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EPIC NEWS

THE QUARTERLY EPIC NEWSLETTER FOR PHOTONICS

EDITORIAL

Creation of new employment opportunities is top priority in all European countries.

Europe is moving towards a science-based society. Employment tomorrow will be based on:
- what we invent and develop today,
- whether we efficiently secure the intellectual property rights on our inventions and most importantly
- an improvement of the cooperation and trust between academic and industrial research and development, leading to a better use of resources and an acceleration of the transfer of results.

No surprises here: The other main industrial players on the globe are also working on this scenario. So, we have limited time to make some important changes.

Our success will depend on three critical parameters:

1. An aggressive change of attitude and the boundary conditions of the "academic" society: university institutes, nationally funded research centres, towards real application oriented research. In Europe, application-oriented research must be accorded at least the same prestige value as fundamental research (in Japan this is the case: the Japanese Society of Applied Physics has more members than the Japan Society of Physics). Internationally Herbert Kroemer and Zhores Alferov received finally in 2000 the Nobel Prize for their applied research on the invention of semiconductor heterostructure lasers, heterobipolar transistors - years after McLaughlin, Störmer and Tsui received it for the discovery of the Anomalous Quantum Hall Effect in the same (GaAs/AlGaAs) heterostructures. We should realize that our powerful European fundamental research organisations are presently successfully lobbying the EU commission and parliament to reduce the amount of money spent for application-related funding of research in the 7th framework programme.

2. Patents - Our PhD students should in the future proudly submit a patent application before they submit their publication to Photonics Technology Letters, Electronics Letters, and should be rewarded for doing so. Einstein himself submitted 50 patents during his most active years – yet another reason to think of him as an idol, since he was always considering practical applications. German government has taken action towards this direction by its "patent initiative" funding regional centres (in Berlin:IPAL) collecting IP from universities and research institutes, screening it and financing to a large extent the submission of patents. My personal experience: Students and researchers are willing, but European legislation unfortunately presents a huge obstacle towards success, leads to frustration and is thus completely counterproductive. European patent laws must be changed fast in a way to match American and Japanese legislation; for example:

a. Submission in one important language like English should be sufficient to receive the protection in all member states of the European Union. Currently, our most active researchers waste huge amounts of money and time (which is worse) for translations of patents and communication with patent lawyers in order to receive protection in each member state of relevance.

b. A limited time-window of one year must be given for submitting a patent after publication of essential results. Otherwise a PhD candidate cannot publish his thesis after his examination in order to receive his title.

3. Industry must encourage protection of IP and the growth of IP portfolios at academic institutions, so that eventually (some decades) they will be able to refinance their research at least partially by income from licensing. National and regional funding of research at universities in Europe is increasingly endangered due to budget deficits and the fixed cost of powerful but hardly innovative national research centres. To give just one example, project-oriented spending of the German Federal Government for Optical Technologies has dropped by 25 % between 1998 and 2004.

Improving these general boundary conditions of our work will contribute to the success of all partners of EPIC.

Professor Dieter Bimberg, Technical University of Berlin

AIXTRON C|D|T OSRAM Opto Semiconductors PHILIPS SAGEM

EPIC NEWS

Production: Yole Developpement, Mathieu Quiblier

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EPIC European Photonics Industry Consortium

Cambridge Display Technology Chief Technical Officer Receives the Jan Rajchman Prize

Jeremy Burroughes, jburroughes@cdtltd.co.uk

EPIC member Cambridge Display Technology (CDT) was recognised for its founding contribution to the field of polymer light emitting diode (P-LED) technology when its Chief Technical Officer, Dr. Jeremy Burroughes, was one of the team awarded the Jan Rajchman Prize at a Gala Dinner of the Society for Information Display (SID) in Boston, MA.

This prestigious award is granted annually for "Outstanding Scientific and Technical Achievement or Research in the Field of Flat-Panel Displays". The prize was awarded to Dr. Burroughes and his colleagues Professor Sir Richard Friend and Professor Donal Bradley for their work with light emitting polymers, and the discovery that certain polymers could emit light when stimulated electrically. This discovery, made at Cambridge University in 1989, led to the creation of the polymer light emitting diode industry.

P-LEDs are among the important next generation display technologies, providing high viewing contrast, fast response and a wide viewing angle. P-LEDs have the significant benefit of being processable from solution, which enables ink-jet printing for example. P-LED fabrication is an easily scaleable technology and attractive for the production of displays from larger sized substrates, for example those used for the production of large panel televisions.

At the SID meeting, CDT claimed another milestone in the development of blue polymers for organic light emitting devices. Its blue polymer material has an estimated lifetime of 100,000 hours and an initial luminance of 100 cd/m^2. The firm believes that the breakthrough will allow more applications to be realized using polymer O-LED technology, such as full color displays for digital cameras and DVD players.

