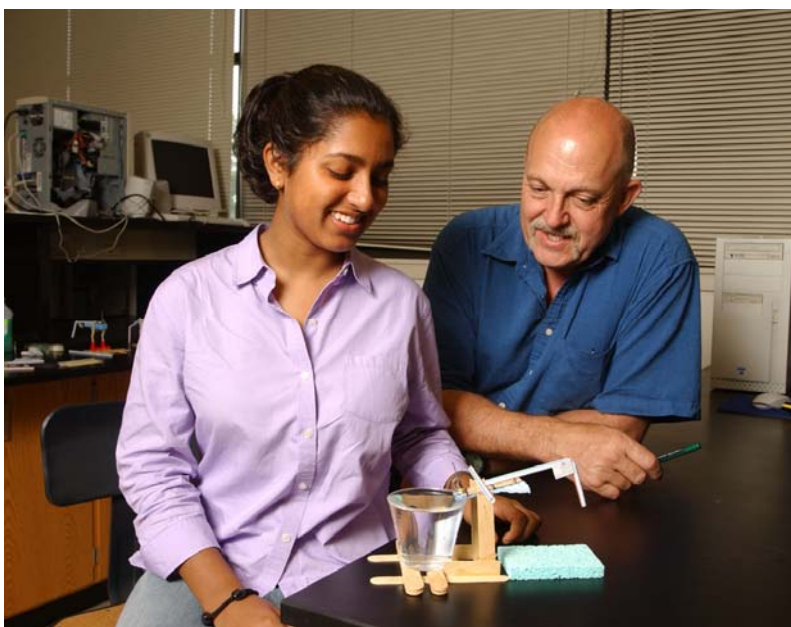


Electronic textbook based on LCI technology.  
(Photo from Yaesu Book Center Co.,Ltd.)

## Education Outreach

Nadine Abraham, a junior at the Western Reserve Academy in Hudson, Ohio, is working with Professor Peter Palffy-Muhoray, Associate Director at LCI, to conduct research on previously unused sources of energy to a device called a dunking bird. The dunking bird is a heat engine and is in the same class as the automobile engine. Nadine is focusing on creating a simple device, much like the dunking bird, which runs on stored energy but is not a heat engine. She hopes her research will allow others to eventually apply alternate sources of energy to everyday mechanical devices.

Nadine learned about the Liquid Crystal Institute and the opportunity to study with a scientist through the ALCOM Center, an 11-year NSF grant involving Kent State, Case Western Reserve and Akron universities. The ALCOM Center education outreach program provided K-12 students with direct contact with scientists through visits to the Liquid Crystal Institute. Scientists also visited schools to enlighten students about the science of liquid crystals.



High school student Nadine Abraham and Professor Palffy-Muhoray work on a project to create a simple device which runs on stored energy but is not a heat engine.



**Table 1**  
**Liquid Crystal Institute Staff**

<u>Name</u>	<u>Year Appointed</u>	<u>Title</u>
Philip J. Bos	1994	Associate Director (1997) Professor, Chemical Physics (2001)
Douglas R. Bryant	1993	Display Engineer (1995)
Brenda Buck	1991	Business Manager (2002)
Liang-Chy Chien	1989	Professor, Chemical Physics (2001)
Lynn Fagan	2001	Secretary
Merrill Groom	1986	Instrumentation Engineer (1993)
Valerie A. Henry	1991	Grants Coordinator (2001)
Antal Jákli	1999	Senior Research Fellow
Jack R. Kelly	1988	Professor, Chemical Physics (2000)
Julie M. Kim	1995	Senior Chemist (1998)
Elaine M. Landry	1983	Business Manager (1998) - retired 7/31/02
Oleg D. Lavrentovich	1992	Interim Director (2002) Professor, Chemical Physics (2000)
Marybeth Lipinski	2000	Grants Assistant (2001)
Mary E. Neubert	1972	Senior Research Fellow (1976) – retired 9/30/02
Peter Palffy-Muhoray	1983	Associate Director (1990) Professor, Chemical Physics (1994)
Donna Warner	1999	Clerical Specialist (Part-time)
John West	1984	Vice President of Research and Dean of Graduate Studies (2003) Professor of Chemistry (1997)
Deng-Ke Yang	1992	Associate Professor, Chemical Physics (1999)
<b>EMERITI</b>		
J. William Doane	1979-1996	Emeritus Director; Emeritus Professor of Physics (Retired, June 30, 1996)
Alfred Saupe	1968-1992	Emeritus Professor of Physics (Retired August 31, 1992)

**Table 2**  
**Liquid Crystal Institute Research Personnel**

<b>Research Personnel</b>	<b>Support Department; Grants</b>
<u>Full Members</u>	
David W. Allender	Physics
Philip J. Bos	LCI/CPIP; DARPA, Rockwell, NASA, USAF, Samsung, DuPont, SAIC, Viztec, industry
Liang-Chy Chien	LCI/CPIP; DARPA, OBR Banana, Boulder Nonlinear, AFRL, Samsung, industry, AFOSR-STTR
Daniele Finotello	Physics; NSF international
Antal Jákli	LCI/CPIP; OBR, NSF Hungary, CoAdna Photonics
Jack R. Kelly	LCI/CPIP
Satyendra Kumar	Physics; Viztec, Unilever, industry
Oleg D. Lavrentovich	LCI/CPIP; DARPA, Rockwell, NASA, PRF, DAGSI, OBR, NSF, AlphaMicron
Mary E. Neubert	LCI; USAF
Peter Pálffy-Muhoray	LCI/CPIP; Anteon/AFRL, NSF Hungary, NSF Brazil (2), NSF REU, NSF-EC
Samuel N. Sprunt	Physics; ONR, NSF
Robert J. Twieg	Chemistry; NSF, NSF REU, NASA, USAF/Stanford, Dreyfus Fndn., Goodrich
John L. West	LCI; NSF REU, TAF OBR, DARPA, Nitto Denko, NSF
Philip W. Westerman	NEOUCOM
Deng-Ke Yang	LCI/CPIP; Matsushita, KDI/ONR, SAIC

\*Grant name indicates that a portion of the investigator's salary was provided by grant(s), either as a cost share or direct charge (academic year or summer).



<b><u>Research Personnel (termination date)</u></b>	<b><u>Supporting Department</u></b>	<b><u>Grant(s) and Principal Investigator(s)</u></b>
George Barrick (2/03)	LCI	Rockwell - Bos
Otilia Catanescu	LCI	ALCOM, Samsung; DARPA - Chien
Xiaoman Dai (9/02)	LCI	Beamsteering - Neubert
Michael R. Fisch	LCI	DARPA - West; ODOD TAF (CCS)
Anatoliy Glushchenko	LCI	DARPA - West
Maxwell Godfrey (6/03)	LCI	ALCOM Education - Palffy-Muhoray
Andrii Golovin	LCI	Rockwell - Lavrentovich
Tamas Kosa (Adjunct)	LCI, CPIP	
Liubov Kreminska	LCI	DARPA, NASA - Lavrentovich
Marina Lavrentovich	LCI	Moxtek, Nitto Denko - Kelly
Gi-Dong Lee (2/03)	LCI	Samsung - Bos
Soon Nam Lee (1/03)	LCI	BNL - Neubert; BNL - Chien
Yuriy Nastyshyn	LCI	OBR Res. Challenge - Lavrentovich
Jonathan Ruth (6/03)	LCI	IPP, ALCOM - Bos
Tatiana Sergan (10/02)	LCI	ALCOM, Moxtek - Kelly
Vassili Sergan (8/02)	LCI	DARPA - Bos
Sergij Shiyanovskii	LCI, CPIP	Rockwell - Lavrentovich
Ivan Smalyukh	LCI	AlphaMicron/ODOD - Lavrentovich
Bahman Taheri (Adjunct)	LCI, CPIP	
Tibor Toth-Katona	LCI	NSF-EC - Palffy-Muhoray
Bin Wang	LCI	THOR, NASA, Rockwell - Bos

**Technicians and Engineers**

James Francl	Liou Qiu
Karen Hullihen	Ryan Stayshich
Gregory Magyar (11/02)	Hugh Wonderly
Aaron Norton (7/02)	

**Student Employees**

Nadine Abraham	Melanie Mahler (5/03)
Jennifer Anderson (12/02)	Julia Sugalski (5/03)
Kathleen Lipinski	

**Student Summer Interns**

Ryan Grams (8/02)	Carroll Moya (8/02)
Jonathan Heflin (8/02)	Ryan Nosler (8/02)
John Holler (8/02)	Matthew Smith (6/03)
Jason Morgan (8/02)	

Table 3

## Chemical Physics Interdisciplinary Program Faculty

<u>Current Faculty</u>	<u>Rank</u>	<u>Appointed</u>	<u>Tenure</u>
Philip J. Bos	Professor (2001) Associate (1995)	1995	1998
Liang-Chy Chien	Professor (2001) Associate (1995)	1995	1998
Jack R. Kelly	Professor (2000) Associate (1994)	1994	1997
Oleg D. Lavrentovich	Professor (2000) Associate (1994)	1994	1997
Peter Palffy-Muhoray	Professor (1994)	1994	1997
Deng-Ke Yang	Associate Professor (1999) Assistant (1995)	1995	1999
<b><u>Past Faculty</u></b>			
J. William Doane	Professor (1994)	1994	Phys. Dept.
<b><u>Joint Professors</u></b>			
David W. Allender	Physics Department	1996	
Julia E. Fulghum	Chemistry Department	1995-2002	
Eugene C. Gartland, Jr.	Math Department	1996	
Satyendra Kumar	Physics Department	1995	
<b><u>Adjunct Professors</u></b>			
Julia Fulghum	University of New Mexico	2003-	
Anatoliy Glushchenko	Liquid Crystal Institute	2003-	
Antal Jakli	Liquid Crystal Institute	2000-	
Shunsuke Kobayashi		1998	
Tamas Kosa	AlphaMicron, Inc.	1998-	
Alan Lien		1998-2002	
Tatiana Sergan	Liquid Crystal Institute	2000-2001	
Sergij Shiyanovskii	Liquid Crystal Institute	1998-	
Bahman Taheri	AlphaMicron, Inc.	1998-	
John L. West	Research & Graduate Studies	1996-	
Philip Westerman	NEOUCOM	1997-	
Haiji Yuan	CoAdna Photonics, Inc.	1999-2001	
<b><u>Emeritus Professors</u></b>			
J.W. Doane		1997-	
<b><u>Graduate Coordinators</u></b>			
Peter Palffy-Muhoray		1994-1997	
Jack R. Kelly		1997-2002	
Oleg D. Lavrentovich		2002-2003	
Liang-Chy Chien		2003-	

**Table 4**  
**Chemical Physics Interdisciplinary Program Graduate Students**

<b><u>Graduate Students</u></b> (start-end)	<b><u>Dept.</u></b>	<b><u>Univ./Grant Support</u></b>	<b><u>Advisor</u></b>
Volodymyr Bodnar (1994)	Chem.-Phys.	None	West
Erica B. Montbach (1999)	Chem.-Phys.	DuPont	Bos
Ebru Aylin Buyuktanir (2001)	Chem.-Phys.	CPIP; TAF Polydisplay	West
Wenyi Cao (1998)	Chem.-Phys.	NSF	Palfy-Muhoray
Cheng Chen (2001)	Chem.-Phys.	CPIP; Hana	Bos
Roland Ennis (1995)	Chem.-Phys.	Anteon	Palfy-Muhoray
Seth Green (12/02)	Chem.-Phys.	CPIP	
Mingxia Gu (2001)	Chem.-Phys.	CPIP; Rockwell	Lavrentovich
Yuanming Huang (1999)	Chem.-Phys.	OBR/Banana	Jákli
Shin-Woong Kang (1997 - 5/03)	Chem.-Phys.		Chien
Wei Kang (transferred 8/02)	Chem.-Phys.		
Asad Khan (1997 - 5/03)	Chem.-Phys.	None	Doane
Sang Hwa Kim (1999 )	Chem.-Phys.	DAGSI	Chien
Fenhua Li (2002)	Chem.-Phys.	CPIP	West
Guangxun Liao (2000)	Chem.-Phys.	CPIP; Moxtek; CoAdna; OBR	Kelly/Jákli
Hui Liu (2001)	Chem.-Phys.	CPIP; Rockwell	Lavrentovich
Oleg Pishnyak (2000)	Chem.-Phys.	Rockwell; workstudy	Lavrentovich
Salman Saeed (1996 - 8/02)	Chem.-Phys.		Bos
Tod Schneider (1996)	Chem.-Phys.	PR Fund; OBR; workstudy	Lavrentovich
Bohdan Senyuk (2003)	Chem.-Phys.	CPIP	
Alexander Semyonov (1998)	Chem.-Phys.	Chemistry Dept.	Twieg
Jianru Shi (1999)	Chem.-Phys.	Rockwell	Bos
Ivan Smalyukh (1999)	Chem.-Phys.	PRF; OBR; AlphaMicron	Lavrentovich
Linli Su (12/02)	Chemistry	ALCOM EPIC; LCI	West
Shouping Tang (2003)	Chem.-Phys.	CPIP	
Bin Wang (1997 – 5/02)	Chem.-Phys.		Bos

<b>Graduate Students</b> (start-end) (continued)	<b>Dept.</b>	<b>Univ./Grant Support</b>	<b>Advisor</b>
Chenhui Wang (1998)	Chem.-Phys.	Displaytech; Univ. Fellowship	Bos
Dong Wang (2000)	Chem.-Phys.	CPIP; BW cholesteric display; KDI	Yang
Xinghua Wang (2000)	Chem.-Phys.	NASA; THOR	Bos
Yin Ye (2001)	Chem.-Phys.	CPIP; Rockwell	Lavrentovich
Guoqiang Zhang (2000)	Chem.-Phys.	DARPA	West
Hailiang Zhang (1996)	Chem.-Phys.		Kelly, Gartland
Yanli Zhang (2000)	Chem.-Phys.	Intel	Bos
Ke Zhang	Chemistry	EPIC; KSU ALCOM	West
Zhou, Fushan (1999)	Chem.-Phys.	LCI; Chromalux; Matsushita; Varilite	Yang/Kelly

Table 5  
Graduate Degrees Awarded

<u>Student</u>	<u>Dissertation/Thesis Title</u>	<u>Advisor/Dept./Date</u>
<b>Doctor of Philosophy</b>		
Ming He	Synthesis of Organic Molecules for Photorefractive Applications	Twieg/Chemistry December 2002
Linli Su	Studies on Non-Contact Alignment of Liquid Crystals	West Chemistry December 2002
Shin-Woong Kang	Spatio-Orientationally Organized Polymer Microstructures Obtained on Self-Assembled Pattern-Forming States of Liquid Crystals: Morphology, Phase Separation and Potential Applications	Sprunt/Chien Physics, Chem. Phys. May 2003
Asad Khan	Chiral Materials and Cell Designs for the Cholesteric Display Technology	Doane Chemical Physics May 2003

**Table 6**  
**Placement of Personnel**

**Graduates**

Shin-Woong Kang

Asad Khan

Salman Saeed

Linli Su

**Employment**

Kent State University

Kent Displays, Inc.

