Vladimir G. Chigrinov
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ACADEMIC DEGREES:

M.S. Applied Mathematics, Moscow Technical University of Electronics and Mathematics **1973**

Ph.D., Solid State Physics, Shubnikov Institute of Crystallography, USSR Academy of Sciences , **1978**
Thesis title "Investigation of Instabilities in Nematic Liquid Crystals"
Shubnikov Instutute of Crystallography (**http://ns.crys.ras.ru/indexe.html**) is a leading research institute in Russia and former USSR, specializing in crystallography. It is well known worldwide due to its outstanding research on the structure and growth of materials, including biological materials and organic systems. Since 1965 the Institute became a leader in liquid crystal research in Russia. The Ph.D. degree in Russia is equivalent to a Ph.D. degree in the West.

Doctoral Degree, Solid State Physics, Shubnikov Institute of Crystallography, USSR Academy of Sciences, **1988** Thesis title "Theory of Electrooptical Effects in Liquid Crystals"

Professor Degree, Solid State Physics, Shubnikov Institute of Crystallography, Russian Academy of Sciences, **1998**

The Doctoral Degree in Russia states, that its holder is a worldwide expert in the subject chosen as the Degree topic. The holder is required to have graduated several Ph.D. students, who obtain their Ph.D. degree under his (her) supervision.
Professor Degree in Russia is given to Doctoral Degree holders with at least five year experience in teaching on the level of University Professor and/or have at least five students obtained their Ph.D. degree under his (her) supervision.

PROFESSIONAL EXPERIENCE:

Oct 73 - June 83 **Scientific Researcher of Organic Intermediates & Dyes Institute (NIOPIK)**

Organic Intermediates and Dyes Institute (NIOPIK) is a leading center of science and research in Russia and former USSR in the field of organic dyes and pigments. Since 1962 NIOPIK became a research center for fine chemicals for the electronics industry, including liquid crystals, photoresists, laser dyes etc. NIOPIK has a production plant, which was the only producer of these materials in Russia and former USSR. At present NIOPIK is mostly concentrated on chemicals for medicine, including photodynamic therapy for cancer. At NIOPIK, I worked in projects aimed at understanding the fundamental aspects of Liquid Crystal Display (LCD) technology , including special measurement techniques of LC physical parameters such as viscosity , elasticity , optical and dielectric constants etc. I participated in making the prototypes of the first LCDs based on dynamic scattering , electrically controlled birefringence etc.

July 83-April 88 **Leading Scientist of NIOPIK**

During this time, I participated in different NIOPIK projects , such as investigating of various electrooptical effects in LC materials, optimization of LC display configurations etc. We successfully developed Electrically Controlled Birefringence (ECB), Twisted Nematic and Supertwisted Nematic LC materials.

April 88-July 96 **Head of Division in NIOPIK**

The division has 120 employees and 5 Laboratories including: "Physics of Liquid Crystals", “Chemistry of Liquid Crystals", “Organic Electrochromic Materials", "Luminiscent Dyes", "Photoanisotropic Materials". The center occupies the leading position in such a field as Fine Chemistry for Electronics, including Liquid Crystals , Electrochromic, Photochromic, Thermochromic and Photoanisotropic Materials, Laser Dyes etc. My responsibilities here were to organize R&D work in accordance with State and Customer Orders (Grants). Our Grants were obtained from the Ministry of Science and Technology as well as some Overseas Companies, such as "F. Hoffmann La Roche", "E. Merck", "Dai Nippon Ink", "Samsung" and others. The products of R&D were made in NIOPIK production plant, thus providing the industry with new chemicals for Electronics. The R&D projects resulted in new patents and scientific publications. The results were presented at the International Conferences and Exhibitions. My personal interests cover Computer Modeling of Liquid Crystal (LC) Display Construction, including Electrooptical Behaviour of LC Materials, Optimization of LC Materials, Geometry of LC Display etc. Under my personal supervision a unique software module was created, which enables us to simulate and to optimize real LC behavior even without making any experiments. In our Labs we had modern physical and chemical equipment, enabling us to provide a comprehensive characterization of LC materials.

September 96 – March 2009 **Leading Scientist of The Shubnikov Institute of Crystallography,**

Russian Academy of Sciences

During my work in the Institute I was a team leader in the projects of “New generation of low power STN-LCDs based on photo-aligning and photo-patterning technology”, “Passive high-information content FLCDs based on the effect of volume bistability” , “Pattern formation and transition to spatiotemporal disorder in liquid crystals", "New fast FLC modulators for video-applications". I was also a team member in the grant "Theory of physical phenomena in Antiferroelectric LCs"

June 99 – June 02 **Visiting Associate Professor of the Department of Electrical and Electronic Engineering, Hong Kong University of Science and Technology, Clear Water Bay, Kowloon, Hong Kong**

July 02-July 08 **Associate Professor of the Department of Electrical and Electronic Engineering, Hong Kong University of Science and Technology, Clear Water Bay, Kowloon, Hong Kong**

July 08-July 15 **Professor of the Department of Electronic and Computer Engineering, Hong Kong University of Science and Technology, Clear Water Bay, Kowloon, Hong Kong**

July 15-present **Professor Emeritus of the Department of Electronic and Computer Engineering, Hong Kong University of Science and Technology, Clear Water Bay, Kowloon, Hong Kong, consultant**

September 18-August 20 **Third Level Distinguished Professor, in Talents Special Zone, Physics and Optoelectronic Engineering School, Foshan University, Foshan**

September 19-present **Senior Researcher, Professor, Moscow Regional State University, Moscow, Russia**

MEMBERSHIP:

Member of **International Liquid Crystal Society**, 1994 -present.

Member of **Society for Information Displays** (SID), 1997-present.

EDITORIAL:

Editorial Board of "Liquid Crystal Today", 1995 -present.

Associate Editor of J. of SID since 06.2005.

The Board member of The Open Crystallography Journal since 11.2007.

Editorial Board of "Photonics Letters of Poland", 2009 -present.

LEADERSHIP AND INTERNATIONAL RECOGNITION

Expert of Flat Panel Display Technology in Russia, Ukraine and Belarus, recognized by World Technology Evaluation Center (WTEC), 1994.

Vice-President of Russian SID Chapter, 1997-present.

Member of **Russian Liquid Crystal Society** "Sodruzhestvo", 1994-present.

Member of **IEEE International Electron Devices Meeting** (IEDM) Subcommittee " Detectors, Sensors and Displays", 2000.

Member of **European SID Program Committee** since May 2004.

Member of **International Advisory Board of International Liquid Crystal Conference** (since June 2006).

Seminar **Chair of Eurodisplay 2007 Conference**, September 2007, Moscow.

Member of the **International Advisory Committee for Advanced Display Technology Conferences** in Russia, Ukraine and Belarus since 1999.

Member of Program Committee of **Emerging Liquid Crystal Technologies Conference Photonics West**, 2008- present.

Co-Chair of **Emerging Liquid Crystal Technologies Conference Photonics West**, 2013- present.

http://spie.org/app/program/index.cfm?fuseaction=conferencedetail&export_id=x13090&ID=x7805&redir=x7805.xml&conference_id=929627&event_id=894273&programtrack_id=929638

Internationally Advisory Board of a new open-access eJournal **Photonics Letters of Poland** http://photonics.pl/PLP/index.php/letters/index

Member of Program Committee of IMID Conference, Korea, October 2009-present.

