



Victor Belyaev, Dr., Professor

Principal Scientist and Chair of Theoretical Physics Department of Moscow Region State University Professor of RUDN University (Peoples' Friendship University of Russia)

Short Course Title

To-date display technologies: current status and trends

Abstract

A brief review of to-date display market and technologies is presented. In recent decade significant enhancement of almost all display performances was provided. Spatial resolution increased up to 1000+ ppi. Instead of typical HD TV format (1920x1080 full-color pixels) to-date LCD panels achieved 8K and 10K resolution (7680x4320 and 9600x4320 pixels). Their size varies from huge (2.5 m diagonal) to relatively small (~20 cm). Some companies plan in the nearest future manufacture microdisplays with 1M pixels on one square millimeter.

Color performances of to-date displays are enhanced too. Modern TV sets provide 10 bit hues for every principal color. High dynamic range (HDR) and HDR+ technologies provide contrast ratio up to 100 000:1 and 1 000 000:1. That means that the black level is black indeed.

Different to-date optical technologies provide enhancement of display brightness owing to increased transmission of the LCD, improved light efficiency of the OLED or LCD backlight. Many modern commercial LCD or OLED panels comprise composite materials with quantum dots (QD) or other nanoparticles (NP).

After BEF and DBEF new optical films have been invented and reduced into praxis that improve significantly light efficiency of LCD backlight.

Significant progress is achieved in development of modern semiconductor materials for the TFT. To-date IGZO and other technologies provide smaller TFT and pixel size as well as signal processing time. Besides of typical frame rate of 60 Hz its value of a few hundred Hertz is obtained.

New LC and OLED materials have been developed and reduced into praxis that provide display performances improvement as well expand their functionality.

Projection displays become very tiny and efficient because of appearance of new lasers and other light sources and display electronics.

Significant part of to-date R&D in display area relates to organic electronics. Almost organic devices provide good performances of flexible and foldable panels. Many modern display designs are based on better study of human vision perception. Some other display technologies (electroluminescent, electrochromic, composite material et al.) will be presented in the tutorial.

Speaker Biography

Victor V. BELYAEV, SID Fellow (2014), M.S., Ph.D., D.Sc., 68 y.o., graduated from Moscow Institute for Physics and Technology (MIPT, Technical University), in 1974. At present he is Principal Scientist / Chair of Theoretical Physics Department of Moscow Region State University and Professor of RUDN University (Peoples' Friendship University of Russia). He is SID Russia Chapter Director (2001-2007).

He was Chairman and Co-Chairman of all SID events held in Russia since 1998, member of Organizing and/or Program committees of many SID events held in Europe. His scientific interests are in area of material sciences and electronics, display devices, systems and technologies, problems of physics and application of liquid crystals and polymer materials, information technologies, investigation of display market, visual perception, image processing.

He is Project Leader of many R&D projects supported by Russian Foundation for Basic Researches, Ministry for Science and Education of the Russian Federation, President of the Russian Federation, Samsung Electronics. He is Certified Expert of the Ministry for Science and Education of the Russian Federation, ROSNANO (Russian Nanotechnologies) Co., Russian Foundation for Basic Researches, Expert of IST program of EU, Consultant of different companies and organizations in Russia, US, Korea, The Netherlands, France, Germany, UK, Taiwan, Japan and other countries. V. BELYAEV is an author of 470+ scientific publications published in leading Russian and international scientific journals, seven books, 50+ patents.