Three Five Systems

AlphaMicron

**Postdoctoral Fellows, Research Associates**

George Barrick

Xiaoman Dai

Gi-Dong Lee

Soonnam Lee

Jonathan Ruth

Tatiana Sergan

Vassili Sergan

Case Western Reserve University

Radiology Department, University of Virginia

Dept. of Electronic Engineering, Pusan National University, South Korea

Unknown

AlphaMicron, Inc.

Unknown

California State University

**Staff/Technicians**

Maxwell Godfrey

Gregory R. Magyar

Aaron Norton

Unknown

Noveon, Inc.

Unknown

**Table 7**  
**Visiting Scientists**

**Long-term Visitors**

<u>Name</u>	<u>Visitation Period</u>	<u>Home Institution</u>
Toshihiro Aoki	April 2003 – Mar. 2004	Nihon University, Japan
Tohru Doi	Sept. 2001 – Oct. 2002	Tosoh Corp., Japan
Antigone Marino	June 2003 – June 2004	University of Naples, Italy
M. Figueiredo Moreira	Aug. – Dec. 2002	Pontifica University, Brazil
Junho Song	Feb. 2001 – Jan. 2003	Samsung, Korea

**Short-term Visitors**

<u>Name</u>	<u>Visitation Period</u>	<u>Home Institution</u>
Katalin Fodor-Csorba	Nov. 11-25, 2002	Hungarian Academy of Sciences
Minoru Miyatake	May - Aug., 2003	Nitto Denko Corp., Japan
Maurizio Nobili	February 2003	Universite Montpellier, France
Ramarao Pratibha	Aug.-Oct. 2002	Raman Research Institute, India
Yuriy Reznikov	April-May 2003	Academy of Sciences, Ukraine
Jose A. Rodriguez-Cheda	May 1 – July 31, 2003	Universidad Complutense, Spain
Boldizsne Vajda	May 3-16, 2003	Hungarian Academy of Sciences

**Table 8**  
**Grants and Contracts, 2002-2003**

Title Grant/Contract Number Agency Period	Amount Project Director; Principal Investigators Faculty Associates or Visiting Scientists Research Associates; Postdoctoral Fellows Graduate Students KSU Account Number
<p><b>1. ALCOM Support</b> ODOD 5/1/02 – 7/31/03</p>	<p>\$282,000 West Godfrey, Hulihan, Ruth, Qiu Staysrich 444249</p>
<p><b>2. Numerical and Experimental Studies on Isotropic-Liquid Crystalline Binary Mixtures</b> P.O. S1214 Anteon Corp (AFRL Subcontract) 05/2002 – 06/2003</p>	<p>\$22,000 Palfy-Muhoray Ennis 440636</p>
<p><b>3. Basic Clean Room Techniques</b> Ohio Board of Regents 07/2000 – 09/2002</p>	<p>\$197,600 Hanniford (CCS), West, Fisch (LCI) Bokrass, Yuhnke (CCS) 440810</p>
<p><b>4. Liquid Crystal Based Beam Steering Device and Optical Telescopes</b> NAG 3-2359 NASA 01/2001 – 01/2004</p>	<p>\$654,066 Bos, Lavrentovich Bryant, Golovin, Groom, Kreminska, Ruth, Shiyankovskii, B. Wang, X. Wang 444102</p>
<p><b>5. Coalescence of Liquid Crystal Lenses</b> PRF 35306-AC7 ACS Petroleum Research Fund 01/01/2000 – 08/31/2002</p>	<p>\$60,000 Lavrentovich Schneider, Smalyukh 444218</p>
<p><b>6. Optical Properties of Holographic Elements in Display Applications</b> Dupont 01/2000 – 01/2003</p>	<p>\$120,000 Bos Bramley-Montbach 444220</p>



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|---|--|
| <p><b>7. Liquid Crystal Based Optical Phase Array for Steering Lasers</b><br/> F33615-00-1-1681<br/> DARPA<br/> 06/2000 – 06/2003</p>                                       | <p>\$2,465,528 (from \$757,731)<br/> Bos, Lavrentovich, West,<br/> Fisch<br/> Bryant, Glushchenko, Golovin,<br/> Groom, Kreminska, Ruth,<br/> Sergan, Shiyansovskii<br/> Zhang<br/> 444226</p> |
| <p><b>8. C1 SSFLC Bistable Device Optimization Project</b><br/> Displaytech<br/> 09/2000 – 08/2003</p>  | <p>\$99,000<br/> Bos<br/> C. Wang<br/> 444228</p>  |
| <p><b>9. Digital Beam Deflector</b><br/> BOU 431588<br/> Rockwell (DARPA subcontract)<br/> 09/2000 – 06/2003</p>  | <p>\$446,499<br/> Bos, Lavrentovich<br/> Barrick, Golovin, Kreminska,<br/> Shiyansovskii<br/> Gu, Liu, Pishnyak, Shi, Yin<br/> 444230</p>  |
| <p><b>10. Electro-optical Devices from Banana-Shaped Liquid Crystals</b><br/> Ohio Board of Regents<br/> Research Challenge<br/> 03/2001 – 12/2002</p>                      | <p>\$70,000<br/> Jákl, Chien<br/> Catanescu<br/> Y. Huang, G. Liao<br/> 444233</p>   |
| <p><b>11. Trans-reflective LCD</b><br/> Matsushita Electric Industrial Co.<br/> 04/2001 – 03/2003</p>   | <p>\$50,000 (reduced from \$100,000)<br/> D.K. Yang<br/> F. Zhou<br/> 444234</p>   |
| <p><b>12. Development of Polymer and Chiral Materials for FE-LCD</b><br/> Boulder Nonlinear Systems<br/> 03/2001 – 02/2003</p>  | <p>\$156,370<br/> L.-C. Chien<br/> S. Lee<br/> 444235</p>  |
| <p><b>13. Carbon Nanotube-Reinforced Liquid Crystal Structural Composites by Electron Beam Curing</b><br/> ML-UD-01-13, DAGSI (AFRL subcontract)<br/> 07/2001 – 12/2003</p> | <p>\$47,628 (reduced from \$99,999)<br/> Chien<br/> S. Kim<br/> 444238</p>   |

<p><b>14. Modeling and Improvements to PI-Cell Type Devices for AMLCD Applications</b>                  Samsung Electronics Co. Ltd.                  03/2001 – 05/2003</p>	<p>\$143,641                  Bos                  Lee, G., Panasyuk                  444241</p>
<p><b>15. Polymer Walls for Ruggedized LCDs Using Plastic Substrates</b>                  Nitto Denko Corporation                  09/2001 – 08/2002</p>	<p>\$62,054                  West                  444244</p>
<p><b>16. Tunable Filters for Telecommunications Applications</b>                  CoAdna Photonics, Inc.                  10/2001 – 10/31/2002</p>	<p>\$96,189                  Jákli                  Olivares, Liao                  444245</p>
<p><b>17. Development of High Birefringence Liquid Crystals for Optical Beam Steering</b>                  Univ. Central Florida/Raytheon Systems;                  (US Air Force subcontract)                  01/2002 – 12/2003</p>	<p>\$90,000                  Chien                  Catanescu                  444247</p>
<p><b>18. Black &amp; White Cholesteric Displays</b>                  Kent Displays, Inc. (ONR subcontract)                  06/2002 – 05/2003</p>	<p>\$28,500                  Yang                  D. Wang                  444251</p>
<p><b>19. Pathogen Detection by Lyotropic Liquid Crystals</b>                  Ohio Board of Regents                  Research Challenge                  02/2002 – 12/2003</p>	<p>\$80,000 (\$53,160 for LCD)                  Woolverton, Lavrentovich                  Nastyshyn, Schneider,                  Smalyukh                  444521</p>
<p><b>20. Sponsored Research Agreement</b>                  Viztec                  4/00 - 12/02</p>	<p>\$233,107                  Kumar                  Q. Wang                  440622</p>
<p><b>21. Research Experiences for Undergraduates in Chemistry at KSU</b>                  NSF                  4/01 – 3/04</p>	<p>\$180,000                  Twieg, Gericke                  442155</p>

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|---|---|
| <p><b>22. Acquisition of Organic Semiconductor Processing and Characterization Facility for Research and Student Training</b><br/>NSF<br/>8/01 – 7/04</p>           | <p>\$200,000<br/>Twieg, Ellman, Huang<br/>442172</p>                              |
| <p><b>23. E-BEAM Sensitive Polyimides</b><br/>NASA<br/>6/99 – 9/03</p>  | <p>\$348,263<br/>Twieg, Uribe, Vargas-Aburto<br/>Korwin<br/>444125</p>            |
| <p><b>24. Dynamic Light Scattering Study of Commensurate and Incommensurate Structure in Ferrielectric and Twist Grain Boundary LCs</b><br/>NSF<br/>8/99 – 7/03</p> | <p>\$284,685<br/>Sprunt<br/>Adorjan, Sharma<br/>Stojadinovic<br/>442132</p>       |
| <p><b>25. Chromophores, Sensitizers and Transport Agents for Polymeric Photorefractive Systems</b><br/>Stanford Univ./US Air Force<br/>11/00 – 10/02</p>            | <p>\$173,814<br/>Twieg<br/>He, Semyonov<br/>444714</p>                            |
| <p><b>26. Real World Research Experience in Undergraduate Materials Chemistry Education</b><br/>Camille &amp; Henry Dreyfus Fndn.<br/>2/02 – 1/04</p>               | <p>\$46,000<br/>Twieg<br/>Semyonov<br/>444735</p>                                 |
| <p><b>27. Acquisition of Imaging Fourier Transform Infrared (FTIR) Spectrometer</b><br/>NSF<br/>8/15/02 – 7/31/05</p>   | <p>\$258,199<br/>Gericke, West, Fulghum,<br/>Cabaniss<br/>(Chemistry account)</p> |
| <p><b>28. Ohio Eminent Scholars Program (endowment)</b><br/>OBR<br/>2002</p>  | <p>\$842,857<br/>LCI</p>  |
| <p><b>29. Tunable Mirrorless Lasing in Cholesteric Liquid Crystalline Elastomers</b><br/>NSF<br/>6/1/02 – 5/31/05</p>   | <p>\$408,000<br/>Palffy-Muhoray<br/>Taheri<br/>Cao, Moya<br/>442232</p>           |
| <p><b>30. Prism Rotator Beam-steering Component and Two-Dimensional Optical Phased Array Wavefront Corrector (THOR)</b><br/>US Air Force<br/>7/17/02 – 9/17/03</p>  | <p>\$379,998<br/>Bos<br/>Fisch, B. Wang, X. Wang<br/>444253</p>                   |

<p><b>31. Commercialization of Plastic Liquid Crystal Displays</b>  Viztec, Inc.  1/1/03 – 12/31/03</p>	<p>\$29,159  Bos  444254</p>
<p><b>32. Liquid Crystal Eyewear</b>  AlphaMicron, Inc./ODOD TAF (subcontract)  1/1/03 – 6/2/04</p>	<p>\$196,253  Lavrentovich, Gartland  Smalyukh, Huang  444255</p>
<p><b>33. Polymer-Stabilized Ferroelectric Liquid Crystal for Analog Switching</b>  AFOSR-BNL  7/02 – 2/03</p>	<p>\$78,185  Chien</p>
<p><b>34. Small Angle Neutron and X-ray Scattering and Heat Capacity Study of Soap Solutions</b>  Unilever Research USA  11/02 – 11/03</p>	<p>\$40,000  Kumar  (Physics acct.)</p>
<p><b>35. Inorganic Alignment Layer Project</b>  Hana Microdisplay Technologies, Inc.  6/1/03 – 5/31/06</p>	<p>\$100,000  Bos  444257</p>
<p><b>36. Polymer Dispersed Liquid Crystal (PDLC) Shutters Research Project</b>  Cubic Defense Systems  7/23/02 – 11/30/02</p>	<p>\$13,467  West  Magyar  444252</p>
<p><b>37. Research Project for Intel Corporation</b>  Intel  6/1/01 – 5/30/04</p>	<p>\$46,756  Bos  Zhang, Y.  444242</p>
<p><b>INTERNATIONAL PROGRAMS</b></p>	
<p><b>38. US-Slovenia Materials Research on Orientational Phenomena in Homeotropic LC Films</b>  NSF-Slovenia  1/99-12/02</p>	<p>\$63,995 (\$24,747 Finotello)  Finotello, Crawford, Zumer  442100</p>
<p><b>39. US-Hungary Materials Research: Investigation of Liquid Crystalline Mesophases of Bent Core Molecules</b>  NSF  9/1/02 – 8/31/05</p>	<p>\$29,840  Palffy-Muhoray, Gleeson, Jákli  442234</p>

Table 9  
Proposals for Extramural Support

<b>Title</b> <b>a. Agency</b> <b>b. Period</b> <b>c. Initial/Renewal/Continuation (Duration)</b> <b>d. Amount Requested</b>	<b>e. Project Director; Principal Investigators</b> <b>f. Faculty Assoc./Vis. Sci.</b> <b>g. Status</b>
<b>1. Polymer Stabilized Blue Phase Photonic Band Gap Materials</b> a. NSF b. 5/1/03 – 4/30/06	c. Initial d. \$507,859 e. Palffy-Muhoray, Chien g. Not Awarded
<b>2. Hana Microdisplay Sponsored Research Agreement</b> a. Hana Microdisplay Technologies, Inc. b. 6/1/03 – 5/31/06	c. Initial d. \$100,000 e. Bos g. Pending
<b>3. Total Internal Reflection of Liquid Crystals</b> a. NSF b. 5/15/03 – 5/14/06	c. Initial d. \$259,807 e. Yang g. Not Awarded
<b>4. NIRT: Tunable Focus Eye Glasses and Switchable Photonic Devices Using Gradient Nanoscale Liquid Crystal Droplets</b> a. Univ. Central Florida (subcontract NSF) b. 4/1/03 – 3/31/07	c. Initial d. \$385,630 e. Chien g. Not awarded
<b>5. Encapsulated Cholesteric Displays</b> a. SAIC (Science Applications Intl. Corp.) b. 1/1/03 – 12/31/04	c. Initial d. \$460,000 e. Bos, Yang, Doane g. Awarded
<b>6. NIRT: Liquid Crystal-Nanoparticle Colloids</b> a. NSF b. 6/1/03 – 5/31/07	c. Initial d. \$1,709,173 e. West, Bos, Jákli, Lavrentovich, Singer g. Not Awarded
<b>7. NASA/URETIs University of Akron</b> a. Univ. Akron subcontract to KSU b. 4/1/02 – 3/31/07	c. Initial d. \$535,957 e. West, Chien, Yang, Lavrentovich g. Not Awarded

