National Inventors Hall of Fame®

Light Technology

The United Nations (UN) General Assembly 68th Session proclaimed 2015 as the International Year of Light and Light-based Technologies. The initiative focuses on light science and its applications so that the importance of these topics is elevated globally.

Light and light-based technologies promote sustainable development and provide solutions to global challenges in energy, education, agriculture and health. Light plays a vital role in our daily lives and is imperative to science and technology of the 21st century to further progress our nation. “It has revolutionized medicine, opened up international communication via the Internet, and continues to be central to linking cultural, economic and political aspects of the global society.” http://www.light2015.org/Home.html

The National Inventors Hall of Fame will celebrate light and light-based technologies during the 2015 Induction Ceremony. This year, three light innovators will be inducted and recognized for their achievements within this industry.

Kristina Johnson

Kristina Johnson is widely recognized as a pioneer in optoelectronic processing systems, 3D imaging and color management systems. While at the University of Colorado at Boulder, she was a leader in interdisciplinary research on optoelectronics, which is the study and application of electronic devices that source, detect and control light (visible light plus other forms of radiation such as gamma rays, X-rays, UV, and infrared).

In a Technology Reinvestment Program in the early 1990s to convert military technology to commercial applications called “Missiles to Mammogram,” Johnson and her team transformed the technology used to track submarines off the Eastern Seaboard into an improved pap smear screening system. Using this technology, the typical error rate of 30% in reading pap smears became over 99% correct readings.

Gary Sharp

Gary Sharp is a pioneer in display technology, polarization optics and liquid crystal projection systems. With his colleague, Kristina Johnson, he has produced work that has formed the basis for 3D films, rear projection systems for televisions and has developed key technology that helps millions enjoy clearer and more realistic entertainment. Sharp and Johnson’s work on the manipulation of light has resulted in birefringent materials, which are materials whose refractive index depends on the polarization and propagation direction of light.

One of the most visible applications of Sharp and Johnson’s birefringent filters is for the production and viewing of 3D movies. Their work has revolutionized the movie industry, ushering in the current wave of 3D movies, starting in 2005 with *Chicken Little* and including high-resolution, high-quality movies such as *Avatar*. More recently, Sharp’s work at RealD has continued to advance 3D technology. Since *Chicken Little’s* premier, there have been hundreds of movies that have used their technology to produce striking optical, 3D effects with the highest quality color.

Kristina Johnson and Gary Sharp are recognized as pioneers in color management systems for high quality 3D movies and video. Their color management technology formed the basis for the highest-speed optical spectrometers, color filters, and color management systems for producing high quality rear-projection 2D and 3D movies, including *Avatar* and hundreds since.

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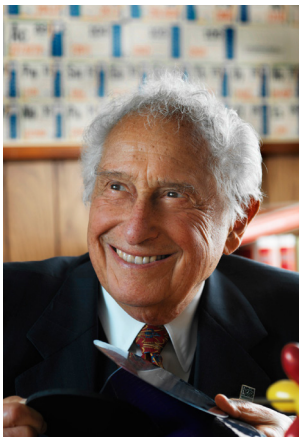
Shuji Nakamura

Shuji Nakamura invented revolutionary new light sources, notably the blue LED and the blue laser diode. Considered groundbreaking in the field of semiconductor research, Nakamura's inventions have numerous important applications in fields that include communication and information, energy and the environment and health care and life sciences. Working alone and building the equipment he needed at Japan's Nichia Chemical in the early 1990s, Nakamura developed novel ways to obtain single-crystal thin films with excellent structural and electrical properties. This led to his greatest achievement: the blue LED.

Nakamura's innovations in blue and true-green LEDs meant that the full spectrum of colors could be produced by LEDs for the first time. With a full array of colors, the devices became essential components of flat-panel displays and video billboards. Blue LEDs are used for machine vision in environmental monitoring and medical diagnostic devices. The brighter-green LEDs have also proven to be more reliable and more efficient in traffic lights than incandescent bulbs. White LEDs backlight displays in PDAs and cell phones. With further improvements in cost and energy-efficiency, white LEDs are replacing incandescent and fluorescent bulbs in many applications. Widespread LED application could cut U.S. energy consumption by almost half, and when used instead of incandescent bulbs, can reduce a building's carbon footprint from lighting by 85%. The Department of Energy estimates that the general use of LED technologies will result in savings of over $250 billion over the next 20 years.

The blue laser diode was also a long-time goal of scientific research. Because blue light has the shortest wavelength of visible light, a blue laser has the potential to read and store five times as much data on a compact disc, CD-ROM or DVD as an infrared laser. Using his work on blue LEDS, Nakamura invented the blue laser and accomplished what researchers at the largest electronics companies had been unable to achieve. Blue lasers are a significant advancement because storage capacities on CD and DVDS are directly related to the frequency of laser used to read them. The use of blue lasers has resulted in a five to ten fold increase in storage capacity and the creation of new industry standards, such as Blu-ray Discs and Players.



Stanford Ovshinsky

Stanford Ovshinsky was a prolific inventor who specialized in amorphous materials that resulted in dramatic improvements in electronics, battery technology and solar power. Called "the Edison of our age" by *The Economist* in 2006, Ovshinsky held over 400 U.S. and international patents but his most important ones relate to his work in the field of alternative energy, including patents on thin-film photovoltaic solar panels, machines to produce those panels, hydrogen fuel storage systems and the nickel metal hydride (NiMH) battery.

Ovshinsky was a self-taught polymath. Starting as a lathe operator in the Akron rubber industry and using the local library, he explored any field that interested him and before the end of World War Two, he had opened his own machine shop. Ovshinsky's first successful invention was a high-speed center-drive lathe that was used to solve problems with the production of artillery shells during the Korean War. Yet, within a few years, his interests had changed and he started to investigate human and machine intelligence.

He was a pioneer in the field of amorphous (disordered or structureless) materials. He discovered that they can be reversibly changed between amorphous and crystalline phases by an energy source, such as electricity or a laser beam. The technology behind much of the material culture of the modern world was touched by Ovshinsky's work on amorphous materials. He worked on the technology behind rewritable CDs and DVDs. Photovoltaic cells, based on his amorphous materials, were designed and developed by Ovshinsky's company, ECD, and were installed on the MIR Russian space station in 1998. His thin-film solar cell technology helped to greatly reduce the cost of production and ECD was at one point America's largest manufacturer of photovoltaic materials.

Another of Ovshinsky's significant inventions is the nickel-metal hydride (NiHM) battery. NiHM batteries are used in consumer electronics, industrial equipment, and as back-up power supplies for telecommunications. They are also safer and more environmentally friendly than other options, such as Nickel-Cadnium batteries, and with the introduction of the EU's Battery Directive, have replaced many other types of batteries for portable use by consumers.

Ovshinsky was driven to improve the world by using science and technology to solve the real-world problems of real people. At the end of his life, he focused on making solar energy economically competitive with coal and oil, as a way to provide the world with solutions for climate change and possibly as a way to eradicate poverty.