Chair of LC Photonics Conference, Hong Kong December 2010.

http://lcp2010.ust.hk/committee.html

Chair of LC Photonics Conference, Hong Kong December 2012.

http://lcp2012.ust.hk/committee.html

Chair of the 1st International Conference on Photoalignment and Photopatterning in Soft Materials 29 November - 2 December, 2014, Hong Kong

http://phosm2014.ust.hk/

Co-Chair of the 16th International Conference on Ferroelectric Liquid Crystals 4-7 December, 2017, Hong Kong

http://flc16.ust.hk/

Chair of Optics 2019 Conference in Barcelona, Spain, 23-25 September, 2019 . https://www.phronesisonline.com/optics-conference/

Scientific Committee Member of Euro-Global Conference on Biotechnology and Bioengineering, June 2022, Rome, Italy, https://biotechnology-conferences.magnusgroup.org/scientific-committee/2022

Honorary Chair of Information Management and Computer Science Conference, 2022 5th International Conference on E-Business, Information Management and Computer Science (EBIMCS 2022) Committees, Hong Kong, December 2022

3rd Global Webinar on Laser, Optics and Photonics, Member of Organizing Committee, India, September 2022, http://www.globalscientificguild.com/laser-optics-photonics/organizing-committee.php

Organizing Committee Member , International Conference On Condensed Matter Physics July 01-02, 2024 Kuala Lumpur, Malaysia

https://spectusconferences.com/condensed-matter-physics-conference/committee.php

AWARDS:

Outstanding poster awards in 2003 and 2006 IDW Conferences (the largest annual display Conference in Japan).

Senior Member of the Society for Information Display (SID) since 10.10.04.

SID Fellow since 15.01.08

The Research Excellence Award of SENG, HKUST, that recognizes the efforts of an outstanding faculty member with a proven record of research excellence, May 2012.

Gold Medal and The Best Award in the Invention & Innovation Awards 2014 held at the Malaysia Technology Expo (MTE) 2014, which was hosted in Kuala Lumpur, Malaysia, on 20-22 Feb 2014.

Member of EU Academy of Sciences (**EUAS**) (http://www.interpaper.org) of distinguished members worldwide since July 2017.

Guest Professor in Shanghai Jiatong University since April 2014.

The paper of M.Schadt, K.Schmitt, V.Kozenkov, **V.Chigrinov**, Surface-induced parallel alignment of liquid crystals by linearly polymerized photopolymers, **Jap. J.Appl. Phys. P.I**., Vol.31, pp. 2155-2164 (1992) is **number 4 among the most heavily-cited and have been influential papers published in JJAP since the first volume (1962)** and have been selected from the various fields of applied physics by the JJAP Editorial Board (http://www.ipap.jp/highlights/jjap.html).

Best HKUST FYP team in displays awarded by Varitronix (2009, 2010, 2012).

Poster by Prof. Vladimir Chigrinov, and Collaborators from National Chiao-Tung University won **Outstanding Poster Award** in 2014 Taiwan Liquid Crystal Society Conference.

Prof. Vladimir Chigrinov supervised ECE PhD student Mr. Tao DU won First Prize in the **Best Poster Awards** in the PhoSM2014 Conference.

A **distinguished student poster award** in the most prestigious display Conference (Display Week 2015) for the paper: L. Shi et al. Field-Sequential-Color Displays Based on Reflective Electrically Suppressed Helix Ferroelectric Liquid Crystal.

Member of EU Academy of Science http://www.interpaper.org/ since July 2017.

2018 Slottow-Owaki Prize "For his educational efforts in the field of liquid-crystal devices, as evidenced by his teaching, supervision of graduate students, and prolific publications and conference presentations."

Outstanding student paper Award (W. Zhang et al.), April 2018, ASID 2018.

Outstanding student paper Award (Shi Liangyu et al.), May 2018, SID 2018.

Best display prototype 2018 in I-zone , (Shi Liangyu et al.), May 2018, SID 2018.

Bronze KID Award for paper in IMID 2018, (S. Gupta et al.), August 2018, IMID 2018.

2019 Distinguished Fellow of IETI (International Engineering and Technology Institute). http://www.ieti.net/news/detail.aspx?id=184

http://www.ieti.net/memberships/Fellows.aspx

2020-2024 Vice President of Fellow of Institute of Data Science and Artificial Intelligence (IDSAI)
Since 2021 distinguished Fellow of Institute of Data Science and Artificial Intelligence
Since March 2022 he is A Fellow of National Academy of Technology for his contributions to Information Electrical and Electronic Research (http://www.usnat.org/fellows.html)

SERVICE IN HKUST:
FYP Coordinator in **ECE Dept** since April 2004.
Member of ECE UG Committee since April 2004.
Member of **Technology Review Committee** (TRC) in HKUST since 2004.
Member of ECE Promotion Committee since September 2011
TEACHING
During fall 1999 –present I have four lecture courses called "**Liquid Crystal Displays (LCDs), ELEC 520**" , **Electromagnetism, ELEC 241**" and "**Physical Optics, ELEC 308**" and "**Flat Panel Displays, ELEC 525**", "**Novel Liquid Crystal Devices for Photonics and Displays, ELEC 6910F".**.
I have **good students responses in all the courses**, including ELEC 241, which is considered as the most difficult course for teaching in the Department.

Some students responses are shown below:

Instructor is “ well prepared for the course”, “very enthusiastic about the material, very knowledgeable on the subject”, “friendly and easy to touch”, “deep understanding of the area and good attitude towards students”, “very good knowledge of the subject, very up-to-date with recent developments”, “very progressive teacher, which uses new advantages in the studying process”, “willing to help students”, “very kind and heart person”, “very experienced”, “clearly explains the concepts”, “provides different media, such as video, java applet, prs, which makes the lecture effective”, “very polite and kind to students”, “hard working and had good temper”, “nice and easy to approach”.

The **teaching philosophy** is based on the following principles:

(i) combine the efforts with the students to provide them with the required knowledge and skills;

(ii) to be the most up-to-date in lecture materials, complying with the existent level of science and technology;

(iii) spare no efforts in improving the teaching process, adequately responding to the students demands;

(iv) wide use of modern facilities, which help the students to understand lecture materials (prs, TV, video, PC etc.)

(v) to carry out the active research program with the maximum possible involvement of the students.

I have been recognized as an **Instructor for the Tutorials and Short Courses at the International level**.

Short Courses at the "**Photonics West**" Conference in USA, California on Physics of LCs and LC Displays in 1995 and 1996.

Tutorials and Pleanary Lectures in ASID’04 in Nanjing, China, February; 2004, ASID’07 Shanghai, China, March, 2007, Eurodisplay 2007**,** September 2007 in Moscow, Russia, IDRC 2008 in Orlando, Florida, Eurodisplay 2009 in Rome, Italy, Asia Display 2009 in Guangzhou, China, Russian Nanotechnology Forum, November 2010, Moscow, Russia, Flat Panel Display Technology (Shanghai, 2012, 2013), LC Photonics in Guilin and Chengdu, China (2012,2013), Tutorial in OLC 2017 (Guaraja, Brasil) , Short Course LCD Material & Device on ICDT 2018 International Conference on Display Technology, Guangzhou, China, April 2018; Workshop on 2018 International Liquid Crystal Conference Kyoto, Japan, July 2018.

Reviewer of the Journals “Physical Review”, “Journal of Applied Physics”, “Liquid Crystals”, “Journal of Display Technology”, “ IEEE Transactions on Electron Devices”, “Optical Engineering”, “Optical Communications”, “Applied Physics Letters”, “Physical Review Letters”,

Ph.D. STUDENTS DEFENDED:

