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ePIXnet: a European Network of Excellence on Photonic Integration

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The integration of complex or high performance photonic functions will become the key enabler for a cost-effective and ubiquitous deployment of photonics in a wide range of applications, including ICT, sensors and biomedical applications.

The technologies needed for photonic integrated components and circuits are characterised by high investment and exploitation cost. This calls for more integration of research at an international level.

On September 1, 2004 the European Commission launched, as part of the 6th framework program, a Network of Excellence (NoE) with a focus on photonic integrated components and circuits. This network, called ePIXnet, consists of 32 partners with a mix of universities, research institutes and companies. The network has a contract for 4 years.

The mission of ePIXnet is three-fold. The first objective is to stimulate the restructuring of the photonic integration research community from a model of independent or collaborative research towards a model of integrated research. The second is to stimulate training activities as well as integration of educational programs. The third objective is to stimulate new opportunities for photonic integration in a wide range of application domains.

While the mission of the network relates more to structuring of the research community than to the research as such, this structuring can only become real in the actual research and its progress will, at least in part, be monitored by means of the research achievements.
The research activities will cover five major interdependent themes, from basic enabling technologies (theme 1, 2 and 3) to advanced applications (theme 4 and 5). The scope of the network is focussed on those activities in which photonic integration technologies play a key role in advancing component and system performance. These five themes are briefly described here after.

Theme 1 Towards technologies for photonic (very) large scale integration

This theme deals with the core technologies behind photonic integration, including monolithic integration, wafer-scale heterogeneous integration and die-level hybrid integration. Only few labs have a complete range of state-of-the-art technologies for photonic integrated components and furthermore some special technologies such as wafer bonding are developed only in few labs. Both factors call for integration of research.

Theme 2 Nanophotonics for advanced integration schemes

Theme 2 focuses on wavelength-scale structures with high-index contrast, such as photonic crystal and photonic wire structures as well as microcavities. These nanophotonic structures hold great promise for ultra-compact circuits and new functionalities. However the technologies for nanophotonics require nanometer-scale accuracy and are not widely available. This calls for integration of research.

Theme 3 Advanced materials for photonic integration

New materials, such as quantum-dot materials and self-organised semiconductors, are of key importance in a variety of components with high performance. The demanding technologies needed for research on those materials are the focus of this theme. As in theme 1 and 2 the complexity and cost of those technologies are the key motivation for integration of research.

Theme 4 Integrated and integratable light sources

Many photonic systems depend critically on a high performance light source : an ultra-short pulse source or a wavelength tuneable source or a single photon source etc. In many cases high performance is achieved by means of integration of sub-components. In other cases the source needs to be integrated with other elements of the system. Integration of research in this field is motivated by the fact that the know-how and/or infrastructure needed to advance this field often surpasses the capabilities of one group. The characterisation – for example - of some of these light sources requires very complex measurement set-ups.

Theme 5 Ultra-wide band photonic signal processing

The last theme deals with components and circuits for photonic signal processing, including ultra-fast digital optical logic, signal regeneration and conversion and all-optical routing and switching. As in theme 4 the progress in this field calls for integration of a variety of capabilities, certainly in those cases where a rather unique technology or characterisation facility is needed.

The research activities are structured by means of two types of activities. The first type is the Facility Access Activity (FAA). In this type of activity a particular technology or infrastructure of high complexity and cost is used by a set of partners to execute joint research. The second type is the Joint Research Activity (JRA). In this type of activity a set of partners has a range of complementary skills and infrastructure to progress research in a particular field.

