

# Brightening the future for optical circuits

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(PhysOrg.com) -- By working together to share costs and know-how, European researchers are shaking up the way research and development is carried out on optical chips.

Optics has come a long way since the 1960s. Today, it is more than just light research. The field of photonics now deals with the science and technology of light, its fundamental properties, how it interacts with other matter, and the technological applications of this.

Photonics technology is playing an increasingly important role in our everyday technology, including displays and cameras, the fibre optics of the internet, optical recording devices such as DVDs, and power-producing solar cells.

"With the invention of the laser and the optical fibre, as well as the development of a host of many different new optical materials, such as semiconductors and liquid crystals, an exponential growth of knowledge and technology has been created," says Roel Baets, coordinator of the ePIXnet network.

"Photonics may well become for the 21st century what electronics has been to the 20th," he posits.

Key to the advances in electronics was the microchip, and this is the direction that photonics is taking. Photonic chips use light to communicate and process information, and are manufactured in much the same way as their electronic counterparts.

Some digital cameras and DVD players already contain photonic chips, albeit very simple versions. "In the future, it is expected that photonic chips will become complex and smart," says Baets who is a professor in the Department of Information Technology (INTEC) at Ghent University, as well as being associated with the microelectronics research centre IMEC.

But as the technology advances, so do the costs to research this field. Long gone are the days when one group could afford all the fancy tools for independent in-house research.

The EU-funded ePIXnet was set up in 2004 to establish an open-access Network of Excellence making it possible for researchers across Europe to access advanced technologies in other institutes.

"Not only does this call for a well-documented, transparent and affordable access model to somebody else's infrastructure, it also calls for trust building," says Baets. "This is what ePIXnet is about."

By sharing technologies, the costs become more affordable. This is complemented by more joint research and collaboration, and a higher research output.

## **Visible results**

To facilitate the opening up of research institutes, ePIXnet has started to set up technology platforms. Seven platforms in all have been launched: four focusing on chip manufacture, and three on design and simulation, packaging, and testing.

"The basic idea is that these platforms will somehow become self-sustainable – in the sense that there is real demand by users who bring in sufficient financial resources to sustain the operation," says Baets. "Even

if the network is not finished yet, it already looks as if at least some of these platforms will indeed become self-sustainable."

Among the four platforms looking at chip manufacture, the ePIXfab platform will be self-sustainable by autumn 2008. This platform is providing a cost-effective service for the fabrication of prototype photonic chips in silicon through the use of the same mainstream technologies being applied to electronic integrated circuits – CMOS circuits as they are called.

Again, photonics is following the trail blazed by micro-electronics and adopting the so-called 'fabless' approach whereby the photonics company focuses on the design, packaging and system integration, while the actual wafer fabrication takes place in third-party foundries offering generic technologies.

ePIXfab organises three "shuttle runs" per year, fabricating 10 to 20 designs in a cost-sharing way. The cost sharing can be as much as 80 to 90 percent, says Pieter Dumon, the full-time coordinator of ePIXfab, compared to the cost of a single processing run for the current technology.

"The cost sharing is the only means to make silicon photonics affordable for academic and industrial research groups and small and medium-sized enterprises," he says.

Self-sustainability is achievable because the full costs of prototyping are paid by the customers, enabling ePIXfab to operate at cost level.

"ePIXfab has a steady user base beyond ePIXnet, and beyond Europe, and we project that with the current customer demand ePIXnet can be self-sustainable," says Dumon.

Working along similar lines is the JePPIX platform where research groups share the costs for one production run of indium phosphide (InP) chips, in place of silicon.

Another platform is focusing on the nanoscale, giving groups without fabrication facilities access to nano-phonic devices, such as photonic crystals and photonic wires. An example of the success of this platform was presented by University of St Andrews researchers who developed an optical switch 36 times smaller than a conventional device.

## **Legacy beyond the platforms**

In addition to these tangible results, Baets notes that ePIXnet has also stimulated a social network of like-minded researchers in Europe. It supported exchanges of junior researchers, and over 100 such exchanges took place between the partners, he said.

"In this way, the social interconnect distance between any two researchers in photonic ICs has gone down drastically in Europe," says Baets. "The long-term impact of this may well be immense."

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