1. **T.V. Korkishko,** " Electrooptics of LC-surface interaction", Shubnikov Institute of Crystallography, Russian Academy of Sciences, PhD, 1987.
2. **V. Shapovalov,** " Flow effects in LC electrooptic phenomena", Moscow State University, PhD, 1987.
3. **Yu.P.Panarin,** "Bistability in thin layers of Ferroelectric Liquid Crystals", Moscow University of Informatics and Electronics, PhD, 1993.
4. **V.P.Vorflusev**,"Electrooptics and Surface Interaction in Thin Layers of Ferroelectric LCs", Moscow University of Informatics and Electronics, PhD, 1995.
5. **G.V.Simonenko**, "Computer Simulation of Electrooptical Effects in LCs", Moscow University of Informatics and Electronics, PhD,1995.
6. **Danding Huang**, "Ferroelectric Liquid Crystal Display Photo-aligned by Azo-dye layers", Hong Kong University of Science and Technology, PhD, August, 2004.
7. **Anatoli Murauski**, " Surface and liquid crystal interlayer interactions: characterizations and applications", Hong Kong University of Science and Technology, PhD, July, 2007.
8. **Xihua Li,** "Bi and Multistable Ferroelectric Liquid Crystal Displays using Non-contacting Aligning Methods", Hong Kong University of Science and Technology, PhD, February, 2008.
9. **Xu Peizhi, "**Electrooptical Modes in Nematic and Ferroelectric Liquid Crystals: Optimization for Display and Shutter Applications", Hong Kong University of Science and Technology, PhD, September, 2008.
10. **Alexander Muravski,** " Liquid Crystal Devices for Display and Photonics Applications, based on Photoalignment Technology", Hong Kong University of Science and Technology, PhD, September, 2008.
11. **Fan Fan**, Liquid Crystal Patterned Photoalignment: Methods and Applications, Hong Kong University of Science and Technology, PhD, August, 2013.
12. **Qi Guo**, Fast electrooptical modes in ferroelectric liquid crystal and their applications, PhD, August, 2013.
13. **WANG Xiaoqian**, Novel Liquid Crystal Diffractive Lenses and Display, PhD, May, 2014.
14. **Jiatong Sun**, Liquid Crystal Power Saving Display:Optically Rewritable E-Paper and Its Applications, PhD, May, 2014.
15. **Tao Du**, Photo-Patterned thin film polarizer with close to 100% efficiency, PhD, December, 2014.
16. **Ying Ma**, Electrically Suppressed Helix Ferroelectric Liquid Crystals and Their Application, PhD, May 2015.
17. **Alwin Ming Wai Tam**, Liquid Crystals Pancharatnam-Berry Phase Devices: Fabrication and Applications, PhD, August 2016.
18. **Shi Liangyu**, Fast Ferroelectric Liquid Crystal for Field Sequential Displays: from Micro-displays to Flat Panels, PhD, August 2018.

19. **Chenxiang ZHAO**, Patterned and Photo-induced Vertical Alignment for Liquid Crystal Photonics and Display Applications, PhD, November 2018.
20. **Wanlong ZHANG**, Photo Induced Semiconductor Quantum Rods Alignment and its Application in Modern Liquid Crystal Displays, PhD, December 2018.

Mphil STUDENTS DEFENDED:

1. **Xu Peizhi** "Liquid crystal modes for display and shutter Applications", Hong Kong University of Science and Technology, Mphil, July, 2005.
2. **Liu Zhijian**, " Photo-aligned LC cell with weak anchoring energy and specific profiles: Physics & Applications", Hong Kong University of Science and Technology, Mphil, June, 2005.
3. **Au Ping Tong**, "Mechanically stabilized bistable FLCD on flexible substrates", Hong Kong University of Science and Technology, Mphil, July, 2006.
4. **Mak Hin Yu,** " Transflective LCD based on photoalignment and photopatterned technology", Hong Kong University of Science and Technology, Mphil, June, 2008.
5. **Du Tao**, "Single cell gap Transflective Liquid Crystal Displays and the use of Photoalignment technology", Mphil, June 2009.
6. **Qiang Yu,** "Light Printer for Optical Rewritable (ORW) Electronic Paper", Mphil, July 2010.
7. **Fan Fei**, "Electrically Tunable Photoaligned Liquid Crystal Cells for Photonic Applications", Mphil, July 2010.
8. **Wang Lu**, Novel Liquid Crystal Devices for Display and Photonics Based on Non-Uniform Alignment, Mphil, June 2012.

FYP PROJECTS.

The total number of teams supervised since 2000 is **60 with about 200 students**. At present I have four FYP projects with HKUST students "LCD Optimization and Modeling" (3), and "Photo-aligning materials and technology: physics and applications in liquid crystal devices" (1).

RESEARCH INTERESTS:

Computer modeling of various electrooptical effects in Liquid Crystals.

The effects include Electrically Controlled Birefringence, Twist and Supertwist Effects, "Guest-Host" Effect, Electrooptic Effects in Ferroelectric Liquid Crystals (LCs), Electrohydrodynamic Effects, Modulated Structures and Dynamic Scattering. Computer modeling includes solving the Euler-Lagrange equations minimizing the free energy of LCs in electric field and then finding the solution of light propagation in the anisotropic media (Maxwell Equations) on the basis of the obtained equilibrium LC alignment. New modeling software for the calculation and optimization of LCD performance (contrast, brightness, response time, viewing angles, controlling voltages, grey scale, color reproduction) has been developed. Recently a powerful optimization module and 2D version was provided, which is useful in particular for new LC applications in fiber optical communication systems.

Photo-aligning technique for LCD applications .

The technique includes the determination of the anchoring energy and surface viscosity, order parameter, evolution of the distribution function, new materials characterization, modeling of various photo-aligning processes in photo-sensitive films. Our azo-dyes alignment materials are stabilized by polymerization, which makes these alignment layers both thermo and UV stable. The fundamental description of the phenomena is based on the model of the rotational diffusion in the field of linearly polarized light proposed by us. Now the azo-dye materials are tested for the display applications by leading Display Companies in Japan (Sony, Sharp etc.) The possibility to use this new photo-aligning layer for various types of liquid crystal displays such as FLCD ,VAN-LCD, π-BTN LCD, optical rewritable memory, superthin polarizers and phase retarders, microdisplays, and TN-LCD on plastic substrates has been also demonstrated. First flexible full color TFT-LCD for roll-to-roll technological process was fabricated using our azo-dye materials. New photoalignment materials are ready for the production of patterned optical films requested by modern LCD technologies.

LC devices in fiber optics.

Passive elements for fiber optical communication systems (DWDM components) based on liquid crystal cells can successfully compete with the other elements used for the purpose, such as micro electromechanical (MEM) , thermo-optical, opto-mechanical or acousto-optical devices. The known LC applications in fiber optics enable to produce switches, filters, attenuators, equalizers, polarization controllers, phase emulators and other fiber optical components. Application of nematic and ferroelectric LC for high speed communication systems, producing elements that are extremely fast, stable, durable, of low loss, operable over a wide temperature range, and that require low operating voltages and extremely low power consumption. Good robustness due to the absence of moving parts and compatibility with VLSI technology makes LC fiber optical devices attractive for the production.

We developed the new optical switches based on LC cells for Photonics applications. The fast ferroelectric LC shutters provided the fast response at a relatively low driving voltage. We have also proposed and checked experimentally the simple method to control light beams in a plane waveguide using a sharp boundary between the regions of a different LC orientations, regulated by electric field. Using different ITO templates, it is possible to create LC switch and other different optical processing data elements, e.g. attenuators. We studied and experimentally investigated liquid crystal (LC) alignment on silicon surfaces with submicrometer-sized straight and curved waveguide profiles. The liquid crystal cladding refractive index is then varied according to the applied voltage, and subsequently the microresonator resonance wavelengths are tuned. The add-drop voltage controllable filters based on this research result are under way. The new software was made to optimize LC applications for fiber optical systems, such as polarization rotators, phase emulators and LC switches.

Fast multistable ferroelectric liquid crystal devices.

Our investigations aim at (i) understanding of the physics of multistable switching in FLC; (ii) developing new FLC materials with optimal characteristics for multistable FLCD; (iii) elaborating new fast FLCD with multistable switching (memorized gray scale), having achromatic black/white switching. Our aim is to generate a full color image, which can be kept on display without power. In this case a very low power consumption portable PC, mobile phones, PDAs, e-books, and smart cards with LC screens become possible.

Liquid Crystal Applications in Photonics

Our goal is to develop passive elements for fiber optical communication systems, based on liquid crystal (LC) cells including hybrid photonic crystal/ liquid crystal (PC/LC) structures. Such elements begin to appear in Photonics market. Passive elements for fiber optical communication systems (DWDM components) based on liquid crystal (LC) cells can successfully compete with the other elements used for the purpose, such as micro electromechanical (MEM), thermo-optical, opto-mechanical or acousto-optical devices. Application of nematic and ferroelectric LC for high speed communication systems, producing elements that are extremely fast, stable, durable, of low loss, operable over a wide temperature range, and that require small operating voltages and extremely low power consumption. The known LC applications in fiber optics enable to produce switches, filters, attenuators, equalizers, polarization controllers, phase emulators and other fiber optical components. Good robustness due to the absence of moving parts and compatibility with VLSI technology, excellent parameters in a large photonic wavelength range, whereas the complexity of the design and the cost of the device are equivalent to regular passive matrix LC displays makes LC fiber optical devices very attractive for mass production.

