Liquid Crystals for Photonics

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Abstract — A brief editorial overview of liquid crystals for photonics in view of a recent scientific event held in Poland in July 2010 is being presented.

23rd International Liquid Crystal Conference (ILCC) was held in Kraków, Poland in extremely hot days between 11th and 16th of July 2010 (http://www.ilcc2010.uj.edu.pl/index.php).

The conference organized by Jagiellonian University in Kraków under the auspices of the International Liquid Crystal Society and the Polish Liquid Crystal Society was co-sponsored by numerous organizations including the Photonics Society of Poland (PSP). The conference gathered several hundred participants from all over the world aiming – apart of its scientific program – also to show some aspects of Polish culture and history, including the tasting of traditional Polish cuisine.

The Photonics Society of Poland sponsored three best presentation awards for young scientists and PhD students who work in the area of Liquid Crystal Photonics. The first reward went to Yo Watanabe from Japan, the second was granted to Jia - De Lin from Taiwan, and the third went to Marzena Tefelska from Poland. The winners were rewarded with Award diplomas on 16th July 2010 during the closing ceremony of the 23rd ILCC as well as with cash awards.

Three out of seven tutorial lectures preceding the formal opening of the 23rd International Liquid Crystal Conference were devoted to Liquid Crystal Photonics.

Peter Palffy-Muhoray, Professor of Chemical Physics and Associate Director of the Liquid Crystal Institute (Kent State University, USA) presented his fascinating tutorial lecture entitled "*Mesomorphic Metamaterials*" proving that liquid crystal metamaterials having unusual properties arising from hierarchical structure promise a new era of liquid crystals. By utilizing the plasmon resonance of metallic nanoparticles, novel optical properties, such as negative refractive index and hyperbolic dispersion may be realized.

Shin-Tson Wu, Pegasus Professor of the College of Optics and Photonics, (University of Central Florida, USA) in his tutorial lecture "*Emerging Liquid Crystal Displays based on the Kerr Effect*" presented recent advances in polymer-stabilized blue-phase liquid crystal displays and a new vision on what would be the next-wave LCD after its dominance in flat panel display technologies. The Kerr effect-induced isotropic-to-anisotropic switching mechanism offers four revolutionary features: no need for alignment layer, submillisecond gray-to-gray response time, wide and symmetric viewing angle, and cell gap insensitivity. However, several technical issues, such as better materials, low operating voltage, small hysteresis and residual birefringence, and long term stability, etc., remain to be overcome before this technology will find widespread applications.

Tomasz R. Woliński, Professor of Physics (Warsaw University of Technology, Poland) and the PSP President in his tutorial lecture entitled "*Photonic Liquid Crystal Fibers"* tried to persuade the audience that these advanced specialty fibers benefiting from a combination of "*passive*" photonic crystal fiber infiltrated with "*active*" liquid crystals are responsible for a diversity of new and uncommon spectral, thermo-optic, electro-optic, and polarization properties. Describing the basic physics and innovative technology behind these developments he indicated some of the impressive sensing and tunable device applications demonstrated over the past few years.

The current issue of the *Photonics Letters of Poland* is generally devoted to Liquid Crystal Photonics (9 out of 16 letters). Its core originates from the oral or poster presentations at the 23rd International Liquid Crystal Conference. The work reported here covers such topics as: liquid crystal photoalignment; theory, technology, and characterization of photonic crystal fibers based on both: fused silica and multicomponent glasses infiltrated with nematic, chiral nematic but also ferroelectric liquid crystals, director fluctuations in nematics, nonlinear reflection from liquid crystal elastomers, LCoS spatial light modulators, and photonic fiber lasers.