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| <p><b>8. Prism Rotator Beam-steering Component and Two-Dimensional Optical Phased Array Wavefront Corrector</b><br/> a. DARPA<br/> b. 4/1/02 – 5/31/03</p>                        | <p>c. Initial<br/> d. \$565,695<br/> e. Bos<br/> g. Awarded</p>   |
| <p><b>9. KSU Sub-contract/Univ. Akron proposal</b><br/> a. NASA/URETI (CAN 01 OAT-01)<br/> b. 4/01/02 – 3/31/07</p>   | <p>c. Initial<br/> d. \$107,320<br/> e. West<br/> g. Pending</p>  |
| <p><b>10. US-Hungary Materials Research: Investigation of Liquid Crystalline Mesophases of Bent Core Molecules</b><br/> a. NSF<br/> b. 9/1/02 – 8/31/05</p>                       | <p>c. Initial<br/> d. \$29,840<br/> e. Palffy-Muhoray, Gleeson, Jákli<br/> g. Awarded</p>                       |
| <p><b>11. IMI on Orientationally Ordered Materials</b><br/> a. NSF<br/> b. 10/1/02 – 9/30/07</p>  | <p>c. Initial<br/> d. \$4,999,999<br/> e. Palffy-Muhoray, Jákli Crawford, Lavrentovich,<br/> g. Not Awarded</p> |
| <p><b>12. Liquid Crystal Based Wavefront Corrector for Space Deployable Optical Elements</b><br/> a. NASA<br/> b. 7/1/02 – 6/30/05</p>  | <p>c. Initial<br/> d. \$1,117,896<br/> e. Bos, Lavrentovich<br/> g. Not Awarded</p>                             |
| <p><b>13. Computer Optimization of Omnidirectional Dielectric Reflectors</b><br/> a. AF STTR (subcontract from 3D Optics)<br/> b. 2 years (submitted April 2002)</p>              | <p>c. Initial<br/> d. \$99,972 (KSU \$30,000)<br/> e. Lavrentovich<br/> g. Pending</p>                          |
| <p><b>14. Ionic Cholesteric Liquid Crystals</b><br/> a. OBR Research Challenge<br/> b. 2003-2004</p>  | <p>c. Initial<br/> d. \$99,763<br/> e. Yang, Twieg<br/> g. Not Awarded</p>                                      |
| <p><b>15. Fluorothiophenes – A New Class of Material with Significant Potential for Ferroelectric Applications</b><br/> a. OBR Research Challenge<br/> b. 01/01/03 – 12/31/04</p> | <p>c. Initial<br/> d. \$149,942<br/> e. Seed, Sampson, Jákli<br/> g. Not Awarded</p>                            |
| <p><b>16. Rheology and Electromechanical Properties of Liquid Crystals from bent-Shape Molecules</b><br/> a. NSF<br/> b. 1/1/03 – 12/31/05</p>                                    | <p>c. Initial<br/> d. \$30,435<br/> e. Jákli<br/> g. Not Awarded</p>  |

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|---|---|
| <p><b>17. Self-assembly and Liquid Crystalline Order in Lyotropic Chromonic Systems: From Nanoscale to Display Applications</b><br/> a. CRDF<br/> b. 2 years</p>  | <p>c. Initial<br/> d. \$100,000<br/> e. Lavrentovich<br/> g. Not Awarded</p>                        |
| <p><b>18. Diluted Suspensions of Ferro-electric Nanoparticles in Liquid Crystals</b><br/> a. CRDF<br/> b. 1-2 years</p>   | <p>c. Initial<br/> d. \$135,540<br/> e. West<br/> g. Not Awarded</p>                                |
| <p><b>19. Subcontract</b><br/> a. Sarnoff Corporation<br/> b. 4/1/03 – 3/31/05</p>  | <p>c. Initial<br/> d. \$357,928<br/> e. West<br/> g. Not Awarded</p>                                |
| <p><b>20. Modeling and Computer Simulation of Phase Separation in Binary Liquid Crystalline Systems</b><br/> a. Anteon Corp.<br/> b. 7/1/03 – 6/30/05</p>         | <p>c. Initial<br/> d. \$62,500<br/> e. Palffy-Muhoray<br/> g. Awarded</p>                           |
| <p><b>21. Inter-American Collaboration on Orientationally Ordered Soft Matter</b><br/> a. NSF<br/> b. 6/1/03 – 5/31/06</p>  | <p>c. Initial<br/> d. \$316,631<br/> e. Palffy-Muhoray, Jákli, Lavrentovich<br/> g. Not Awarded</p> |
| <p><b>22. Flexible Optical and Electronic Device Manufacturing Facility</b><br/> a. Ohio Dept. of Development/Wright Capital Project<br/> b. 7/1/03 – 6/30/06</p> | <p>c. Initial<br/> d. 1,640,000 (equipment)<br/> e. West<br/> g. Awarded</p>                        |
| <p><b>23. ACT/SGER: Liquid Crystal Materials for Biosensor Development</b><br/> a. NSF<br/> b. 9/15/03 – 8/31/04</p>  | <p>c. Initial<br/> d. \$100,000<br/> e. Lavrentovich, Woolverton<br/> g. Awarded</p>                |
| <p><b>24. Commercialization of Plastic Liquid Crystal Displays</b><br/> a. Viztec, Inc.<br/> b. 1/1/03 – 12/31/03</p>   | <p>c. Initial<br/> d. \$29,159<br/> e. Bos<br/> g. Awarded</p>                                      |

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|--|---|
| <p><b>25. Oscillatory Fin Locomotion with Artificial Muscles for Autonomous Undersea Vehicles (AUVs)</b><br/> a. ONR<br/> b. 5/03 – 4/08</p>                                   | <p>c. Initial<br/> d. \$2,028,429<br/> g. Pending</p>   |
| <p><b>26. Conductive Liquid Crystal Elastomers for Aircraft Wing Structure</b><br/> a. AFOSR-STTR Phase I<br/> b. 9/03 – 5/06</p>  | <p>c. Initial<br/> d. \$240,000<br/> e. Chien<br/> g. Awarded</p>   |
| <p><b>27. Polymer Enhanced Liquid Crystal Displays</b><br/> a. Samsung<br/> b. 2003</p>  | <p>c. Initial<br/> d. \$20,000<br/> e. Chien</p>  |
| <p><b>28. Liquid Crystals in Self-Organized Templates</b><br/> a. NSF<br/> b. 9/1/03 – 8/31/06</p>   | <p>c. Initial<br/> d. \$623,232<br/> e. Jákli, Kelly<br/> g. Not Awarded</p>                                |
| <p><b>29. Banana Liquid Crystal Fibers</b><br/> a. OBR Research Challenge<br/> b. 1/1/03 – 5/31/04</p>   | <p>c. Initial<br/> d. \$97,253<br/> e. Jákli<br/> g. Not Awarded</p>  |
| <p><b>30. Acquisition and Development of Fast Confocal Polarizing Microscope for Liquid Crystal Materials Research and Education</b><br/> a. NSF<br/> b. 8/15/03 – 7/31/04</p> | <p>c. Initial<br/> d. \$190, 000<br/> e. Lavrentovich<br/> g. Awarded</p>                                   |
| <p><b>31. Thermal and Daylight Transmission of Selective Polymer Stabilized Cholesteric Liquid Crystal Glazing</b><br/> a. NSF<br/> b. 2 years</p>                             | <p>c. Initial<br/> d. \$332,487<br/> e. Sharag-Eldin, Yang<br/> g. Not Awarded</p>                          |
| <p><b>32. Composites of Electrically Conducting and Liquid Crystal Polymers</b><br/> a. Cornerstone Research Group (sub: AFOSR/STTR)<br/> b. 9/1/03 – 5/31/06</p>              | <p>c. Initial<br/> d. \$240,000<br/> e. Chien<br/> g. Awarded</p>   |
| <p><b>33. Nano and Micro-scale Templating of Liquid Crystalline Materials</b><br/> a. NSF-INT USA-Slovenia<br/> b. 8/1/03 – 7/31/06</p>  | <p>c. Renewal of 442100<br/> d. \$45,528 (KSU share)<br/> e. Finotello, Crawford, Zumer<br/> g. Awarded</p> |



- 34. Center for Liquid Crystal Science and Education**
- a. US Dept. Education/Congressional Appropriation
  - b. 9/03 – 9/04
  - c. Initial
  - d. \$471,913
  - e. Lavrentovich, Palfy-Muhoray, Jákli, Gleeson, West
  - g. Awarded
- 35. Instruction in Data Acquisition, Data Presentation and Instrument Control**
- a. Ohio Board of Regents (H.B. 675)
  - b. 2003-2004
  - c. Initial
  - d. \$18,618
  - e. Palfy-Muhoray
  - g. Awarded

Table 10

Patents

KSU#	Patent #	Title	Date	Inventors
	6,583,838	Bistable Liquid Crystal Display Device Using Polymer Stabilization	6/24/03	C. Hoke, P. Bos, J. Li
	6,411,354	Bulk Alignment of Lyotropic Chromonic Liquid Crystals	6/25/02	O. Lavrentovich T. Ishikawa
235	EL726132215 U.S. provis.	Polymer Modified Ferroelectric Liquid Crystals	6/12/02	L.C. Chien S. Lee, S. Suresh
	EL72613974 U.S. provis.	Polymer Enhanced LC Devices for Flexible Plastic Displays	5/22/02	L.C. Chien T. Wang S. Kumar
	EL72613196 U.S. provis.	Polar Phenyltolane Liquid Crystals	5/8/02	L.C. Chien S.N. Lee
<b>Patent Applications</b>				
254		Electro-Optical Devices from Polymer-Stabilized Liquid Crystal molecules	6/03	L.C. Chien L. Komitov S.H. Kim
247		Optical Anisotropic Compensators by Polymer Stabilization Technique	11/02	Toru Doi L. C. Chien
245		Apparatus and Method of Plasma Treatment of the Aligning Films for Liquid Crystals	11/02	O. Yaroshchuk O. Lavrentovich L.C. Chien
	09/855,054	Alignment of Lyotropic Chromonic Liquid Crystals at Surfaces as Monolayers and Multilayered Stacks	11/14/02	T. Schneider O. Lavrentovich
243	10/365,322	Stressed LCs as an Ultra-Fast Light Modulating Material Consisting of Unidirectionally Oriented LC Microdomains Separated by Polymer Chains	2/11/03	J. West A. Glushchenko
226	PCT/US03/ 00861 Intl. App.	A Material for Liquid Crystal Cell	1/10/03	J. West A. Glushchenko Y. Reznikov V. Reshetnyak
229	60/350,747	Fast Switching Dual-frequency LC Cells w/High Pretilt Angle, Driven by Amplitude and Frequency Modulated Voltage	1/16/03	A. Golovin S. Shiyanovskii O. Lavrentovich
<b>Invention Disclosures</b>				
		Apparatus and Method of Plasma Treatment of the Aligning Films for Liquid Crystals	9/9/02	O. Yaroshchuk A Dobrovolskyy O. Lavrentovich L.-C. Chien

Table 11  
Publications

**David W. Allender**

Peer Reviewed Journals

G. Panasyuk, J. Kelly, D. Allender, E. Gartland, "Geometrical Optics Approach in Liquid Crystal Films with Three Dimensional Director Variations," *Phys. Rev. E*, **67**, 041702 (2003).

X. Liu, D.W. Allender, D. Finotello, "A Calorimetric Study of Nematic Prewetting," *Europhys. Lett.* **59**, 848-854 (2002).

**Philip J. Bos**

Peer Reviewed Journals

G. Lee, P.J. Bos, S. Ahn, K. Kim, "Fast Q-Tensor Method for Modeling the Dynamics of Defects in a Liquid Crystal Director Field," *Phys. Rev. E* **67**, 41, 417151-417157, April (2003).

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**Bahman Taheri**

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W. Cao, A. Muñoz, P. Palffy-Muhoray, B. Taheri, "Lasing in a Three-dimensional Photonic Crystal of the Liquid Crystal Blue Phase II," *Nature Mat.*, Oct. (2002).

W. Cao, H. Finkelmann, S.-T. Kim, A. Munoz, P. Palffy-Muhoray, B. Taheri, R. Twieg, "Mirrorless Lasing in Liquid Crystalline Materials," *Proc. SPIE* **4642**, 55-61 (2002).

Table 12  
Presentations at Professional Meetings

**Philip J. Bos**

Oral Presentations

“2-D Modeling of the Effect of Electrode Topography and Interpixel Gap on LCoS Devices,” Y.L. Zhang, P.J. Bos, D.B. Chung, SID Conference, May 20, 2003, Baltimore MD.

Poster Presentations

“Eliminating Layer Undulation Textures in SSFLC Devices,” C. Wang, P.J. Bos, S. Kumar, M. Wand, M. Handschy, SID Conference, May 20, 2003, Baltimore MD.

“Design of Switchable Grating for a Color Control Element,” B. Wang, P.J. Bos, SID Conference, May 20, 2003, Baltimore MD.

**Liang-Chy Chien**

Invited Talks and Seminars

“Polymer-Enhanced Liquid Crystal Displays,” Technical Conference, Electronic Research Service Organization, Industrial Technology Research Institute, Hsinchu, Taiwan, February 24-26, 2003.

“Light and Liquid Crystal Director-controlled Polymer Morphology,” Eindhoven Polymer Laboratories, Eindhoven, Netherlands, February 14, 2003.

“Polymer-Enhanced Liquid Crystal Displays,” Philips Research, Eindhoven, Netherlands, March 14, 2003.