We investigate and develop the new technologies for prototype production of optical switches based on LC cells and PC/LC hybrid technologies. We have already successfully fabricated certain prototypes of the optical switches based on ferroelectric and nematic LC materials. The electrooptical modes used for the purpose included the light polarization rotation, voltage controllable diffraction and fast switching of the LC refractive index. We used the powerful software to optimize the LC modulation characteristics. We may apply our expertise to develop new electrooptical effects and new LC materials for IR region. Use of photo-alignment technique makes it possible to develop new LC fiber components. Almost all the criteria of perfect LC alignment are met in case of azo-dye layers. We have already used azo-dye materials to align LC in superthin photonic holes, curved and 3D surfaces and as cladding layers in microring silicon based resonators. We are going to continue our research in this field. The prototypes of new LC efficient Photonics devices are envisaged.

Controllable photonic crystal / liquid crystal (PC/LC) devices became a “hot” topic of research. Photonic crystals are known to provide wavelength-dependent filters, beam splitters and mirror components. As photonic crystals are on the order of several wavelengths, in each of two major dimensions, and are made with microprocessing techniques, optical processing systems employing photonic crystals can be very small, thereby permitting extremely high bit density and high rates of data processing. Filling the interstices of the photonic crystal with the properly aligned LC material, and subjecting the LC to a varying electric field can produce a tunable photonic crystal element. We have already used the photoaligning materials to align LC mixtures in small cavities, such as the holes and tubes of photonic crystals, having size of 1 μm and less and obtained excellent LC orientation inside the tubes by photoalignment. We will work to develop LC and PC/LC passive elements of fiber optical systems: optical switches, fiber optical isolators, optical filters, wavelength selective mirrors for fiber lasers, polarization controllers, attenuators etc.

Liquid Crystal Devices for Non-Display Applications

Our goal is to develop liquid crystal devices for non-display applications, including passive elements for fiber optical communication systems, based on liquid crystal (LC) cells, lenses with electrically tunable focal distance, and LC based sensors for polarizing imaging.

1. Various tunable optical components, such as switches, filters, attenuators, polarization rotators and controllers are required to enable fiber-to-the-home (FTTH) access network technology enables the delivery of broadband communications signals over optical fibers from the operator switching equipment all the way to customer premises. LC cells provide a good alternative among other devices by its reliability, extremely low power consumption and easy realization. Passive elements for fiber optical communication systems (DWDM components) based on liquid crystal (LC) cells can successfully compete with the other elements used for the purpose, such as micro electromechanical (MEM), thermo-optical, opto-mechanical or acousto-optical devices. Application of nematic and ferroelectric LC for high speed communication systems, producing elements that are extremely fast, stable, durable, of low loss, operable over a wide temperature range, and that require small operating voltages and extremely low power consumption. The known LC applications in fiber optics enable to produce switches, filters, attenuators, equalizers, polarization controllers, phase emulators and other fiber optical components. Good robustness due to the absence of moving parts and compatibility with VLSI technology, excellent parameters in a large photonic wavelength range, whereas the complexity of the design and the cost of the device are equivalent to regular passive matrix LC displays makes LC fiber optical devices very attractive for mass production. In this project we will investigate and develop the new technologies for prototype production of optical switches based on LC cells. We have already successfully fabricated certain prototypes of the optical switches based on ferroelectric LC materials. We will concentrate on further developments of fast LC switching elements based on developed by us DHF-FLC mode and SSFLC

modes in ferroelectric LC materials. We used the powerful software to optimize the LC modulation characteristics. We may apply our expertise to develop new electrooptical effects and new LC materials for IR region. Use of photo-alignment technique makes it possible to develop new LC fiber components. Almost all the criteria of perfect LC alignment are met in case of azo-dye layers pioneered by us. We have already used azo-dye materials to align LC in superthin photonic holes, curved and 3D surfaces and as cladding layers in microring silicon based resonators. Controllable photonic crystal / liquid crystal (PC/LC) devices became a “hot” topic of research. Filling the interstices of the photonic crystal with the properly aligned LC material, and subjecting the LC to a varying electric field can produce a tunable photonic crystal element. We have already used the photoaligning materials to align LC mixtures in small cavities, such as the holes and tubes of photonic crystals, having size of 1 μm and less and obtained excellent LC orientation inside the tubes by photoalignment. We will work to develop LC and PC/LC passive elements of fiber optical systems: optical switches, fiber optical isolators, optical filters, wavelength selective mirrors for fiber lasers, polarization controllers, attenuators etc. New thin porous films with LC filling will be also investigated taking into account practical applications in electrically controlled optical attenuators and polarization independent optical switches.

2. LC lenses with electrically tunable focal distance for video cameras with variable zoom and 2d/3D switchable LCD. A tunable-focus liquid crystal (LC) lens can be achieved using stacked alignment layers. The stacked alignment layer is made of photo-aligned polymer on top of a rubbed polyimide. Spatial variable pretilt angle is obtained by exposing the stacked alignment layer using UV laser. A lens-like phase retardation profile can be achieved due to the variable LC pretilt angle on the surface. The focal length of the LC lens can be worked out according to the retardation profile and it is electrically tunable. Conventional mechanical zoom lens system for digital camera is bulky size and mechanically adjusted. LC lens is compact, lightweight, low-cost, and highly efficient. The applications in adaptive optics, optoelectronics, machine vision, 2D/3D switchable LCD, and eyeglasses are envisaged.

3. A fibre optic high voltage sensor for high power distribution systems based on monitoring the variation of reflectivity at a boundary between a cleaved fibre end and a LC will also optimized. We fabricated and characterized a thin high spatial resolution, photo-patterned micropolarizer array for complementary metal–oxide–semiconductor (CMOS) image sensors. We are going to continue our research in this field. The prototypes of new LC efficient LC based sensors are under way.

Fast Ferroelectric Liquid Crystal Display for Field Sequential Applications

The proposed research involves a comprehensive investigation of fast V-shaped photoaligned ferroelectric liquid crystal field sequential display displays, including the following main items.

The goal is the further development of novel photoaligned fast field sequential FLCD and devices aimed at (i) further fundamental study of the new appropriate electrooptical modes used for switching such as deformed helix ferroelectric (DHF) FLC mode; (ii) the development of new fast responding FLC materials with fast switching and a sufficient number of switchable gray levels (V-shape switching); (iii) the implementation of the working prototypes of novel FSC FLC displays; (iv) the investigations of regimes of operation to allow efficient addressing of FLCD; and (v) the development of the software module, taking into account real FLC parameters with further optimization of FLC optical and electrooptical performance.

The display quality needs further improvement in terms of (i) the elimination of the sticking effect; (ii) the realization of a fast switching V-shape gray levels with a low voltage driving; (iii) the improvement of the contrast ratio and quality of FLC alignment on sufficiently large surface areas with achromatic (black/white) switching; (iv) the increase of FLCD resolution up to VGA and higher; and (v) the demonstration of FSC FLCD working with a frame frequency of 60Hz and higher up to 240 Hz for complete avoiding of the color break up effect; (vi) demonstration of the apparent threshold of FLCD switching curve, which is important for FSC LCD applications.

The prototypes of the novel photoaligned FLC devices developed may include FSC FLC with a high resolution, low power consumption and extended color gamut, which can be used in the screens of portable PCs, mobile phones, PDAs. FSC FLC microdisplays, which is now one of the most advanced technologies for pico-projectors can be also made on the basis of new materials and electrooptical modes in FLC to be developed in the project.

