

## Light instead of electricity - Photonics paves the way

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Light is on its way to substitute and complete electricity in more areas in our society than we can think of. Mostly known is the fiber optical cable, which transfers light pulses instead of electricity. For a long time, data transmission was done electrically over copper cables, but when the amount of data is increasing and the speed for transmission is increasing the energy loss in copper will be too large. Light, which is almost travelling lossless in the thin optical fiber, is then the alternative. In the future communication in the computer processor will also be optical for the same reason. Signals will be sent all the way into the heart of the computers, the integrated circuits, and they will be powered by microscopic lasers, light emitting diodes and other *photonic* components.

**Janne Oskarsson** construction manager at Stokab and **Frank Strand** from Elements consulting show a newly installed optical fiber which goes all the way to the apartment so called fiber to the home.

The 20<sup>th</sup> century was the century of the electron when technical development was driven by access to electricity. We got electrical machines, electrical lighting, computers, etc., all powered by the electron. The 21<sup>st</sup> century is the century of the photon when light and light based technologies will provide sophisticated solutions for mankind, says **Fredrik Laurell** professor in laserphysics and **Lars Thylén**, professor emeritus, at the Royal Institute of Technology (KTH) in Stockholm.

**Michael Fokine**, associate professor at KTH shows how lasers are used for research on glass and integration of functionality in the optical fiber. The structures he inscribes in the fiber are used in many kinds of sensors. They measure forces in the wings of airplanes and bridges, but are also used in medical devices to determine diseases and in the petrochemical industry to measure pressure in the oil well.

The development of photonics is relying on sophisticated material science, so called nanotechnology, where the dimensions of components have shrunken to the size of the wavelength of light. This makes the interaction between light and matter very efficient and enables light technologies to be integrated on e.g. the computer chip. With the small dimensions classical phenomena will transfer to quantum physical ones, and it is expected quantum phenomena will be exploited in the computers in the future. However, the dimensions of photonic devices are ultimately set by the wavelength of light, which is on the order of a micrometer, which might be too large for dense integration says **Gunnar Björk**, professor at the Royal Institute of Technology (KTH) in Stockholm.

Most people, as well as the authorities, are not aware of the importance of photonics and how rapidly it contributes to societal development. The essential role of photonics is of course most visible in data transmission over the optical fiber which powers the internet and the development of LED lighting where we reduce energy consumption by almost 90 percent, at the same as we obtain a light source which lasts for 20 years. A similar revolution will most likely appear for solar cells during the next 10 years. A modern car consists of 10 % photonics, from the lighting and the panel to the vision system and the communication from all the sensors to the main processor over plastic optical fibers. The latter has naturally to be extremely safe and optical communication is immune to electromagnetic interference and it has been a driving force for integration in the automotive industry. For development countries the novel solar and lighting systems can provide means for better life. Pupils without access to electricity can now do their homework in the evening and they can get water purified with UV lighting.

Photonics is an enabling technology which appears everywhere in the society, in lighting, in energy harvesting, production technology, health care and life science, security, information technology and many more areas. In fact, it is one of the most rapidly growing industrial areas and one where EU is investing most resources. The future is bright thanks to photonics.

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