“Polymer-Enhanced Liquid Crystal Displays,” Samsung Electronic Corporation, TFT-LCD Division, Suwon, Korea, March 20, 2003.

“Imaging Liquid Crystal Templates,” 2002 USA-Korea Science and Engineering Conference, Seoul, Korea, July 10-13, 2002.

“Analog Switching Ferroelectric Displays,” Samsung Corporation, SDI, August 19, 2002.

“Polymer-Stabilized Analog-Switching Ferroelectric Displays,” Seoul National University, Seoul, Korea, August 20, 2002.

“Fast-Switching Polymer-Stabilized Bend Nematic Devices,” *IMID '02 Digest*, Daegu, Korea, August 21-23, 2002.

“Polymer Stabilized Liquid Crystal Devices,” Avery Dennison, Pasadena, CA, September 18, 2002.

“Liquid Crystal Alignment and Optical Compensators,” Kodak Company, Rochester, NY, November 18, 2002.

“Anisotropic Gels and Applications,” Symposium, *Liquid Crystal Elastomers and Gels*, 1<sup>st</sup> World Congress on Biomimetic and Artificial Muscles, Dec. 14-18, 2002, Albuquerque, NM.

“Future Advanced Materials for Display Applications,” 2002 Chinese Liquid Crystal Society Annual Meeting, Hsinchu, Taiwan, December 20, 2002.

### Oral Presentations

“IR Imaging of Liquid Crystal Optical Patent Forming States,” S.W. Kang, D.W. Rafferty, J. Koneig, L.C. Chien, 19<sup>th</sup> International Liquid Crystal Conference, July 1-5, 2002, Edinburgh, Scotland.

“Polymer Enhanced Bend Nematic Cells,” S.H. Kim, L. C. Chien, American Chemical Society, Fall Meeting, Aug 21-24, 2002, Boston, MA.

### Poster Presentations

"Optical Anisotropic Compensator by Polymer Stabilization Technique," T. Doi, L.C. Chien, *SID Intl. Digest Tech. Papers* **34**, P-121, 688-691, SID Conference, May 20, 2003, Baltimore MD.

“High Birefringence Liquid Crystals and Mixtures,” O. Catanescu and L. C. Chien, Gordon Research Conference, New London, New Hampshire, June, 2003.

“Effect of Polymer Networks on Ferroelectric Liquid Crystals,” S.N. Lee and L. C. Chien, 19<sup>th</sup> International Liquid Crystal Conference (2002).

“High Birefringence Liquid Crystals and Mixtures,” O. Catanescu and L. C. Chien, 19<sup>th</sup> International Liquid Crystal Conference (2002).

“New Banana-shaped Liquid Crystals with a Vinyl Terminal Group,” C.K. Lee and L. C. Chien, 19<sup>th</sup> International Liquid Crystal Conference (2002).

“Bent-core Liquid Crystal Polymers,” E.J. Choi and L.C. Chien, 19<sup>th</sup> International Liquid Crystal Conference (2002).

“New Banana-shaped Liquid Crystals with a Chiral Terminal Group,” C.K. Lee and L.C. Chien, *IMID'02*, August, 2002, Daegu, Korea.

### **Daniele Finotello**

#### Invited Talks and Seminars

“The Amazing World of Confined Liquid Crystals,” D. Finotello, Plenary Talk, INFM 2003, BOA p. 9, Genova, Italy, June 2003.

#### Oral Presentations

“Boundary-Induced Structural Transitions in Smectic Liquid Crystals,” ECLC 2003, BOA P117, selected for contributed oral, Jaca, Spain, April 2003.

“<sup>2</sup>H-NMR Spectroscopy of Surfactant-Induced Pretransitional Order in the Isotropic Phase of Smectogenic Liquid Crystal Films,” 19<sup>th</sup> ILCC, BOA C55, selected for contributed oral, Edinburgh, Scotland, July 2002.

#### Poster Presentations

“Deuteron NMR investigation of 5CB Local Ordering and Molecular Dynamics in Nanosize Restricting Geometries of CPG and Vycor Glass,” A. Lebar, G. Lahajnar, M. Vilfan, S. Zumer, D. Finotello, B. Zalar, ECLC 2003, BOA P116, Jaca, Spain, April 2003.

“Boundary-Induced Structural Transitions in Smectic-A Liquid Crystals,” T. Jin, D. Finotello, B. Zalar, A. Lebar, M. Vilfan, S. Zumer, ECLC 2003, BOA P117, Jaca, Spain, April 2003.

“Boundary-Induced Structural Transitions in Smectics,” T. Jin, D. Finotello, B. Zalar, A. Lebar, M. Vilfan, S. Zumer, BAPS 48, Part II, 982 (2003).

“Deuteron NMR investigation of 5CB Local Ordering and Molecular Dynamics in Nanosize Restricting Geometries of CPG and Vycor Glass,” A. Lebar, G. Lahajnar, M. Vilfan, S. Zumer, D. Finotello, B. Zalar, XXXI Ampere Congress, BOA P203, Poznan, Poland, July 2002.

“<sup>2</sup>H-NMR Characterization of Liquid Crystalline Phases in Aqueous Disodium Cromoglycates,” P.W. Westerman, M. Malmer, T. Schneider, O.D. Lavrentovich, D. Finotello, 19th ILCC, BOA P131, Edinburgh, Scotland, July 2002.

“Deuteron NMR Studies of 5CB Molecular Surface Depositions,” B. Zalar, R. Blinc, S. Zumer, T. Jin, D. Finotello, 19th ILCC, BOA P130, Edinburgh, Scotland, July 2002.

## **Antal Jákli**

### Invited Talks and Seminars

“Light Shutters and Electro-optical Storage Devices from Antiferroelectric Liquid Crystals of Bent-shape Molecules,” A. Jákli, L-C. Chien, D. Krüerke, S. Rauch, H. Sawade, P. Bault, G. Heppke, K. Fodor-Csorba, G. G. Nair, *Liquid Crystal Materials, Devices and Applications, IX*, SPIE, Santa Clara (2003).

“Liquid Crystals of Bent-shape Molecules,” Seminar, Wayne State University, Detroit, (2003).

“Classification and Electro-optical Properties of Smectic Phases of Bent-shape Molecules,” Boulder FLC Workshop: Banana Liquid Crystals: Chirality and Polarity, Boulder (2002).

“Electro-optical Switching and Storage Effects in Liquid Crystals of Bent-shape Molecules,” A. Jákli, G.G. Nair, S. Rauch, D. Krüerke, H. Sawade, G. Heppke, (LCT-1), IDW'02 (2002).

“Electro-optical Properties of Smectic Phases of Bent Shape Molecules,” Seminar, Tokyo University of Science and Technology, Yamaguchi (2002).

“Fibers, Glasses and Isotropic Fluids of ‘Banana-shaped’ Molecules,” Seminar, Tokyo Institute of Technology, Tokyo (2002).

### Oral Presentations

“Triclinic – Monoclinic Liquid Crystal Phase Transitions in Fluoro-Substituted Bent-Shape Compounds,” A Jákli, G G Nair, S Rauch, H Sawade, P Bault, G Heppke, P Toledano, 19<sup>th</sup> ILCC, Edinburgh (2002).

“Dynamics of the Nematic Phase of a Bent-core Liquid Crystal,” S. Stojadinovic, A. Adorjan, A. Jákli, H. Sawade, S. Sprunt, APS meeting, Indianapolis (2002).

### Poster Presentations

“Comparative Studies of Bent-core Nematics,” S. Stojadinovich, A. Olivares, H. Sawade, K. Fodor-Csorba, S. Sprunt, A. Jákli, Gordon Conference, New Haven (2003).

“Synthesis and Properties of New Banana-Shaped Liquid Crystalline Monomers and their Mixtures,” K Fodor-Csorba\*, G Galli, A Vajda, D Demus and A Jákli, 19<sup>th</sup> ILCC, Edinburgh (2002).

“Laterally Fluorinated Thiophene-Containing Mesogens. A New Class of Ferroelectric Materials with Very Low Viscosity, Fast Response Time and Chevron-Free Structures,” A.Kiryanov, P. Sampson, A. Jákli, A. J. Seed, 19<sup>th</sup> ILCC, Edinburgh (2002).

“Dynamics of the Nematic Phase of a Bent-Core Liquid Crystal,” S. Stojadinovic, A. Adorjan, S. Kumar, A. Jákli, S. Sprunt, 19<sup>th</sup> ILCC, Edinburgh (2002).

“Infrared Spectroscopy of Liquid Crystals in Fabry Perot Cells,” J. A.Olivares, A. Jákli and J. Kelly, 19<sup>th</sup> ILCC (2002).

“Freely Suspended Strands and Filaments of Smectic Phases of Banana-Shaped Molecules,” A. Jákli, G. G. Nair, D. Krüerke; 19<sup>th</sup> ILCC, Edinburgh (2002).

“Piezoelectricity of a Ferroelectric Liquid Crystal with Glass Transition,” A. Jákli, T. Tóth-Katona, T. Scharf, M. Schadt, A. Saupe, 19<sup>th</sup> ILCC, Edinburgh (2002).

“Molecular Chirality Induced Polarization in Banana Liquid Crystal Phases,” S. Rauch, Ph. Bault, C. Binet, A. Jákli, G. Heppke, Ch. Selbman, H. Sawade, “Boulder FLC Workshop: Banana Liquid Crystals: Chirality and Polarity, Boulder (2002).

“Glass Forming Banana Shaped Compounds,” S. Rauch, Ph. Bault, Ch. Selbman, H. Sawade, G. Heppke, I. Jánosy, A. Jákli, Th. Rasing, Boulder FLC Workshop, *Banana Liquid Crystals: Chirality and Polarity*, Boulder (2002).

## **Satyendra Kumar**

### Invited Talks and Seminars

“Different Limits of Phase Separation and Their Applications,” SPIE Meeting, Santa Clara, January 20-24, 2003.

“The Old Phase Separation Method and its New Limits,” Plenary Talk, 2nd International Meeting on Information Display, Daegu, Korea, August 21, 2002.

“Critical Divergence of Smectic Correlations at the Nematic to Smectic Transition in a Strong Magnetic Field,” 19th International Liquid Crystal Conference, Edinburgh, Scotland, June 30-July 5, 2002.

“The Thermotropic Biaxial Nematic Phase,” Conference on Liquid Crystals and Other Soft Materials, Raman Research Institute, Bangalore, India, December 18-20, 2002.

“Different Shades and Shapes of Phase Separation and Their Applications,” Workshop on Phase Separated Composites and Networks, Seoul National University, August 20, 2002.

### Oral Presentations

“Observation of Novel Liquid Crystalline Phase above the Bulk Melting Temperature,” K. Gautam, A. Dhinojwala, S. Kumar, D. Wermeille, D. Robinson, Abstract Y17.011. Presented at the American Physical Society Meeting, March 2-7, 2003, Austin, TX.



Poster Presentations

“Eliminating Layer Undulation Textures in SSFLC Devices,” C. Wang, P. J. Bos, S. Kumar, M. Wand, M. Handschy, P-101, SID 2003 International Symposium, Baltimore, MD, May 18-23 (2003).

“Smectic Layer Reorientation Induced by AC Field,” J.-H. Song, Y.-B. Kim, S. Kumar, J.-H. Souk, S.-T. Shin, Paper P1-6, 2nd International Meeting on Information Display, Daegu, Korea, August 21 (2002).

“Dielectric Characteristics in Smectic Phases,” J.-H. Song, Y.-B. Kim, S. Kumar, J.-H. Souk, S. T. Shin, Paper P1-5, 2nd International Meeting on Information Display, Daegu, Korea, August 21 (2002).

“Novel LCD with a Single Substrate,” I. Kim, J.H. Kim, D. M. Agra-Kooijman, S. Kumar, Paper P1-11, 2nd International Meeting on Information Display, Daegu, Korea, August 21 (2002).

“Layer Reorientational Dynamics Induced by an Applied Electric Fields in a Chiral Smectic Liquid Crystal,” J.-H. Song, H. Choi, Y.-B. Kim, S. Kumar, S.-T. Shin, Paper P-010, 5th Korean Liquid Crystal Conference, Chun Cheon, Korea, July 19-20, (2002).

“Dielectric Characteristics in Smectic Phase,” J.-H. Song, S. Choi, Y.-B. Kim, S. Kumar, J.-H. Souk, S.-T. Shin, Paper P-011, 5th Korean Liquid Crystal Conference, ChunCheon, Korea, July 19-20, (2002).

“The Study of Alignment and Layer Structure in a Banana Shaped Achiral Molecule,” J.-H. Song, H.-K. Kim<sup>1</sup>, T.-K. Lim, C.-K. Lee, Paper P-016, 5th Korean Liquid Crystal Conference, ChunCheon, Korea, July 19-20, (2002).

“Biaxial Nematic Phase Exhibited by Bent-Core Molecules,” B. R. Acharya, A. Primak, T. J. Dingemans, E.T. Samulski, P. Toledano, S. Kumar, Poster P559, 19th International Liquid Crystal Conference, Edinburgh, Scotland, June 30-July 5 (2002).

“Morphological Anisotropy and Relaxation Dynamics of Surface Modified Thin Films for LC Alignment,” D. M. Agra-Kooijman and S. Kumar, Poster P560, 19th International Liquid Crystal Conference, Edinburgh, Scotland, June 30-July 5 (2002).

“The Study of Alignment and Layer Structure in a Banana Shaped Achiral Molecule,” J.-H. Song, H.-K. Kim, T.-K. Lim, C.-K. Lee, E.-J. Choi, S. Kumar, and S.T. Shin, Poster P849, 19th International Liquid Crystal Conference, Edinburgh, Scotland, June 30-July 5 (2002).

“Smectic Layer Reorientation Induced by AC Field,” J.-H. Song, Y.-B. Kim, S. Kumar, and S.-T. Shin, Poster P848, 19th International Liquid Crystal Conference, Edinburgh, Scotland, June 30-July 5 (2002).

“Spatial Orientation of Azochromophores in the Azopolymer Films and its Correlations with LC Alignment,” Yu. Zakrevskyy, O. Yaroshchuk, J. Kelly, S. Kumar, L.-C. Chien, J. Lindau, Poster P875, 19th International Liquid Crystal Conference, Edinburgh, Scotland, June 30-July 5 (2002).

“Dynamics of the Nematic Phase of a Bent-Core Liquid Crystal,” S. Stojadinovic, A. Adorjan, S. Kumar, A. Jáklí, S. Sprunt, Poster P545, 19th International Liquid Crystal Conference, Edinburgh, Scotland, June 30-July 5 (2002).