New Optically Rewritable Electronic Paper Liquid Crystal Displays

The idea of the electronic paper is to store and display information generated by computer on a light weight thin flexible and robust, paper-like carrier with good brightness, high contrast and full viewing angle. Ultra low or zero power consumption is highly desirable. Several liquid crystal (LC) based candidates of the electronic paper have been announced. The most mature are cholestreric LCD, zenithal bistable device (ZBD) and bistable nematic (BiNem). Still the e-paper application of liquid crystals also suffers from the high level complexity of driving electronics, which often fails for flexible display due to the insufficient durability of flexible conductor and contact bonding.

Our recent developments of optically rewritable (ORW) LC photoaligning display and progress in LC photoalignment has made it possible to separate e-paper display-unit and driving optoelectronics part together with the significant reduction of complexity of our ORW e-paper structure making device properties and cost both paper-like. It operates by optically rewritable alignment technology, has no electrodes, possesses grey scale capability, is truly stable and does not require power to show the image with wide viewing angles and high contrast. New electronic ORW paper display is very tolerable to the cell gap variation, as even 50% variation of the cell gap will not cause noticeable change in LC transmission value.

The goal is the further improvement of e-paper design aimed at (i) further fundamental study of the reorientation process in solid state photoaligned azo-dye layers, aimed at understanding of physical mechanisms of photoactivated molecular reorientation, adhesion and hydrogen bonding in film stabilization processes, mathematical modeling of photoinduced reorientation processes in thin organic layers (ii) development of new highly sensitive ORW photoaligning materials and layers; (iii) implementation of ORW e-paper very durable, cheap and ready for the flexible challenge, contact printing of the polymer spacers and lamination; (iv) investigations of regimes of operation to allow to use cheap and low power consuming high efficient blue LED as an alternative exposure light source instead of expensive and high power consuming mercury lamps or lasers; (v) design of new function of 3D image for electronic paper on liquid crystal technology, i.e. by combining two ORW LC layers in one unit to obtain e-paper with advanced security features or even stereoscopic 3D image; (vi) implementation of multi-color LC e-paper by combining the colors of the polarizers and dichroic dyes dissolved in LC mixture. The possible but not limiting applications of the new e-paper based on photoaligning are light printable rewritable paper, labels and plastic card displays, as well as rewritable 3D paper for security applications.

RESEARCH GRANTS AT NIOPIK (Responsibility-team member, since 1988 -PI):

Sources:

Ministry of Chemical Industry of USSR, Ministry of Science and Technology of Russian Federation, Russian Electronic Plants (Saratov, Fruazino, Zelenograd etc.), Overseas Companies, such as "F.Hoffmann La Roche", "E.Merck", "Dai Nippon Ink", "Samsung" etc.

Project objective:

Optimization of electrooptical effects for LCDs, LC Materials (research, development and production) for LCDs, LCD testing and quality evaluation

Amount:

HK$10,000,000/year

Period: 1974 – 1996

RESEARCH GRANTS AT SHUBNIKOV INSTITUTE OF CRYSTALLOGRAPHY, RUSSIAN ACADEMY OF SCIENCES (Responsibility -PI):

Sources:

Ministry of Science and Technology of Russian Federation, Russian Fund of Fundamental Research, International grants (INTAS)

Project objective:

“New generation of low power STN-LCDs based on photo-aligning and photo-patterning technology”, “Passive high-information content FLCDs based on the effect of volume bistability” , “Pattern formation and transition to spatial-temporal disorder in liquid crystals”, “New fast FLC modulators for video-applications”, “Theory of physical phenomena in Antiferroelectric LCs”

Amount:

HK$100,000/grant

Period:

1996 – 1999

RESEARCH GRANTS AT HKUST, 2000-2015, Responsibility -PI:

Sources: DAG99/00.EG36

Project objective: “Computer modeling of Liquid Crystal Displays “

Amount: HK$ 30,000

Period: 01/01/2000 - 31/12/2000 (12months)

Sources: RGC grant HKUST6004/01E

Project objective: "LCD technology of photo-aligning and photo-patterning on the basis of novel photosensitive materials"

Amount: HK$ 543,712

Period: 07/2001-06/2003 (24 months)

Sources: SSRI grant SSRI01/02.EG15

Project objective: "Modeling software for liquid crystal device applications in photonics "

Amount: HK$ 420,000

Period: 11/12/2002 - 10/03/2004 (15 months)

Sources: DAG02/03.EG04

Project objective: "LCD optimization and modeling "

Amount: HK$ 70,000

Period: 01/02/2003 - 31/01/2004 (12months)

Sources: HKUST Post-Doctoral Fellowship (PDF) Matching Fund

Project objective: "Modeling Software for liquid Crystal Device Applications in Photonics"

Amount: 50% postdoctoral salary matching, not exceeding $15,000/month,12 months maximum

Period: 01/02/2003 - 30/06/2004.

Sources: RGC grant HKUST6102/03E

Project objective: "Novel LCDs based on photo-aligning technology"

Amount: HK$ 464, 452

Period: 07/2003-06/2005 (24 months)

Sources: ITF grant ITS/111/03

Project objective: "Novel types of photo-aligned bistable LCD "

Amount: HK$ 1,610,300

Period: 01/07/2004 - 31/12/2005 (18 months)

Sources: RGC grant HKUST6149/04E

Project objective: "Development of passive elements for fiber optical communication systems based on liquid crystal and photonic crystal structures "

Amount: HK$ 496,691

Period: 01/2005-31/2006 (24 months)

Sources: DAG05/06.EG14

Project objective: "Surface interaction of liquid crystals with photoalignment layers "

Amount: HK$ 70,125

Period: 01/01/2006 - 31/12/2006 (12months)

Sources: CERG 612406

Project objective: "New liquid crystal displays based on photo-aligned polarizers and phase retarders "

Amount: HK$ 810,500

Period: 01/12/2006 - 31/11/2008 (24months)

Sources: F-HK06/07.EG03

Project objective: "Non-contact methods for liquid crystal alignment and anchoring strength control and their practical applications "

Amount: HK$ 30,600

Period: 01/01/2008 - 31/12/2008 (12 months)

Sources: CERG RPC07/08.EG01

Project objective: "New Optically Rewritable Electronic Paper Liquid Crystal Displays"

Amount: HK$ 400,000

Period: 01/06/2008 - 31/05/2010 (24months)

Sources: CERG 612208

Project objective: "Liquid Crystal Applications in Photonics"

Amount: HK$ 340,019

Period: 01/09/2008 - 31/08/2010 (24months)

Sources: CERG 612409

Project objective: "Novel Photoaligned Optically Rewritable Liquid Crystal Displays and Photonics Devices"

Amount: HK$ 698,000

Period: 01/09/2009 - 31/08/2011 (24months)

Sources: ITP/009/09NI

Project objective: "Flexible liquid crystal displays based on nanotechnology "

Amount: HK$ 525,970

Period: 01/09/2009 - 31/08/2010 (12 months)

Sources: CERG 612310

Project objective: "Novel Photoaligned Fast Ferroelectric Liquid Crystal Display and Photonics Devices"

Amount: HK$ 1,012,000

Period: 01/09/2010 - 31/08/2012 (24months)

Sources: PCF.001.09/10

Project objective: "Optically rewritable liquid crystal e-paper "

Amount: HK$ 100,000

Period: 01/10/2010 - 30/09/2011 (12 months)

Sources: W0297, Croucher Foundation

Project objective: Liquid Crystals for Photonics (LCP 2010), 8-10 Dec 2010

Amount: HK$ 100,000

Period: 08/12/2010 - 10/12/2010 (3 days)

Sources: PCF.002.10/11

Project objective: “Novel fast ferroelectric liquid crystal display ”

Amount: HK$ 100,000

Period: 01/09/2011 - 30/08/2012 (12 months)

Sources: PCF.002.11/12

Project objective: “Patterned polarization converter ”

Amount: HK$ 100,000

Period: 01/05/2012 - 30/04/2013 (12 months)