Both FAA and JRA activities, as defined for the first two years of the network operation, are listed hereafter

FAA1 : Access to monolithic integration of InP-active and passive devices
FAA2 : From 2 to 2.5 Dimensional Microphotonics based on Heterogeneous Integration Technology and 2 Dimensional Photonic Crystal membranes
FAA3 : Nanophotonic circuits in SOI based on CMOS-compatible process technology
FAA4 : Single-Photon emitters characterisation facility
FAA5 : Access to characterisation facilities for ultrafast photonic switches

JRA1 Lithography limits for Nanophotonic devices
JRA2 Photonic crystals: Loss Analysis, Tuning and Technology
JRA3 Quantum dot arrays with engineered linear and nonlinear optical properties
JRA4 High speed transmission based on chirpless quantum dot laser Source
JRA5 Multi-GHz semiconductor light sources
JRA6 Picosecond pulse sources for ultra-high bit-rate communication
JRA7 External Cavity Lasers Built by Hybrid Integration in MicroMachined Packages
JRA8 Exploration of device concepts for all-optical switching at high speeds
JRA9 Photonic Switches and Modulators based on Surface Acoustic Waves

ABSTRACTS

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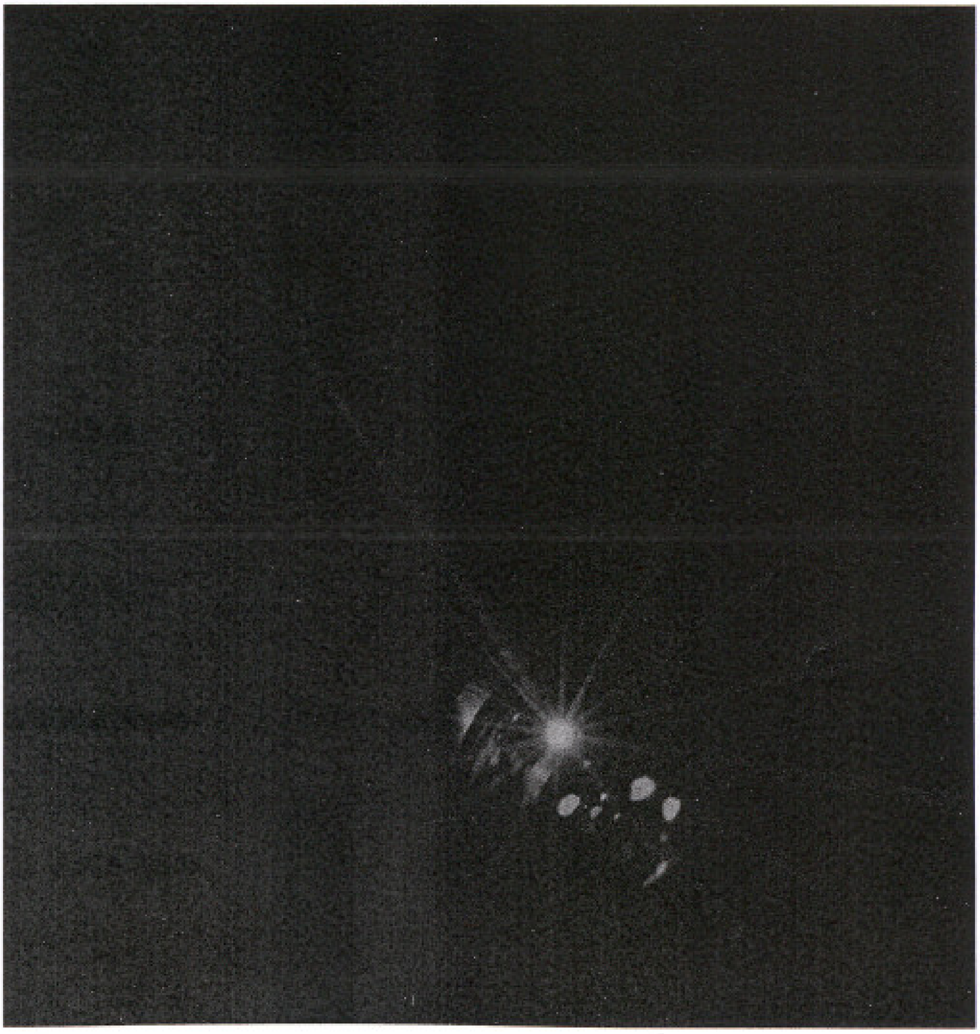

RÉSUMÉS

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