## **Oleg D. Lavrentovich**

### Invited Talks and Seminars

“Characterization Facilities and Research,” presentation at Samsung Electronics, Seoul, Republic of Korea, March 20, 2003.

“3D Non-destructive Imaging of Orientational Order in Soft Matter by Fluorescence Confocal Microscopy,” Seminars in Interdisciplinary Chemistry and Physics, Institute for Physical Science and Technology, University of Maryland, March 12, 2003.

“Tilt Grain Boundaries, Dislocations and Focal Conic Domains in Lamellar Liquid Crystals,” Session V2: Connection between Geometry and Defects in Liquid Crystals, Invited presentation at the American Physical Society Meeting, March 1-6, Austin, Texas (2003).

“Fluorescence Confocal Polarizing Microscopy,” Conference on liquid crystals and other soft matter materials, Bangalore, India, Dec. 18-20 (2002).

“Dupin Cyclides and Defects in Liquid Crystals,” Department of Mathematics, Purdue University, October 15, 2002.

“Defects in Liquid Crystals,” Series of three lectures (1, Sept. 24, 2002) Experimental studies of Defects in Liquid Crystals; (2, Sept. 25, 2002) Defects in Nematics; (3, Sept. 26, 2002) Defects in Lamellar Phases; NATO Advanced Study Institute and COSLAB School on Patterns of Symmetry Breaking, Krakow, Poland, Sept. 15-30, 2002.

“Geometry and Defects in Lamellar Liquid Crystals,” Mini Symposium on Geometry in Soft Matter and Biological Physics, Society of Industrial and Applied Mathematics (SIAM) 50<sup>th</sup> Anniversary and 2002 Annual Meeting, Abstracts, p. 73, July 8-12, 2002, Philadelphia.

### Oral Presentations

“Three-dimensional Visualization of Defect Patterns in Cholesteric Liquid Crystals,” I.I. Smalyukh, S.V. Shiyankovskii and O.D. Lavrentovich, Oral presentation C21, 19<sup>th</sup> International Liquid Crystal Conference 2002, Edinburgh, UK, June 30-July 5, 2002.

### Poster Presentations

“Fast-switching Dual-frequency Nematic Cells,” A. Golovin, S. Shiyankovskii, and O.D. Lavrentovich, Gordon Research Conference on Liquid Crystals, Poster presentation, June 15-20, 2003, Colby-Sawyer College.

“Liquid Crystals for Biological Detection,” T. Schneider, I. Smalyukh, V. Nazarenko, O.D. Lavrentovich, G. Niehaus, K. Doane, C. Woolverton, Gordon Research Conference on Liquid Crystals, Poster presentation, June 15-20, 2003, Colby-Sawyer College.

“Nanostructured Lyotropic Chromonic Liquid Crystals,” H. Lui, T. Schneider, O.D. Lavrentovich, 19<sup>th</sup> Intl. Liq. Crystal Conf., Edinburgh, UK, 30 June-5 July, 2002.

“Tactoidal Droplets in Lyotropic Chromonic Liquid Crystalline Systems,” T. Schneider, O.D. Lavrentovich, 19<sup>th</sup> Intl. Liq. Crystal Conf., Edinburgh, UK, 30 June-5 July, 2002.

“Droplet Structure Transformation in Nematic Emulsion Under the Action of Magnetic Field,” B. Lev, A. Nych, U. Ognysta, D. Reznikov, V. Nazarenko, I. Smalyukh, O.D. Lavrentovich, 19<sup>th</sup> Intl. Liq. Crystal Conf., Edinburgh, UK, 30 June-5 July, 2002.

“<sup>2</sup>H-NMR Characterization of Liquid Crystalline Phases in Aqueous Disodium Cromoglycates,” P.W. Westerman, M. Malmer, T. Schneider, O.D. Lavrentovich, D. Finotello, 19th ILCC, Edinburgh, Scotland, July 2002.

### **Mary E. Neubert**

#### Invited Talks and Seminars

“Thirty Years of Organic Synthesis at the Liquid Crystal Institute,” Gordon Research Conference, June 15, 2003.

### **Peter Palffy-Muhoray**

#### Invited Talks and Seminars

“Lasing in Liquid Crystals,” Gordon Research Conference on Liquid Crystals, June 15, 2003.

“Mirrorless Lasing in Liquid Crystalline Photonic Bandgap Materials,” MRS Symposium, San Francisco, April 21-25, 2003.

“Swimming Towards the Dark: A Photophobic Light-Driven Elastomeric Swimmer,” Dept. of Physics, Case Western Reserve University, Cleveland, OH, April 14, 2003.

“The Dynamics of Phase Separation in Binary Liquid Crystal Mixtures,” Center for Scientific Computing, Simon Fraser University, Burnaby, Canada, April 4, 2003.

“Mirrorless Lasing in Liquid Crystalline Photonic Band Gap Materials,” Dept. of Physics, Miami University, Oxford, OH, Feb. 19, 2003.

“Muscles, Motors and Liquid Crystal Elastomers,” Dept. of Materials Science and Engineering, Cornell University, Ithaca, NY, Feb. 13, 2003.

“From Artificial Muscles to Lasers: Liquid Crystals in Science and Technology,” Dept. of Physics, Kenyon College, Gambier, OH, Feb. 8, 2003.

“Swimming Towards the Dark: a Photophobic Elastomeric Swimmer,” Dept. of Polymer Engineering, Univ. of Akron, Akron, OH, Dec. 6, 2002.

“Liquid Crystals as Photonic Band Gap Materials,” Courant Institute of Mathematical Sciences, New York University, NY, Oct. 17, 2002.

“Aspects of Display Related Liquid Crystal Research,” V Info Display, Campinas, Brazil, Sept. 18, 2002.

“Liquid Crystals as Photonic Band Gap Materials,” V Info Display, Campinas, Brazil, Sept 17, 2002.

#### Oral Presentations

“Swimming Towards the Dark: a Photophobic Light-driven Elastomeric Swimmer,” P. Palffy-Muhoray, M. Camacho-Lopez, H. Finkelmann, M. Shelley, American Physical Society March Meeting, March 3-7, 2003, Austin, Texas.

“Mirrorless Lasing in a 3-D Photonic Bandgap Material: Liquid Crystal Blue Phase II,” W. Cao, A. Munoz, P. Palffy-Muhoray, B. Taheri, American Physical Society March Meeting, March 3-7, 2003, Austin, Texas.

“Cholesteric Liquid Crystal Laser Coupled to Optical Fibers,” M. Moreira, I. Carvalho, L. Carlos Valente, P. Palffy-Muhoray, B. Taheri, A. Munoz, American Physical Society March Meeting, Austin, TX (2003).

“Brownian Motors in the Photoalignment of Liquid Crystals: Simulations,” P. Palffy-Muhoray, R. Ennis, T. Kosa, American Physical Society March Meeting, Austin, TX (2003).

“Lasing at Photonic Defect Modes of a Cholesteric Liquid Crystal,” W. Cao, T. Kosa, P. Palffy-Muhoray, B. Taheri, American Physical Society March Meeting, Austin, TX (2003).

“Modeling Phase Separation of Binary Liquid Crystalline Isotropic Fluids,” R. Ennis, P. Palffy-Muhoray, American Physical Society March Meeting, Austin, TX (2003).

### **John L. West**

#### Invited Talks and Seminars

“Creating Research Partnerships,” Keynote speaker for Celebration of Scholarship & Distinguished Scholar Awards, April 7, 2003, Kent State University.

“Higher Education and Economic Development: A Case Study,” Akron Round Table, August 14, 2002.

Seminar at Bowling Green University, December 4, 2002.

### **Deng-Ke Yang**

#### Invited Talks and Seminars

“Cholesteric Liquid Crystal Display Technologies,” Eastman Kodak, New York, June 2003.

“Light Shutters Based on Cholesteric Liquid Crystals,” Avery Dennison, California, June 2003.

“Modeling an E-Beam Addressed Liquid Crystal Projection Display,” Intl. Mtg. Info. Display IMID '02, Daegu, Korea, Aug. 2002.

“Optical Properties and Drive Schemes of Bistable Cholesteric Reflective Displays,” China Flat Panel Display Conference, Shenzheng, China, Dec. 2002.

“Recent Progress in Polymer Stabilized Cholesteric Liquid Crystal Displays,” Seoul National University, Korea, August 2002.

#### Oral Presentations

“Bistable Cholesteric Liquid Crystals,” DARPA Industrial Day, George Mason University, March 2003.

“Bistable Polymer Dispersed Cholesteric Reflective Display,” D.-K. Yang, Z.J. Lu, L.C. Chien, J.W. Doane, SID Conference, May 20, 2003, Baltimore MD.

“Wavelength Divided Trans-reflective Liquid Crystal Display,” F. Zhou, D.-K. Yang, *SID Intl. Digest Tech Papers* **34**, 82-85, SID Conference, May 20, 2003, Baltimore MD.

#### Poster Presentations

“Temperature Dependence of Pitch and Twist Elastic Constant in a Cholesteric-Smectic-A Transition,” Gordon Liquid Crystal Conference, New Hampshire, June 2003.

Table 13  
Other Activities

**David Allender**

Short course lecturer, “Liquid Crystals: Materials and Display Devices,” Kent State University, Liquid Crystal Institute, October 29-November 1, 2002.

**Philip J. Bos**

Short course chair and lecturer, “Liquid Crystals: Materials and Display Devices,” Kent State University, Liquid Crystal Institute, October 29-November 1, 2002.

Travel to Seoul, Korea to meet with Samsung to discuss collaboration, March 2003.

**L.C. Chien**

Organizing Committee, 1<sup>st</sup> World Congress on Biomimetics and Artificial Muscles, December, 2002, Albuquerque, NM.

Symposium chair, *Liquid Crystal Materials, Devices, and Applications IX*, International Society of Optical Engineering and Electronic Imaging Science and Technology Annual Meeting, Santa Clara, California, January 21-25, 2003.

Travel to Seoul, Korea to meet with Samsung to discuss collaboration, March 2003.

**Satyendra Kumar**

Travel to Seoul, Korea to meet with Samsung to discuss collaboration, March 2003.

Sabbatical: one month at the Institute Curie, Paris, France.

Two weeks at NASA Langley collaborating on polymer composites.

**Oleg D. Lavrentovich**

Attended Annual Black Physicists Conference in Atlanta, GA, February, 2003, as a recruiter for CPIP.

Travel to Seoul, Korea to meet with Samsung to discuss collaboration, March 2003.

Vice-Chair, Gordon Research Conference on Liquid Crystals, June 2003.

**John L. West**

Short course lecturer, “Liquid Crystals: Materials and Display Devices,” Kent State University, Liquid Crystal Institute, October 29-November 1, 2002.

Hong Kong Plastics & Mould Trade/Study Mission in USA and Canada, June 30, 2003.

Travel to Seoul, Korea to meet with Samsung to discuss collaboration, March 2003.

**Deng-Ke Yang**

Short course lecturer, “Liquid Crystals: Materials and Display Devices,” Kent State University, Liquid Crystal Institute, October 29-November 1, 2002.

## Table 14

### LCI Seminar Program 2002-2003

- Aug. 28 **Sebastian Rauch**  
Technical University, Berlin, Germany  
*Banana Shaped LC Compounds with Molecular Chirality and Glass Transitions*
- Sept. 3 **Professor C.L. Khetrpal**, Postgraduate Medical Research Institute  
*A Transition from Liquid Crystal NMR to Biochemical and Biomedical NMR*  
Interdisciplinary Seminar: Chemistry, Physics, LCI, Research and Grad.Studies
- Sept. 18 **Dr. Mary E. Neubert**  
Liquid Crystal Institute, Kent State University  
*What Has the Organic Synthesis Group Accomplished in 30 Years?*
- Oct. 9 **Drs. Laurence Kiernan, Oliver Petitpiere, Markus Hauser**  
European Patent Office  
*The European Patent Office*
- Oct. 16 **Dr. R. Pratibha**  
Raman Research Institute, Bangalore, India  
*Experimental Sstudies on Mixtures of Compounds Made of Rod-like and Bent-core Molecules*
- Nov. 6 **Dr. Ken Werner**  
President, Nutmeg Consultants; Ed., Information Display  
*The Path from SID 2002 to the Future*
- Nov. 13 **Greg Wilson**, Assoc. VP, Technology Transfer & Economic Development  
**Bill Fuller**, Technology Transfer Mgr; **Connie Hawke**, Assoc. University Counsel  
*Commercializing Innovation: Tech Transfer and IP 101*
- Nov. 20 **Dr. Warren Herman**  
Laboratory for Physical Sciences, College Park, MD  
*Chiral Optical Waveguides: Unique Polarization Properties and materials Issues*
- Jan. 15. **Prof. Phil Castellano**  
Chemistry Dept., Center for Photochemical Sciences, Bowling Green State Univ.  
*Photochemical Modulation of Luminescence in Metal-Organic Chromophores*
- Jan. 29 **Dr. Brian DiDonna**  
Department of Physics, University of Pennsylvania, Philadelphia  
*Smectic Phases with Cubic Symmetry: The Splay Analog of the Blue Phase*
- Feb. 5 **Prof. Alex Seed**  
Department of Chemistry, Kent State University  
*Recent Advances in the Chemistry of Ferroelectric Liquid Crystal Materials*
- Feb. 12 **Prof. Maurizio Nobili**  
Universite Montpellier II/CNRS, France  
*Disclination Dynamics in Nematic Liquid Crystals*
- Feb. 26 **Prof. R.K.P. Zia**  
Department of Physics, Virginia Polytechnic Institute and State Univ.  
*Non-equilibrium Statistical Mechanics: A Growing Frontier of "Pure and Applied" Theoretical Physics*

- March 12 **Prof. Jun Zhang**  
Department of Physics, Courant Institute, New York University  
*Playful Flexible Structures in Moving Fluid* (Joint Seminar with Physics)
- April 2 **Prof. Hui Cao**  
Department of Physics and Astronomy, Northwestern University  
*Lasing in Disordered Media*
- April 11 **Prof. Sajeev John**  
Department of Physics, University of Toronto  
*Photonic Band Gap Materials: Semiconductors of Light*
- April 30 **Prof. Carme Calderer**  
School of Mathematics, University of Minnesota  
*Mathematical Modeling of Ferroelectric Phase Transitions*  
(Joint seminar with Department of Math)
- May 7 **Prof. Daniel Phillips**  
Department of Mathematics, Purdue University  
*Some Analytic Aspects of Transitions in Liquid Crystals*
- May 16 **Prof. Shunsuke Kobayashi**  
Liquid Crystal Institute, Tokyo University of Science,  
*Fabrication and Characteristics of Defect-Free PS-V-mode FLC and Intrinsic FLC: Their Applications to Color Sequential Fullcolor LCDs*
- May 29 **Prof. Lachezar Komitov**  
Chalmers University, Göteborg, Sweden  
*Dynamic Anchoring of Liquid Crystals: Path to New Applications*