Sources: ITP/039/12NP

Project objective: “Novel Fast Ferroelectric Liquid Crystal Display Based on Nano-Scale Photoaligning Technology ”

Amount: HK$ 3,225,250.00

Period: 01/02/2013 - 30/06/2015 (24 months)

Sources: FSGRF13EG35/ FSGRF12EG09

Project objective: “Liquid crystal devices based on photo-alignment and photo-patterning materials ”

Amount: HK$ 100,000.00

Period: 04/10/2012 - 03/10/2014 (24 months)

Sources: PCF.002.13/14

Project objective: “Diffractive liquid crystal lens based on patterned alignment ”

Amount: HK$ 120,000

Period: 01/07/2014 - 30/06/2015 (12 months)

RESEARCH GRANTS AT HKUST, 2003-2007, Responsibility –Co-PI:

Sources: ITS/069/02, Institute of NanoMaterials and Nanotechnology (INMT)

Project objective: “Development of functional nanomaterial and technologies”

Amount: HK$ 21,000,000

Period: 07/2003-06/2007 (48 months)

NOTATION:

/Italic/ indicates supervised PG students. And * indicates supervised postdoc or RAs and Visiting Scholars at HKUST

PUBLICATIONS: BOOKS

1. L. M.Blinov, V.G.Chigrinov, **Electrooptic effects in Liquid Crystal Materials**, Springer-Verlag, N.Y. 459pp, 1994.

Electrooptic effects provide the basis for much liquid-crystal display technology. This book, by two of the leaders in liquid-crystal research in Russia, presents a complete and accessible treatment of virtually all known phenomena occurring in liquid crystals under the influence of electric fields.

(http://www.amazon.com/gp/product/product-description/0387947086/ref=dp_proddesc_0/102-0026271-1929709?ie=UTF8&n=283155&s=books)

2. V.G. Chigrinov, **Liquid Crystal Devices: Physics and Applications**, 357 pp., *Artech-House,* Boston-London, 1999.

Select more accurate liquid crystal (LC) mixtures for various applications and design better performing liquid crystal devices (LCD)s in less time with this practical resource that provides an expert account of the fundamental physics of LCs and its practical application to device design. Liquid Crystal Devices: Physics and Applications provides engineers, physicists, and device designers with the most up-to-date descriptions of the dielectric, optical, and viscoelastic properties of LCs, including their relation to molecular structure, mixture content, and material characteristics. The book gives you the knowledge needed to optimize LC cell geometry, select proper display configurations, and develop non-display applications such as optical data processing systems and surface defect detectors. (http://www.buy.com/prod/Liquid_Crystal_Devices_Physics_and_Applications/q/loc/273/30818750.html)

The book was used as a **text book** in the Universities of Kent (USA), Tokyo (Japan), Oxford (UK), Chalmers (Sweden), Piza (Italy), HKUST (Hong Kong) and some others.

3. V.G. Chigrinov, V.M. Kozenkov, H.S. Kwok, **Photoalignment of Liquid Crystalline Materials: Physics and Applications,** 248 pp., Wiley, August 2008. http://as.wiley.com/WileyCDA/WileyTitle/productCd-0470065397.html

Photoalignment possesses significant advantages in comparison with the usual ‘rubbing’ treatment of the substrates of liquid crystal display (LCD) cells as it is a non-contact method with a high resolution. A new technique recently pioneered by the authors of this book, namely the photo-induced diffusion reorientation of azodyes, does not involve any photochemical or structural transformations of the molecules. This results in photoaligning films which are robust and possess good aligning properties making them particularly suitable for the new generation of liquid crystal devices.

Photoalignment of Liquid Crystalline Materials covers state-of-the-art techniques and key applications, as well as the authors’ own diffusion model for photoalignment. The book aims to stimulate new research and development in the field of liquid crystalline photoalignment and in so doing, enable the technology to be used in large scale LCD production.

Key features:

- Provides a full examination of the mechanisms of photoalignment.
- Examines the properties of liquid crystals during photoalignment, with particular reference made to the effect on their chemical structure and stability.

- Considers the most useful photosensitive materials and preparation procedures suitable for liquid crystalline photoalignment.
- Presents several methods for photoalignment of liquid crystals.
- Compares various applications of photoalignment technology for in-cell patterned polarizers and phase retarders, transflective and micro displays, security and other liquid crystal devices.

Through its interdisciplinary approach, this book is aimed at a wide range of practising electrical engineers, optical engineers, display technologists, materials scientists, physicists and chemists working on the development of liquid crystal devices. It will also appeal to researchers and graduate students taking courses on liquid crystals or display technologies.

4.Pasechnik, Sergey V. / Chigrinov, Vladimir G. / Shmeliova, Dina V. **Liquid Crystals, Viscous and Elastic Properties**, Wiley-VCH, Berlin, 424 pp, October, 2009. http://www.wiley-vch.de/publish/dt/books/bySubjectEE00/ISBN3-527-40720 -0/?sID=58scjhajapfe2rcjeet4pst280

Focusing on fiber optic devices in telecommunication circuits, this monograph presents and discusses the viscous and elastic properties of liquid crystals and shows the importance of these properties for practical applications in both display and non-display technologies.

Content

1. Introduction
2. Physical Backgrounds for Practical Applications of Liquid Crystals
3. Flows of Anisotropic Liquids
4. Ultrasound in Liquid Crystals
5. Experimental Determination of Elastic and Viscous Parameters of Liquid Crystals
6. Liquid Crystals for Display and Photonics Applications
7. Liquid Crystal Sensors

5. Dmitry A. Yakovlev , Vladimir G. Chigrinov , Hoi-Sing Kwok, **Modeling and Optimization of LCD Optical Performance** (Wiley Series in Display Technology), 576 pp, Wiley-Blackwell; 1 edition (3 Oct 2014). http://www.amazon.co.uk/Modeling-Optimization-Optical-Performance-Technology/dp/0470689145/ref=sr_1_2?s=books&ie=UTF8&qid=1405393655&sr=1-2

The aim of this book is to present the theoretical foundations of modeling the optical characteristics of liquid crystal displays, critically reviewing modern modeling methods and examining areas of applicability. The modern matrix formalisms of optics of anisotropic stratified media, most convenient for solving problems of numerical modeling and optimization of LCD, will be considered in detail. The benefits of combined use of the matrix methods will be shown, which generally provides the best compromise between physical adequacy and accuracy with computational efficiency and optimization facilities in the theoretical model. The book will include algorithms for solving common problems of LCD optics, and will give recommendations of how to build the basic theoretical model and choose mathematical tools to solve particular problems. Special attention will be paid to solving optimization and inverse problems of liquid crystal optics. Earlier books have covered the classic Jones Matrix method, but the authors will cover the newer, more universal and successful electrodynamic Jones matrix method; this has extremely high accuracy and is especially useful in oblique light incidence and because it acknowledges multiple reflection. This book will prove a useful tool for developers of new generations of liquid crystal displays, and for scientists dealing with optical investigation of liquid crystals. An appendix will be provided which includes a robust technique for calculating the equilibrium LC director field in 1D case.

Focussing on polarization matrix optics in many forms, this book includes coverage of a wide range of methods which have been applied to LCD modeling, ranging from the simple Jones matrix method to elaborate and high accuracy algorithms suitable for off–axis optics. Researchers and scientists are constantly striving for improved performance, faster response times, wide viewing angles, improved colour in liquid crystal display development, and with this comes the need to model LCD devices effectively. The authors have significant experience in dealing with the problems related to the practical application of liquid crystals, in particular their optical performance. Key features: Explores analytical solutions and approximations to important cases in the matrix treatment of different LC layer configurations, and the application of these results to improve the computational method Provides the analysis of accuracies of the different approaches discussed in the book Explains the development of the Eigenwave Jones matrix method which offers a path to improved accuracy compared to Jones matrix and extended Jones matrix formalisms, while achieving significant improvement in computational speed and versatility compared to full 4x4 matrix methods Includes a companion website hosting the authors′ program library LMOPTICS (FORTRAN 90), a collection of routines for calculating the optical characteristics of stratified media, the use of which allows for the easy implementation of the methods described in this book. The website also contains a set of sample programs (source codes) using LMOPTICS, which exemplify the application of these methods in different situations.

6. Vladimir G. Chigrinov, **Liquid Crystal Photonics**, 165 pp., Nova Science Publishers, December 2014.

https://www.amazon.com/Liquid-Crystal-Photonics-Engineering-Techniques/dp/162948315X/ref=sr_1_6?s=books&ie=UTF8&qid=1488254729&sr=1-6&keywords=chigrinov

LC devices for Photonics applications is a “hot topic” of research. Such elements begin to appear in photonics market. The book provides engineers, physicists, and device designers with the most up-to-date descriptions of the dielectric, optical, and viscoelastic properties of LCs, for photonics applications and design better performing liquid crystal photonic and display devices (LCD)s. The book gives you the knowledge needed to optimize LC cell geometry, select proper display configurations, and develop photonics LC applications.

The electrooptical modes used for the purpose included the light polarization rotation, voltage controllable diffraction and fast switching of the LC refractive index. Use of photo-alignment technique makes it possible to develop new LC fiber components. Photoaligning materials used to align LC in superthin photonic holes, curved and 3D surfaces and as cladding layers in microring silicon based resonators. The new LC photonics elements, such as switches, polarization controllers, polarization rotators, phase emulators, variable optical attenuators, lenses, sensors, light converters as well as the other LC optical elements for fiber communication networks are under way.

The application of ferroelectric LC (FLC) for high speed communication systems, producing elements that are extremely fast, stable, durable, of low loss, operable over a wide temperature range, and that require small operating voltages and extremely low power consumption when using bistable and multi-stable switching with optical memory. Passive FLC elements for fiber optical communication systems (DWDM components) based on liquid crystal (LC) cells can successfully compete with the other elements used for the purpose, such as micro electromechanical (MEM), thermo-optical, opto-mechanical or acousto-optical devices.

The prototypes of the novel photoaligned LC devices may include field sequential color (FSC) LC with a high resolution, low power consumption and extended color gamut, which can be used in the screens of portable PCs, mobile phones, PDAs. The switchable goggles and lenses based on new FLC prototypes can be efficiently applied in the new generations of switchable 2D/3D LCD TV. FSC LC microdisplays, which is now one of the most advanced technologies for pico-projectors can be also made.

The aim of the book is highlighted below:

to describe the physical properties of liquid crystals and preparation of liquid crystal cells the most important for applications;

to show how to control the liquid crystal behavior in electric fields by varying its macroscopic physical parameters, cell geometry and addressing schemes;

to summarize basic electrooptical phenomena, as a basis for liquid crystals devices;

to introduce new liquid crystal technologies, such as photoalignment and photopatterning;

to show new photonics applications of liquid crystals: LC photonics elements for passive optical network systems, such as LC switches, polarization rotators, variable optical attenuators, photonic crystal/liquid crystal devices;

to describe new LC photonics devices such as lenses, sensors, light converters, field sequential color LCD.

The book is intended for a wide range of engineers, scientists and managers, who are willing to understand the “hot” topics of LC applications in photonics and displays. Liquid crystal physical properties, geometry of liquid crystal cell and characteristics of electrooptical effects to choose and/or to develop liquid crystal photonics devices with optimal parameters were highlighted. Special attention was paid to photoalignment technology for LC photonics and emergent display devices. University researchers and students, who is specialized in the condensed matter physics and liquid crystal device developments will also find some useful information here.

https://www.novapublishers.com/catalog/product_info.php?products_id=51381

PUBLICATIONS- BOOK CHAPTERS, REVIEWS, PREPRINTS, SHORT COURSES

1. V.G. Chigrinov, V.V. Belyaev, A.V. Parfenov, **Bistable liquid crystal structures**, Moscow, Preprint of Lebedev Physical Institute, USSR Academy of Sciences, 42 pp., 1982.
2. V.G.Chigrinov, V.V.Belyaev, A.V.Parfenov, A.A.Vasiliev, **Orientational effects in nematic liquid crystals in electric and magnetic fields. Main properties**. Moscow, Preprint of Lebedev Physical Institute, USSR Academy of Sciences, 46 pp., 1982.
3. V.G. Chigrinov, Yu.B. Podyachev, N.V. Malimonenko, V.M. Muratov, V.G. Rumyantsev, V.A. Tsvetkov, A.V. Parfenov, **Electroptics of twist-effect in liquid crystals and its application in light modulators,** Moscow, Preprint of Lebedev Physical Institute, USSR Academy of Sciences, 38 pp., 1985.

4. A.A. Vasiliev, Yu.K. Gruzevich, S.N. Levov, A.V. Parfenov, V.G. Chigrinov, **Resolution of liquid crystal modulators**, Moscow, Preprint of Lebedev Physical Institute, USSR Academy of Sciences, 45 pp., 1986.
5. V.G. Chigrinov, V.V. Belyaev, A.V. Parfenov, A.A. Vasiliev, **Orientational effects of nematic liquid crystals in electric and magnetic fields. Optical properties,** Moscow, Preprint of Lebedev Physical Institute, USSR Academy of Sciences, 58 pp. ,1986.
6. V.G. Chigrinov,I.N. Kompanets, A.V. Parfenov, M.I. Barnik, A.I. Allagulov, V.V. Belyaev, N.V. Volkov, V.V. Kozenkov, **Electrooptics of nematic liquid crystal in non-uniform electric field. Light valves: the role of flexoelectric effect,** Moscow, Preprint of Lebedev Physical Institute, USSR Academy of Sciences, 33 pp., 1986.
7. G.E. Nevskaya, T.V. Korkishko, A.V. Parfenov, V.G. Chigrinov, **Visualization of defects in dielectric layers using liquid crystals,** Moscow, Preprint of Lebedev Physical Institute, USSR Academy of Sciences, 26 pp., 1987.
8. V.A. Kozunov, V.G. Chigrinov**, Electrooptics of twist-effect in liquid crystals,** Electronic review series, 60 pp., 1988.
9. V.G. Chigrinov, T.V. Korkishko, G.E. Nevskaya, A.E. Rubtsov, **Optimization of nematic liquid crystals for defect visualization of solid surface in electric field,** Electronic review series,52 pp., 1989.
10. V.L.Ariston, V.V.Mitrohin, V.P.Sevostianov, S.A.Pikin, V.G.Chigrinov, **Electroacoustic effect in liquid crystals**, In a book "Modern Topics in Liquid crystals". Ed. by A.Buka. World Scientific,1994, pp. 257-269.
11. V.G. Chigrinov, **Liquid Crystals in Electric Fields: Physics and Applications**, SC81, Photonics West, San Jose, CA, 1995.
12. V.G. Chigrinov, **Liquid Crystals Devices: Physics and Applications**, SC81, Photonics West, San Jose ,CA, 1996.
13. V.G. Chigrinov, V.M. Kozenkov* and H.S. Kwok, **New developments in photo-aligning and photo-patterning technologies: physics and applications,** In a book “Optical Applications of Liquid Crystals”, Ed. by L. Vicari, Institute of Physics Publishing, Bristol and Philadelphia, 2003, pp.201-244.
14. V.G. Chigrinov, **Liquid Crystal Devices: Physics and Applications,** ASID’04 Tutorial notes, pp.51-157, Nanjing, China, February 14, 2004.
15. V.G. Chigrinov, **Liquid Crystal Devices: Physics and Applications,** ASID’07 Tutorial notes, Shanghai, China, March, 2007.
15. V.G. Chigrinov, **Liquid Crystal Devices: Physics and Applications,** Eurodisplay ’07 Tutorial notes, Moscow, Russia, September, 2007.
16. V.G. Chigrinov, **LCD Modeling,** IDRC’08 Tutorial notes, Orlando, Florida, November, 2008.
17. V.G. Chigrinov, **LC-devices: new trends**, Eurodisplay ’09 Tutorial notes, Rome, Italy, September, 2009.