Table 15

ALCOM Industrial Partnership Program

Aerospace Display Systems	Hatfield PA
Agilent Technologies	Wilmington DE
AlphaMicron, Inc.	Kent OH
Avanex	Fremont CA
Avery Dennison Microreplication	Painesville OH
ChemImage, Inc.	Pittsburgh PA
CoAdna Photonics, Inc.	Stow OH
Company H (anonymous)	MN
Corning, Inc.	Corning NY
DCI, Inc.	Lenexa KS
Dow Corning	Midland MI
Dupont Company	Wilmington DE
Eastman Kodak Company	Rochester NY
Essilor of America	St. Petersburg FL
Gables Engineering	Coral Gables FL
GMA Industries, Inc.	Annapolis MD
Hana Microdisplay Technologies, Inc.	Twinsburg OH
Intel Corporation	Santa Clara CA
Kent Displays, Inc.	Kent OH
Kent Optronics Inc	Fishkill NY
LC-Tec, Inc.	Brunswick OH
Lucent Technologies, Bell Labs	Murray Hill NJ
LXD, Inc.	Cleveland OH
Motorola, Inc.	Schaumburg IL
Optiva, Inc.	San Francisco CA
Philips Flat Display Systems	Sunnyvale CA
Planar Systems, Inc.	Beaverton OR
Rockwell Science Center	Thousand Oaks CA
Rohm and Haas Company	Bristol PA
Scientific Solutions, Inc.	North Chelmsford MA
SpectraSwitch	Santa Rosa CA
Sunnybrook & Women's College	North York, Ontario CAN
Three Five Systems	Tempe AZ
Trivium Technologies, Inc.	Westlake OH
VDC Display Systems	Cape Canaveral FL



**Table 16**  
**Resource Facility Services**

<b><u>Invoice Date</u></b>	<b><u>Type</u></b>	<b><u>Client</u></b>
7/8/02	Electron microscopy of fiber optics	VDC Display Systems
7/17/02	UV/Visible Spectroscopy	Hana Microdisplay
7/17/02	Cleanroom use	Viztec
7/17/02	ITO deposition; cleanroom training	ChemIcon
7/17/02	Test cell preparation; cleanroom training	Intel
7/17/02	Cell fabrication	Trivium Technologies
7/17/02	Cell fabrication	LSA
7/18/02	Cleanroom use	CoAdna Photonics
7/19/02	Cleanroom use	AlphaMicron
7/19/02	Use of laser repair station	Kent Displays
7/19/02	Synthesis	Swarthmore College
8/21/02	Synthesis	Viztec
8/23/02	Gold sputtering	Hana Microdisplay
8/29/02	Cleanroom use; office and lab rental	Viztec
9/9/02	Cleanroom use	CoAdna Photonics
9/16/02	Pretilt angle measurement	Corning
9/16/02	Cleanroom training; device fabrication	Gables Engineering
10/28/02	Cleanroom use	CoAdna Photonics
11/12/02	Cleanroom use	CoAdna Photonics
11/19/02	Liquid crystal material	Photon-X
11/19/02	Cleanroom use	LC Technologies
12/16/02	Computation time on Beowolf Cluster	Dimension Technologies
12/16/02	Pretilt angle measurement	Philips Research
1/6/03	Miscibility studies of reactive monomers	Rockwell Scientific
1/8/03	Cleanroom use	CoAdna Photonics
1/8/03	Cleanroom use and technician time	VDC Display Systems
1/8/03	Cleanroom use	Scientific Solutions
1/14/03	Laser repair station use	Kent Displays
1/14/03	Pretilt angle measurements; polarizing microscopy inspection	Aerospace Display Systems
1/27/03	Simulation Software	Tosoh Corporation
3/28/03	Cleanroom use	CoAdna Photonics
4/9/03	Polarizing microscopy characterization	Innis Maggiore Group
5/7/03	Cleanroom use	CoAdna Photonics
6/6/03	Photolithography and device assembly	Optiva
6/9/03	Cleanroom use	Avanex
6/11/03	Matlab program; consulting	LXD
6/12/03	Cleanroom use	CoAdna Photonics
6/17/03	Photolithography and device assembly	Optiva
6/23/03	Test cell assembly	Compro Services
6/24/03	Develop nematic discotic reactive monomer	Rockwell

Table 17

Education and Public Service

**Student Intern Program**

Five college students from California Polytechnic State University in San Luis Obispo and one KSU undergraduate student (Jonathan Heflin) participated in the Summer Student Intern program at the Liquid Crystal Institute during Summer, 2002.

<u>Student</u>	<u>Project Title</u>	<u>Advisor</u>
Jacob Fontana	Characterizing the solvability of dichroic dyes in liquid crystals	Bahman Taheri (at AlphaMicron, Inc.)
Ryan Grams	Electric field-induced birefringence of liquid crystals and its applications in photonics	Peter Palffy-Muhoray
Jason Morgan	Liquid crystal and colloidal crystal fibers	Antal Jákli
Carol Moya	Computer interfacing and nonlinear dynamics	Bahman Taheri
Ryan Nosler	Liquid crystalline photonic band gap materials	Peter Palffy-Muhoray and Bahman Taheri
Jonathan Heflin	Rheology (shear-thinning) of lyotropic chromonic materials and dispersion of nano/micro-particles of various sizes, charge and anchoring interactions in a lyotropic chromonic LC	Oleg Lavrentovich

**NSF REU Program**

Linda Williams, University of Wisconsin, worked with Prof. Oleg D. Lavrentovich on molecular modeling of lyotropic chromonic liquid crystals (Summer 2003).

Dale Kimbrough, Kent State University, examined various polymers, block-copolymers and surfactants as alignment layers for lyotropic chromonic materials with Prof. Oleg D. Lavrentovich (Summer 2002).

**K-12 Education**

Nadine Abraham, a junior at Western Reserve Academy in Hudson, Ohio, collaborated with Professor Peter Palffy-Muhoray to conduct research on previously unused sources of energy to a device called a dunking bird (see LCI Highlights, page 9).

**Short Courses and Workshops**

Cleanroom Training: *Developing Cleanroom Skills for the 21<sup>st</sup> Century*; 55 participants from Bhem Quartz, Diagnostic Hybrids, and Hana Microdisplay Technologies.

Short Course: *Liquid Crystals: Materials and Display Devices*, October 29-November 1, 2002; 31 participants from universities and industry.

## APPENDICES

### I. Outreach Activities

Cleanroom Training  
Industrial Partnership Program  
Liquid Crystal Short Course  
Technology Transfer

### II. Doctoral Dissertations on Liquid Crystals 1967 – 2003



## Cleanroom Training

*Developing Cleanroom Skills for the 21<sup>st</sup> Century*  
Coordinated through the College of Continuing Studies



## **Industrial Partnership Program**

Providing scientific expertise and services to the liquid crystal industry





## Short Course

*Liquid Crystals: Materials and Display Devices*  
October 29 - November 1, 2002



## Technology Transfer

Transferring liquid crystal technology from the  
research laboratories to the marketplace



## Appendix II

### DOCTORAL DISSERTATIONS ON LIQUID CRYSTALS

Date	Name, Title of Dissertation	Advisor	Department
1967	<b>GULRICH, LESLIE</b> X-Ray Diffraction Studies of the Nematic Structure of p-methoxybenzylidene p'-cyanoaniline * DuPont	<u>Brown</u>	<u>Chemistry</u>
1970	<b>WILLEY, DAVID</b> The Thermodynamics of Dilute Solutions using Selected Liquid Crystalline Solvents * Industry, Akron	<u>Brown</u>	<u>Chemistry</u>
1972	<b>LEE, Y.S.</b> An Ultrasonic Shear Wave Study of the Mechanical Properties of a Nematic Liquid Crystal * Industry, Taiwan	<u>Brown</u>	<u>Chemistry</u>
1972	<b>LESSER, DAVID</b> Crystal Structure Analysis of X-Ray of 2,2'-Dibromo-4,4'-bis-(p-methoxybenzylideneamino) Biphenyl *	<u>Brown</u>	<u>Chemistry</u>
August 1972	<b>HSU, Y.Y.</b> Studies of Liquid Crystals: Part I - Synthesis and Characterization of Selectively Deuterated Compounds with Mesomorphic Properties; Part II - Synthesis of Novel Schiffs Bore Compounds and the Investigation of Binary Systems with Nemorphic Properties * Consultant, California	<u>Fishel</u>	<u>Chemistry</u>
December 1972	<b>WILSON, JACK</b> Mossbauer Effect in a Smectic Liquid Crystal * Retired	<u>Uhrich</u>	<u>Physics</u>
March 1973	<b>VISINTAINER, JAMES</b> Spin-Lattice Relaxation in the Nematic Liquid Crystalline Phase * Research Scientist, Goodyear Tire and Rubber Co., Akron, Ohio	<u>Doane</u>	<u>Physics</u>
March 1973	<b>WISE, RAYMOND</b> A Nuclear Magnetic Resonance Study of Smectic C Liquid Crystals * Retired	<u>Doane</u>	<u>Physics</u>
June 1973	<b>FELLNER, HANS G.</b> Light Scattering from Liquid Crystals * Professor, Slippery Rock University, PA	<u>Franklin/Christensen</u>	<u>Physics</u>

Doctoral Dissertations, 1967-2003

Date	Name, Title of Dissertation	Advisor/Department
August 1973	<b>DETJEN, ROBERT E.</b> A Mossbauer Investigation of the Lattice Dynamics of the Smectic Liquid Crystalline State *	<u>Uhrich</u> <u>Physics</u>
August 1973	<b>KESS, SHARON</b> The Photostatistics of Brillouin Scattering by a Liquid Crystal * IBM Corp., R&D, Vermont	<u>Franklin</u> <u>Physics</u>
August 1973	<b>MURPHY, JOHN A.</b> NMR Pulsed Gradient Studies of Diffusion in Liquid Crystals * Keithley Instruments, Solon, Ohio	<u>Doane</u> <u>Physics</u>
December 1973	<b>NANDY, PAPIYA SENGUPTA</b> Theoretical Studies of the Electrohydrodynamic Instabilities in Nematic Liquid Crystals * Instructor of Physics, Jadavpur University	<u>Saupe</u> <u>Physics</u>
March 1974	<b>SCHENZ, ANNE FILLER</b> Optical and Faraday Studies of Liquid Crystals * General Foods, White Plains, NY	<u>Neff</u> <u>Chemistry</u>
June 1974	<b>CHU, KWO-SUN</b> Theories of Intermolecular Potential and Molecular Diffusion in the Mesophases of Liquid Crystalline Systems * Retired (NY)	<u>Moroi</u> <u>Physics</u>
June 1974	<b>CHUNG, DAVID BUU-VINH</b> An X-Ray Study of the Crystal Structure and the Smectic E Structure of a Smectogenic Liquid Crystal -- Di-n-Propyl-p-terphenyl-4,4"-carboxylate * Research Scientist, Intel Corp., Santa Clara, CA	<u>Brown</u> <u>Chemistry</u>
December 1974	<b>CHIN, JOHN S.H.</b> The Effect of Compressibility on the Thermodynamic Properties of Liquid Crystals *	<u>Neff</u> <u>Chemistry</u>
June 1975	<b>PHOTINOS, PANAGIOTIS J.</b> Mean Field Study of the Formation of Uniaxial Smectic Liquid Crystals with Polarized Layers * Professor and Chair, Dept. of Physics, Southern Oregon State University, Ashland, OR	<u>Saupe</u> <u>Physics</u>
December 1975	<b>BERMAN, ARTHUR L.</b> Optical Studies of Electric Field Effects in Nematic Liquid Crystals That Have Some Smectic Ordering * Optical Shields Corp., Menlo Park CA	<u>Gelerinter</u> <u>Physics</u>

Doctoral Dissertations, 1967-2003

Date	Name, Title of Dissertation	Advisor/Department
June 1976	<b>AIMIUWU, VICTOR Q.</b> Fe-57 Mossbauer Study of Four Ferrocene Derivatives in a Smectic B Liquid Crystalline Glass *	<u>Uhrich</u> <u>Physics</u>
August 1976	<b>MORITZ, ELAN</b> A Class of Nonlinear Electrohydrodynamic Effects in a Nematic Liquid Crystal * Research Scientist, US Naval Coastal Systems, Panama City FL	<u>Franklin</u> <u>Physics</u>
December 1976	<b>FLICK, CATHERINE M.</b> An Electron Paramagnetic Resonance Study of the Action of Selected Polyene Antibiotics on Lipid Planar Multibilayers (Model Membranes) * John Wollman Enterprises, Indiana	<u>Gelerinter</u> <u>Physics</u>
December 1976	<b>UKLEJA, PAUL</b> Spin-Lattice Relaxation and Director Fluctuations in Nematic Liquid Crystals * Professor, University of Massachusetts at Dartmouth	<u>Doane</u> <u>Physics</u>
June 1978	<b>BOS, PHILIP J.</b> NMR Studies of Orientational Order in the Smectic C Liquid Crystalline Phase * Professor, Chemical Physics Program, Kent State University	<u>Doane</u> <u>Physics</u>
June 1978	<b>D'SIDOCKY, RICHARD</b> Investigations of Liquid Crystals: Part I. The Effect of Terminal Substituent Branching on Mesogenic Behavior of Phenyl Benzoates. Part II. Synthesis of Novel Organotin Compounds Exhibiting Liquid Crystalline Behavior * Resarch Scientist, Goodyear Tire and Rubber Co., Akron, Ohio	<u>Fishel</u> <u>Chemistry</u>
August 1978	<b>LAPRICE, WALTER J.</b> Iron-57 Mossbauer Temperature Study of Nematic, Smectic B and Smectic H Liquid Crystalline Glasses * Materials Engineer, Westinghouse, Pittsburgh, PA	<u>Uhrich</u> <u>Physics</u>
December 1978	<b>BRISBIN, DOUGLAS J.</b> Divergence of the Bend Curvature Coefficient above the Nematic-Smectic A Phase Transition: Freedericksz Transition * Research Scientist, General Dynamics Corp., Los Angeles, CA	<u>Johnson</u> <u>Physics</u>
December 1978	<b>MAJOROS, STEPHEN J.</b> A Test of Curvature Elasticity Above the Nematic-Smectic A Phase Transition * Lorrain Co. Community College, Elyria OH	<u>Johnson</u> <u>Physics</u>
June 1979	<b>GRADDICK, WILLIAM</b> The Effect of Calcium on the Thermotropic Phase Behavior of Dipalmitol Phosphatidylcholine (DPPC) Multilayers *	<u>Spielberg</u> <u>Physics</u>

Doctoral Dissertations, 1967-2003

Date	Name, Title of Dissertation	Advisor/Department
June 1980	<b>NAIKSATAM, PRAKASH</b> Structure-Property Relationships of Thermotropic Liquid Crystals * Brookhaven National Lab	<u>Fishel</u> <u>Chemistry</u>
August 1980	<b>BAGINSKI, GERARD H.</b> Proton Magnetic Resonance Study on Iron bis(cyclopentadienyl) in Nematic Solutions *	<u>Saupe</u> <u>Physics</u>
August 1980	<b>EKACHAI, ARUN</b> X-Ray and Optical Studies of Several Smectic Phases * Lecturer, Prince of Songkla University, Thailand	<u>Spielbertg/deVries</u> <u>Physics</u>
August 1980	<b>SETHNA, VIJAY N.</b> X-Ray Diffraction Studies of the Skewed Cybotactic Nematic Phases * Industrial Scientist, Kaiser Electronics, San Jose, CA	<u>Spielberg/deVries</u> <u>Physics</u>
August 1980	<b>VAZ, NUNO A.</b> Nuclear Magnetic Resonance Studies of Orientational Order in Lyotropic Liquid Crystals * Research Scientist, General Motors, Warren, Michigan	<u>Doane</u> <u>Physics</u>
December 1980	<b>DEHOFF, RICHARD J.</b> Specific Heat in the Vicinity of a Nematic-Smectic A-Smectic C Multicritical Point * Research Scientist, Tektronix, Inc., Beaverton OR	<u>Johnson</u> <u>Physics</u>
December 1980	<b>HAVEN, THOMAS J.</b> Elastic and Viscous Properties of Nematic Systems in Aqueous Decylammonium Chloride Solutions * Research Scientist, Sarif, Vancouver, Washington	<u>Saupe</u> <u>Physics</u>
December 1980	<b>RICHARDS, BERNARD L.</b> Rotational Diffusion in Nematic Liquid Crystals * Assistant Professor, Stark Campus, Kent State University	<u>Moroi</u> <u>Physics</u>
May 1981	<b>LOCKHART, THOMAS E.</b> Indices of Refraction at Smectic A-Smectic C Phase Transitions * Associate Professor, University of Wisconsin, Eau Claire	<u>Gelerinter</u> <u>Physics</u>
August 1981	<b>KTORIDES, PETROS</b> Mossbauer Study of the Smectic Liquid Crystalline Glass Phase Using Sn-bearing Molecules * Teaching, Cyprus	<u>Uhrich</u> <u>Physics</u>
December 1981	<b>KUZMA, MICHAEL R.</b> Mean Field Study of Molecular Tilt in Uniaxial Liquid Crystalline Phases * Real Estate, Philadelphia	<u>Allender/Johnson</u> <u>Physics</u>



Doctoral Dissertations, 1967-2003

Date	Name, Title of Dissertation	Advisor	Department
December 1981	<p><b>VAZ, MARIA J.</b>                      Orientational Order in Phospholipid, Cholesterol-Phospholipid, and Protein-Phospholipid Bilayer Membranes: A DMR Study                      * Professor, Lawrence Technical University, Detroit MI</p>	<u>Doane</u>	<u>Physics</u>
June 1982	<p><b>SHARMA, BRIJ B.</b>                      Proton Magnetic Resonance in Nematic Solvents: Orientation and Structure of Anthraquinone Derivatives and a Linewidth Analysis of Benzene Spectrum                      * Research Scientist, Bell Communications, Piscataway, NJ</p>	<u>Saupe</u>	<u>Physics</u>
June 1982	<p><b>SHETTY, ANIL N.</b>                      Molecular and Segmental Orientational Order in Thermotropic Liquid Crystals: An NMR Study                      * Scientist, Imaging Center, William Beaumont Hospital, Royal Oak, MI</p>	<u>Doane</u>	<u>Physics</u>
June 1982	<p><b>SHIH, LIH-BIN</b>                      Laser Light Scattering of Surface Fluctuations of Liquid Crystals                      * Research Scientist, S.C. Johnson, Racine, WI</p>	<u>Brown</u>	<u>Chemistry</u>
December 1982	<p><b>YANIV, ZVI</b>                      A Deuterium Magnetic Resonance Study of Biaxial Ordering and Self-Diffusion in Chiral Nematic and Smectic Phases                      * President, SI Diamond Technology, Austin TX</p>	<u>Doane</u>	<u>Physics</u>
May 1983	<p><b>TODOROFF, DOUGLAS G.</b>                      Sn-119 Mossbauer Investigation of Different Sn-Bearing Molecules in Nematic and Smectic Glasses                      * Research Scientist, US Naval Coastal Systems, Panama City FL</p>	<u>Uhrich</u>	<u>Physics</u>
August 1983	<p><b>BENIGNI, SAMUEL P.</b>                      An X-Ray Study on the Thermal Behavior of Potassium-Palmitate-Water Mixtures                      * Staff Scientist, RCA, Inc., Lancaster PA</p>	<u>Spielberg</u>	<u>Physics</u>
December 1983	<p><b>BIGGERS, RAND R.</b>                      Thermal Properties Near the Nematic-Smectic A Tricritical Point                      * Research Scientist, Wright Patterson AFB, Ohio</p>	<u>Johnson</u>	<u>Physics</u>
December 1983	<p><b>BOONBRAHM, POONPONG</b>                      Optical Studies on Micellar Nematics and on Phase Transitions Between Nematic States                      * Lecturer, Prince of Songkla University, Thailand</p>	<u>Saupe</u>	<u>Physics</u>
December 1983	<p><b>GOODEN, CLARENCE E.</b>                      Light Scattering and Magnetic Deformation Study of the Nematic-Smectic A Transition                      * Research Scientist, Eglin Air Force Base, Fort Walton Beach, FL</p>	<u>Johnson</u>	<u>Physics</u>

Doctoral Dissertations, 1967-2003

Date	Name, Title of Dissertation	Advisor/Department
December 1983	<b>MAHMOOD, RIZWAN</b> Director Elasticity Above the Nematic-Smectic A Transition * Associate Professor, Slippery Rock University, PA	<u>Johnson</u> <u>Physics</u>
December 1983	<b>ROTH, ROBERT A.</b> Theoretical Studies on the Dielectric Permittivity of Liquid Crystals with Application to Alkylazoxybenzene Derivatives * Research Scientist, US Air Force, Dayton, Ohio	<u>Saupe</u> <u>Physics</u>
December 1983	<b>STEFANOV, MICHAEL E.</b> Physical Properties of Nematic Decylammonium Chloride/Ammonium Chloride/Water Systems *	<u>Saupe</u> <u>Physics</u>
May 1984	<b>STRENK, LAWRENCE M.</b> A Deuterium NMR Study of Orientational Order and Spatial Modulation in Phosphatidyl Choline Bilayers Including Those Containing Cholesterol and Protein * Pres. and CEO, Strenk Scientific Consultants, Inc., Middleburg Heights, Ohio	<u>Doane</u> <u>Physics</u>
August 1984	<b>MARANDE, ROBERT P.</b> Iron-57 Mossbauer Temperature Study of Smectic A., Smectic B and Smectic C Liquid Crystalline Glasses * Assistant Professor, Behrend College, Erie, PA	<u>Uhrich</u> <u>Physics</u>
December 1984	<b>HAFIZ, NAJMA</b> Nematic Phases in Liquid Crystals: Theory of Uniaxiality and Biaxiality and an NMR Study of Reentrants *	<u>Allender/Doane</u> <u>Physics</u>
May 1985	<b>RAHMAN, JOLLY A.</b> The Development of Some Molecular Models for Smectic A Phases * Research Scientist, Tektronix, Inc., Beaverton, OR	<u>deVries/Spielberg</u> <u>Physics</u>
May 1985	<b>SPIELBERG, JOHANAN</b> An EPR Study of Glass-Forming Liquids and Liquid Crystals *	<u>Gelerinter</u> <u>Physics</u>
August 1985	<b>HENDERSON, GIRARDEAU L.</b> Phenomena at the Isotropic - Nematic Transition Induced by Surface Order * Research Scientist, US Naval Coastal Systems, Panama City, FL	<u>Allender</u> <u>Physics</u>
August 1985	<b>LIU, HSING-CHUNG</b> Analysis of the X-Ray Diffraction Pattern of the Skewed Cybotactic Nematic Phase of p-n-Octyloxybenzoic Acid *	<u>deVries/Spielberg</u> <u>Physics</u>

Doctoral Dissertations, 1967-2003

Date	Name, Title of Dissertation	Advisor/Department
August 1985	<b>VLACHOPOULOS, PETROS</b> Theoretical Studies of Local Orientational Order in Cholesterics and Cholesteric Liquid Crystal Mixtures *	<u>Lee</u> <u>Physics</u>
December 1985	<b>MOTTAKABBIR, KAZI A.</b> Quantum Simulations of the Ground State of the One-Dimensional Hubbard Model * Postdoctoral Fellow, University of Texas, Austin	<u>Lee</u> <u>Physics</u>
May 1986	<b>WU, BAO-GANG</b> Deuterium NMR of Asymmetric Motion and Molecular Ordering in Liquid Crystals and Microdroplet Controlled Scattering in Display Applications * R&D Scientist, Advanced Display Systems, Amarillo, TX	<u>Doane</u> <u>Physics</u>
August 1986	<b>LEE, YOUNG-HEE</b> Classical and Quantum Computer Simulation Studies: Molecular Dynamics of the Kerr Effect in Carbon di-sulfide in Green's Function Monte Carlo Calculations of the Electronic Correlation Energy in Atoms * Assistant Professor, Physics, Jeonbug National University, Korea	<u>Lee</u> <u>Physics</u>
December 1986	<b>CUNNINGHAM, BETH A.</b> The Influence of Monovalent Ions on Dipalmitoylphosphatidyl-choline Bilayer Structure and Packing * Assistant Professor of Physics, Bucknell University, Lewisburg, PA	<u>Lis/Doane</u> <u>Physics</u>
May 1987	<b>KHAN, IQBAL</b> Director Dynamics Above Nematic-Smectic (A,C) Transitions * Scientist, Textile Institute of Pakistan	<u>Johnson</u> <u>Physics</u>
August 1987	<b>FIGUEIRINHAS, JOAO</b> A Deuterium Nuclear Magnetic Resonance Study of the SF Phase * Scientist, Centro de Fisica da Materia Condensada, Lisbon, Portugal	<u>Doane</u> <u>Physics</u>
August 1987	<b>LEWIS, MICHAEL E.</b> A Mode 1 Light Scattering Study of the Smectic-A Phase Near the NA Transition: Critical Behavior of the Layer Dilatation Elastic Coefficient * Lewis Consulting, Akron, Ohio	<u>Johnson</u> <u>Physics</u>
August 1987	<b>ZHOU, E</b> Curvature Elasticity of the Micellar Nematics * Lecturer, Beijing University, China	<u>Saupe</u> <u>Physics</u>
December 1987	<b>GOLEMME, ATTILIO</b> Nuclear Magnetic Resonance of Polymer Dispersed Liquid Crystals * Research Scientist, Dept. of Chemistry, Unviersity of Calabria, Rende, Italy	<u>Doane</u> <u>Physics</u>

Doctoral Dissertations, 1967-2003

Date	Name, Title of Dissertation	Advisor/Department
December 1987	<b>KLEMM, STEFAN</b> Quantum Simulation of Polyene Ground States * Postdoctoral Fellow, University of Notre Dame, Notre Dame, IN	<u>Lee</u> <u>Physics</u>
December 1987	<b>MELNIK, GEORGE</b> Critical Properties of Phase Transitions in Micellar Nematics in Microscopic Textures of Micellar Cholesterics * North American Phillips Corp., Briarcliff Manor, NY	<u>Saupe</u> <u>Physics</u>
August 1988	<b>PHONPHOK, NASON</b> Effects of Anesthetic Membrane Solutes on Orientational Order in Lecithin Bilayer Membranes: An NMR Study * Lecturer, Chulalongkorn University, Bangkok, Thailand	<u>Westerman/Doane</u> <u>Physics</u>
May 1989 <u>Physics/UBC</u>	<b>FRISKEN, BARBARA J.</b> Nematic Liquid Crystals in Electric and Nematic Fields * Assistant Professor of Physics, Simon Fraser University, Vancouver, BC, Canada	<u>Palfy-Muhoray</u>
May 1989	<b>RISSER, STEVEN</b> Model Hamiltonian Calculations of the Nonlinear Polarizabilities of Conjugated Molecules * Texas A&M, Commerce, TX	<u>Lee</u> <u>Physics</u>
August 1989	<b>WHITEHEAD JR., JOE B.</b> Light Scattering from Polymer Dispersed Liquid Crystals * Associate Professor of Physics, University of Southern Mississippi, Hattiesburg, MS	<u>Doane</u> <u>Physics</u>
December 1989	<b>VITHANA, HEMASIRI</b> Light Scattering and Magnetic Field Deformation Study Near the Nematic-Smectic A Phase Transition: Critical Behavior of Twist and Bend Elastic Coefficients * Research Scientist, Reveo, Hawthorne, NY	<u>Johnson</u> <u>Physics</u>
May 1990	<b>ERDMANN, JOHN H.</b> Electro-Optic Response of Polymer-Dispersed Liquid Crystals * Hana Microdisplay Technologies, Inc., Twinsburg, OH	<u>Doane</u> <u>Physics</u>
May 1990	<b>LEE, JONG-CHEON</b> Theoretical and Experimental Study of the Homeotropic Surface Effect on the Cholesteric-Nematic Phase Transition of a Compensated Mixture * Research Scientist, Samsung Corporation, Seoul, Korea	<u>Allender/Neff</u> <u>Physics</u>
May 1990	<b>PLUMLEY, SULAKSHANA</b> Elasticity and Dynamic Properties of Ionic Micellar Mixtures *	<u>Saupe</u> <u>Physics</u>