18. V.G. Chigrinov, **Liquid crystal photoalignment: physics and applications**, Asia Display '09 Tutorial notes, Guangzhou, China, October, 2009.
19. V.G. Chigrinov, **Liquid Crystal Photoalignment by Azo-Dyes**, In a book: "Current Development of Photoalignment Technology", Supervisor: K. Ichimura, CMC Publishing Co. Ltd, Japan, 2010.
20. V. Chigrinov, **Liquid Crystal Photonics Conference 2010**, *Liquid Crystals Today*,Vol. 20, No. 2, April 2011, 71–73.
21. Vladimir G. Chigrinov, **Liquid Crystals for Photonics**, *PHOTONICS LETTERS OF POLAND*, Vol. 2 (3), 104-106 (2010).
22. Vladimir G. Chigrinov, **NAMI's Highlight: Flexible Liquid Crystal Displays**, *NAMI Times*, November 2011, pp.7-11.
23. Vladimir G. Chigrinov and Hoi-Sing Kwok, **Photoalignment of liquid crystals: applications to fast response ferroelectric liquid crystals and rewritable photonic devices**, In a book: "Progress in Liquid Crystal Science and Technology: in Honor of Shunsuke Kobayashi's 80th Birthday", World Scientific, February 2013.
24. V. Chigrinov, Book review: New developments in liquid crystals and applications,

    edited by P.K. Choudhury, Liquid Crystals Today, 1 May 2014.
    http://www.tandfonline.com/doi/full/10.1080/1358314X.2014.912383#.U2mZT09ZqXg
25. Andy Y.-G. Fuh, Iam Choon Khoo, Tsung-Hsien Lin, Yi-Pai Huang,Liang-Chy Chien, Vladimir G. Chigrinov, and Tsung-Hsun Yang, **Optics and Photonics of Taiwan International Conference: Introduction by the feature editors**, APPLIED OPTICS, Vol. 53, No. 22 , DT1-DT5, 1 August 2014 .
26. Vladimir Chigrinov, **Liquid crystal applications: new trends.** Tutorial T1, OLC 2017, September 2017, Guaruja, Brasil.
27. V. Chigrinov, Ferroelectric liquid crystal conference 2018, Liquid Crystals Today, 27, N2, pp.28-30, July 2018.
28. Vladimir Chigrinov, **Liquid crystal applications: new challenges.** Tutorial T5, ILCC 2018, July 2018, Kyoto, Japan.
29. Vladimir Chigrinov, **LCD and its applications,** Short Course 1, ICDT 2019, March 2019, Kunshan, China.
30. V. Chigrinov, A. Srivastava, H.S. Kwok, **Azo-dye photoalignment materials,** In a book "High Quality Liquid Crystal Displays and Smart Devices - Volume 2: Surface alignment, new technologies and smart device applications". IET. 2019, 41-64. Stevenage, UK.
31. Vladimir Chigrinov, **Liquid Crystal Application in Display and Photonics: New Trends,** Tutorial T4, Eurodisplay 2019, Minsk, Belarus, September 2019.
32. Vladimir Chigrinov, **Liquid crystal applications in displays and photonics: new possibilities,** ICDT 2022, Tutorials, Fuzhou, China, July 2022.

33. Wanlong Zhang, Abhishek Srivastava, Vladimir Chigrinov, and Hoi-Sing Kwok, **Optically Rewritable Liqiuid Crystal Display,** E-paper Diaplays, pp. 171-196, Ed. By Bo-Ru Yang, Wiley & Sons, 2022.
34. Chigrinov, V.G. (2023). **Ferroelectric Liquid Crystal Cells for Modern Applications in Displays and Photonics.** In: Shamey, R. (eds) Encyclopedia of Color Science and Technology. Springer, Berlin, Heidelberg. https://doi.org/10.1007/978-3-642-27851-8_183-2
35. Efim I. Kats, Vladimir E. Dmitrienko, Eugene M. Terentjev, Vladimir G. Chigrinov, Mikhail A. Osipov, Maxim V. Gorkunov, Anna S. Gorkunova, Boris I. Ostrovskii & Elena S. Pikina, **Professor Sergey Alekseevich Pikin (1941 – 2024),** Liquid Crystals Today, June 2024.
36.

PUBLICATIONS-JOURNAL PAPERS:

Explanation of Russian Journals:

1.**Sov. phys. JETP - Jurnal Experimentalnoi I Teoreticheskoi Fiziki** (In Russian), English version is provided by American Institute of Physics as **Sov. phys JETP**. The journal has the highest grade in Russia in the field of general physics and condensed matter physics.

2. **Crystallography Reports** – **Kristallografiya** (In Russian), English version is provided by American Institute of Physics as **Crystallography Reports**. The journal has the highest grade in Russia in the field of crystallography research, real structure and properties of crystals, including thin films and liquid crystals.

3. **Optics and Spectroscopy** - **Optika I Spektroskopiya** (In Russian), English version is provided by American Institute of Physics as **Optics and Spectroscopy**. The journal has the highest grade in Russia in the modern optics and spectroscopy starting from radiowaves to X-rays. Physical and geometrical optics, interaction of light and matter, lasers, holography and optical instrumentation are covered.

4. **Soviet Technical Physics Letters** – **Pisma v Jurnal Tehnicheskoi Fiziki** (In Russian). The journal is well known by publication in the latest achievements in physics, that can be practically useful. The English version **Soviet Technical Physics Letters (USA)** is provided by American Institute of Physics.

5. **Soviet Physics - Lebedev Institute Reports** – **Kratkie Soobsheniya Po Fizike** (In Russian). English version is **Soviet Physics - Lebedev Institute Reports(USA).**The journal is published by

Lebedev's Physical Institute in Moscow, known by outstanding research in physics, astronomy and modern optics.

6. **Doklady Physics** – **Dokladi Akademii Nauk** (In Russian). English version is provided by American Institute of Physics as **Doklady Physics**. A comprehensive research journal for all physical science reference collections with the highest grade in academic research in physics.

7. **Bulletin of the Academy of Sciences of the USSR, Physical Series** - **Izvestiya Akademii Nauk , Seriya Fizicheskaya-** (In Russian). English version is provided as **Bulletin of the Academy of Sciences of the USSR, Physical Series (USA)**.The journal is well known by publications from various fields of fundamental physical research.

8. **Poverhnost**- Russian journal, published by Shubnikov Institute of Crystallography. The papers are related to the physical properties of thin layers and surface physics.

9. **Journal of Optical Technology-** **Optiko-Mekhanicheskaya promishlennost** (In Russian). English version is provided by Optical Society of America as **Journal of Optical Technology (USA).** The journal contains the latest achievements in optical science and technology, which can be useful for practical applications.

10. **Physics-Uspekhi-** **Uspekhi Fizicheskikh Nauk** (InRussian). English version is provided by American Institute of Physics as Physics-Uspekhi. The journal has the highest grade in Russia and contains the original reviews in various field of fundamental physical research.

11. **JETP Letters** – **Pisma v Jurnal Eksperimentalnoi I Teoreticheskoi Fiziki** (In Russian). English version is provided by American Institute of Physics as **JETP Letters(USA).** The journal has the highest grade in Russia and contains the short notes on the most important achievements of fundamental physical research.

Journal publications:

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CONFERENCE PRESENTATIONS

Explanation of the conferences:

The subject	Title of the Conference	Rank of the Conference
Liquid Crystals	International Liquid Crystal Conference	1
	Winter International Liquid Crystal Conference	2
	Liquid Crystal Conference of Socialists Countries (before 1991)	3
	USSR Liquid Crystal Conference	4
Display Conferences	Society for Information Displays (SID) International Display Conference (USA)	1
	International Display Research Conference (Europe, Asia, USA)	2
	International Display Workshop (IDW) in Japan	3

Optical Conferences of The International Society for Optical Engineering (SPIE)	**SPIE International Symposium Annual Meeting on Science and Technology**	**1**
	Photonics West SPIE Conference (CA, USA)	**2**
	National Optical SPIE Conferences (Poland, Russia etc.)	**3**

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