Doctoral Dissertations, 1967-2003

Date	Name, Title of Dissertation	Advisor/Department
December 1990	<b>SUBRAMANIAM, RAVI</b> Quantum Simulations of the Ground State Electronic Structure of Diatomic Molecules * Research Fellow, University of Pittsburgh	<u>Lee</u> <u>Physics</u>
December 1990	<b>SUBRAMANYAM, SUNDAR</b> Liquid Crystals Containing the Dibenzopyran Nucleus: Synthesis and Mesomorphic Properties of 3-(4-n-Alkoxybenzylidene-amino) Dibenzo[b,d]Pyran * Research Fellow, University of Lowell	<u>Fishel</u> <u>Chemistry</u>
May 1991	<b>BOYD, DARWIN</b> Mossbauer Studies of Some 1. Iron(III) Spin Crossover Systems and 2. A Cold Cholesteric Liquid Crystal * Assistant Professor of Technology, Kent State University, Kent, OH	<u>Uhrich</u> <u>Physics</u>
May 1991	<b>GLEESON, JAMES L.</b> Instabilities During Directional Solidification of a Transparent Material * Associate Professor, Dept. of Physics, Kent State University, Kent, Ohio	<u>Palfy-Muhoray</u> <u>Physics</u>
August 1991	<b>SARKAR, MOINUDDIN</b> X-Ray Study of Some Columnar Thermotropic Mesophases * Assistant Professor of Physics, Tennessee State University, Nashville, TN	<u>Spielberg</u> <u>Physics</u>
August 1991	<b>SU, WEN-CHEN</b> Part 1. Novel Syntheses of Substituted 6H-D(b,d) Pyrans by Pschorr Cyclization; Part 2. Synthesis and Studies of Mesomorphic Compounds Derived from 3-Amino and 3-Hydroxy-6H-D(b,d) Pyrans * Avery Dennison, Pasadena, CA	<u>Fishel</u> <u>Chemistry</u>
December 1991	<b>CHEN, LI</b> High-Resolution X-Ray Diffraction Studies of the Nematic to Smectic-A Phase Transition and the Frustrated Smectic A Phase *	<u>Kumar</u> <u>Physics</u>
December 1991	<b>CRAWFORD, GREGORY P.</b> Nematic Liquid Crystals Confined to Cylindrical Cavities: A 2H-NMR Study * Assistant Professor of Engineering, Brown University	<u>Doane</u> <u>Physics</u>
December 1991	<b>LIU, JIMING</b> Line Defects in Biaxial Nematics and Critical Properties of Nematic-Isotropic Transitions Near the Landau Point * Computer Scientist, Pittsburgh, PA	<u>Saupe</u> <u>Physics</u>
December 1991	<b>YUAN, HAJI (JIM)</b> Nonlinear Optical Properties of Liquid Crystals * CoAdna Photonics, Inc., San Jose, CA	<u>Palfy-Muhoray</u> <u>Physics</u>

Doctoral Dissertations, 1967-2003

Date	Name, Title of Dissertation	Advisor/Department
May 1992	<b>KIM, JAE YON</b> Phase Separation Kinetics of Binary Liquid Crystal Polymer Mixtures * Research Scientist, Samsung Corp., Seoul, Korea	<u>Palffy-Muhoray</u> <u>Physics</u>
August 1992	<b>SEEKOLA, DESMOND</b> Dielectric Response of Polymer Dispersed Liquid Crystalline Films * SpectraSwitch, Inc., Santa Rosa, CA	<u>Kelly</u> <u>Physics</u>
December 1992	<b>LIN, HEFEN</b> Optical Fibers with Liquid Crystalline Cores * Philips Flat Displays, San Jose, CA	<u>Palffy-Muhoray</u> <u>Physics</u>
December 1992	<b>NAGVEKHAR, DEVDATT</b> Novel Mesomorphic Systems Based on Heteromethylene Bridged Biphenyls * Postdoctoral Fellow, Virginia Tech., Blacksburg, VA	<u>Fishel</u> <u>Chemistry</u>
May 1993	<b>KIM, DU RIM</b> Effects of Polymers in the Rotational Viscosity of Nematic Liquid Crystals and Dynamics of Field Alignment * Instructor, Kangwon National University, Korea	<u>Saupe</u> <u>Physics</u>
May 1993	<b>PATEL, PREM L.</b> High-Resolution X-Ray Diffraction Study of Frustrated Smectics * Private Enterprise, Philadelphia, PA	<u>Kumar</u> <u>Physics</u>
August 1993	<b>AMARASINGHE, NANDANA</b> Iterative Solutions to Nonlinear Wave Equation in a X(2) Medium and Permittivity Gradient Induced Polarization and Second Harmonic Generation in Inhomogeneous Media * Staff Scientist, SpectraSwitch, Santa Rosa CA	<u>Moroi</u> <u>Physics</u>
August 1993	<b>ONDRIS-CRAWFORD, RENATE</b> The Effect of Molecular Anchoring and Curvature on Confined Nematic Liquid Crystals * University of Massachusetts at Dartmouth	<u>Doane</u> <u>Physics</u>
December 1993	<b>FREDLEY, DAVID S.</b> Phase Behavior and Electro-Optics of Dispersions of Polymers and Low Molecular Weight Liquid Crystals * Research Scientist, Motorola, Ft. Lauderdale, FL	<u>West</u> <u>Chemical-Physics</u>
December 1993	<b>IANNACCHIONE, GERMANO S.</b> AC Calorimetric Study of Liquid Crystal Phase Transitions and Restrictive Geometries * Asst. Professor, Brandeis University, Waltham, MA	<u>Finotello</u> <u>Physics</u>

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Date	Name, Title of Dissertation	Advisor/Department
May 1994	<b>SHIN, SUNG-TAE</b> Calorimetric and X-Ray Diffraction Studies of Phase Transitions in Lyotropic Liquid Crystals * Faculty, Korea University	<u>Kumar</u> <u>Physics</u>
December 1994	<b>ABEGUNARATHNA, SUGATH</b> Dielectric Properties of Liquid Crystals: Polymer Dispersions and Chiral Smectic Phases * Unknown	<u>Saupe</u> <u>Physics</u>
December 1994	<b>CULL, BRIAN C.</b> High Resolution X-Ray Reflectivity Studies of Ordering in Liquid Crystal and Polymer Thin Films * Research Scientist, 3M Corporation, Minneapolis, MN	<u>Kumar</u> <u>Physics</u>
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December 1994	<b>LEE, SEUNGHEE</b> Paramagnetic Resonance (epr) Studies of Glass-Forming Polymers and Liquid Crystal Polymers * Chonbuk National University, Korea	<u>Gelerinter</u> <u>Physics</u>
December 1994	<b>LEE, SUNG HEE</b> Molecular Dynamics of Glass-Forming Polymer, Plasticized Polymers and Liquid Crystal Polymers: An Electron Paramagnetic Study * Applications Engineer, Hyundai Corp., Korea	<u>Gelerinter</u> <u>Physics</u>
December 1994	<b>LI, JIANLIN</b> Determination of Surface Anchoring of Nematic Liquid Crystals from Optical Response Measurements * Polytronix, Inc., Richardson, TX	<u>Palfy-Muhoray</u> <u>Physics</u>
December 1994	<b>PAK, SUNGSIK</b> The Effects of Polyethylene Oxide on Curvature, Elasticity and Viscosity of Micellar Nematic Cesium Perfluoro-Octanoate Water Mixtures *	<u>Saupe</u> <u>Physics</u>
May 1995	<b>KOTHEKAR, NATASHA</b> Modeling and Numerical Analysis of Surface Effects and Critical Phenomena in Nematic Liquid Crystals *	<u>Allender</u> <u>Physics</u>
May 1995	<b>MANG, JOSEPH T.</b> High Resolution X-Ray and Small Angle Neutron Scattering Studies of Liquid Crystal Structure * Postdoctoral Fellow, Los Alamos National Lab, NM	<u>Kumar</u> <u>Physics</u>

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Date	Name, Title of Dissertation	Advisor/Department
August 1995	<b>DAI, SONG</b> X-ray Studies of Phase Transitions and Structures of Some Columnar Liquid Crystals * Research Specialist, Alltristar Corp., Mogadore OH	<u>Spielberg</u> <u>Physics</u>
August 1995	<b>FRITZ, WILLIAM</b> Reflection from Imperfect Cholesteric Liquid Crystals: Basic Properties and Applications * Gelcore, Cleveland OH	<u>Doane</u> <u>Physics</u>
August 1995	<b>HUANG, JING</b> Critical Behavior of Heat Capacity Near a Nematic-Smectic A Tricritical Point * Computer Specialist, Cray Computer, NJ	<u>Johnson</u> <u>Physics</u>
August 1995	<b>JI, YIMIN</b> Surface Anchoring at a Polymer/Liquid Crystal Interface in the Neighborhood of the Glass Transition * Thales Navigation, Inc.	<u>Kelly</u> <u>Physics</u>
December 1995	<b>CHEN, JIANMIN</b> Nonrubbing Techniques for Alignment of Nematic Liquid Crystals: Fundamentals and Applications * Colorlink, Inc., Boulder, CO	<u>Johnson</u> <u>Physics</u>
December 1995	<b>FOLKS, RAYMOND</b> Light Induced Instabilities in Smectics * Research Scientist, CREOL, Univ. Central Florida	<u>Lavrentovich</u> <u>Physics</u>
December 1995	<b>LU, ZHIJIAN</b> Reflective Cholesteric Liquid Crystal Displays * Rockwell Scientific	<u>Doane</u> <u>Physics</u>
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Date	Name, Title of Dissertation	Advisor/Department
December 1996	<b>QIAN, SIHAI</b> Liquid Crystal Phase Transitions in Porous Media * Optiva, Inc., South San Francisco CA	<u>Finotello</u> <u>Physics</u>
May 1997	<b>HU, GONGJIAN</b> Laser Induced Configurational Transition in Liquid Crystals * Arroyo Optics, Santa Monica, CA	<u>Palfy-Muhoray</u> <u>Physics</u>
May 1998	<b>GALABOVA, HRISTINA</b> A Theoretical Study of Surface Induced Phenomena in nematic Liquid Crystals * Staff Scientist, Reveo Corp., Hawthorne, NY	<u>Allender</u> <u>Physics</u>
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August 1998	<b>LIU, HONG</b> Theory of Liquid Crystal Static Distortions in Uniaxial and Biaxial Nematics * Lecturer, Nanjing University, China	<u>Allender</u> <u>Physics</u>
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August 1999	<b>WU, WEI</b> Single and Multiple Light Scattering Studies of PDLC Films in the presence of Electric Field * Monsanto	<u>Kelly</u> <u>Physics</u>
December 1999	<b>ZENG, HUAIREN</b> Liquid Crystal Orientational Order in Confined Geometries: An NMR Perspective * Postdoctoral Fellow, Yale University	<u>Finotello</u> <u>Physics</u>
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Date	Name, Title of Dissertation	Advisor/Department
May 2000	<b>WATSON, PHILIP E.</b> The Homeotropic to Planar Transition in Cholesteric Liquid Crystals * Research Scientist, 3M Company, Minneapolis MN	<u>Bos</u> <u>Chemical Physics</u>
May 2000	<b>XU, MING</b> Electro-Optical Properties of Cholesteric Liquid Crystal Devices and Applications of Dual Frequency Cholesterics * Research Scientist, Chorum Technologies, Richardson TX	<u>Yang</u> <u>Chemical Physics</u>
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December 2000	<b>ANDERSON, JAMES E.</b> Transitions from the Homeotropic in Cholesteric Liquid Crystals * Hana Microdisplay Technologies	<u>Bos</u> <u>Chemical Physics</u>
December 2000	<b>KONOVALOV, DMITRI A.</b> A Dynamic Light Scattering Study of Ferrielectric Phases of Chiral Smectic Liquid Crystals * Postdoctoral Fellow, Brandeis University	<u>Sprunt</u> <u>Physics</u>
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December 2000	<b>YUAN, HAIJUN</b> Light Propagation in Complex Liquid Crystal Structure * Avanex, Inc., Fremont, CA	<u>Palfy-Muhoray</u> <u>Chemical Physics</u>
May 2001	<b>LIU, WEIMIN</b> Characterization of Some Wide Viewing Angle Liquid Crystal Displays * EL-COS, Inc., San Jose, CA	<u>Yang</u> <u>Chemical Physics</u>
August 2001	<b>ACHARYA, BHARAT RAJ</b> Correlation Between the Surface Properties and Liquid Crystal Anchoring on Polymer Films * Platypus Technologies, Madison WI	<u>Kumar</u> <u>Physics</u>

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August 2001	<b>ASFAW, LETEMESKEL</b> Coherent Backscattering from Complex Liquids * Alcorn State University, Mississippi	<u>Sprunt</u> <u>Physics</u>
December 2001	<b>VOLOSHCHENKO, DMITRY</b> Photoinduced Aggregation in Cholesteric Liquid Crystals * Motorola	<u>Laventovich</u> <u>Chemical Physics</u>
December 2001	<b>ZHANG, FANG</b> Physical Properties of Cholesteric Liquid Crystal Displays * Dimensional Media, Inc.	<u>Yang</u> <u>Chemical Physics</u>
May 2002	<b>WANG, BIN</b> Two Dimensional Liquid Crystal Devices and their Computer Simulations * Lab Manager, Liquid Crystal Institute, Kent State University	<u>Bos</u> <u>Chemical Physics</u>
August 2002	<b>SAEED, SALMAN</b> Electro-optical Polarization Interference Filters * Three Five Systems, Inc.	<u>Bos</u> <u>Chemical Physics</u>
December 2002	<b>SU, LINLI</b> Studies on Non-Contact Alignment of Liquid Crystals * AlphaMicron, Inc., Kent, OH	<u>West</u> <u>Chemistry</u>
May 2003	<b>KANG, SHIN-WOONG</b> Spatio-Orientationally Organized Polymer Microstructures Obtained on Self-Assembled Pattern-Forming States of LiquidCrystals: Morphology, Phase Separation and Potential Applications * Postdoctoral Fellow, Dept. of Physics, Kent State University	<u>Chien</u> <u>Chemical Physics</u>
May 2003	<b>KHAN, ASAD</b> Chiral Materials and Cell Designs for the Cholesteric Display Technology * Kent Displays, Inc.	<u>Doane</u> <u>Chemical Physics</u>

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