Receiving the award, Dr. Burroughes said: "I am delighted to have received this honor. My colleagues and I are thrilled at the way P-LED technology has developed and look forward to purchasing our first P-LED televisions in the next few years!"

Osram Hits 200-lumen Output with Ostar LED

Klaus Streubel, Klaus.streubel@osram-os.com

Osram Opto Semiconductors has unveiled a 200-lumen white version of its Ostar LED for general lighting, while an RGB version has been incorporated into a camera light. The 3 x 1 cm Ostar contains four GaN chips and is rated at 10W, with an operating current of 700 mA. Samples and technical data sheets will be available end of June, 2005. The white source has a lifetime of more than 50,000 hours, with a low profile of just six millimetres.

The chip design coaxes nearly all the light generated to be emitted from the top, rather than the sides of the LED. White light is generated using a phosphor converter material applied directly to the chip. Osram technology assures that the homogeneity and thickness of the converter material is constant, to produce a constant white appearance from any viewing angle.

The Osram OSTAR solid-state white lamp structure (shown in the inset) challenges fluorescent tubes for luminance and efficiency in general lighting applications.

ALSI among Europe's top 100 Hi-Tech, Start-up Companies according to *Tornado Insider*

Henk van der Heide, henk.van.der.heide@alsi-international.com

EPIC member Advanced Laser Semiconductor International (ALSI) has been selected as one of the best-performing and innovative high-tech private companies of Europe in the fourth annual Tornado 100 list. ALSI, headquartered in Beuningen, the Netherlands, was founded in 2001 by Dr. Peter Chall and Dr. Henk van der Heide and specializes in innovative wafer dicing solutions for the semiconductor industry.

"We are honored that our efforts have been recognized by *Tornado Insider* in its ranking of the top 100 start-ups" said Peter Chall, CEO of ALSI. "The award acknowledges the fact that our top-quality company has developed a superior product. Being a 2004 Tornado 100 winner will allow us to generate more visibility in the international marketplace"

"The companies *Tornado Insider* selected are Europe's technology stars," said Niels Valkering, Head of Research at *Tornado Insider*. "Combining internal analysis with advice from industry specialists, we identified the elite of Europe's high-tech entrepreneurial vanguard, appreciating excellence both in innovative, commercial and financial performance. Watch these companies in 2005, as the technology they are commercializing today will change tomorrow's trends."

OSRAM Opto Semiconductors Uses LEDs for Backlighting Flat Panel Displays

Klaus Streubel, Klaus.streubel@osram-os.com

Osram Opto Semiconductors has introduced a prototype demonstrator of a backlighting system with Golden DRAGON LEDs that measures an impressive 82 inches across. This model is the size of a door and is the largest LED backlighting system ever completed for an LCD display. The backlighting system has a depth of just 40 mm, produces 10,000 cd/m^2 and has a life span of 50,000 hours. Its power consumption is 1000 W.

To make the best possible use of the available space behind the display and achieve uniform illumination with optimum colour mixing, a total of 1120 LEDs is used in clusters of four. Each of these clusters includes two green, one blue and one red chip. OSRAM's thin-film technology produces chips that emit almost all their light upwards. This means that the light can be better injected into external optics. The wavelengths have been slightly changed (green 527 nm, blue 458 nm and red 625 nm), which increases the colour gamut by more than 50% compared with conventional cold cathode fluorescence lamps.

This model is the first to include a new OSRAM Optotronic driver specifically for displays and is capable of handling a maximum output of 1500 W. Displays backlit with LEDs do not require fans.

In this detail of the OSRAM flat-panel display, the corner has been cut away to reveal the placement of the backlighting LED clusters underneath.

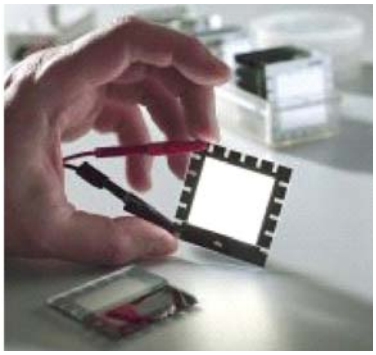
Philips and Novaled Announce New Record for Efficiency of High-brightness White OLEDs

www.philips.com

Philips Electronics, an EPIC member and Novaled have collaborated to produce a new record for efficiency of high-brightness white OLEDs. By combining Philips' results on both layer schemes that build up an OLED device and on materials selection with Novaled's proprietary doping technology, more than 20 lm/W power efficiency has been achieved in a white-emitting OLED at a brightness level of 1000 cd/m^2.

"This is an encouraging result that clearly demonstrates the potential of OLED technology for lighting applications," comments Klaas Vegter, Chief Technology Officer of the business group Lamps at Philips Lighting. "We are pleased that within a considerably short period of time it has been possible to push the limits further. We are confident that this is not the end of the development and that OLEDs will establish themselves as the second solid state lighting technology in the market."

"Power efficiency is one of the crucial properties for light sources," states Gildas Sorin, CEO of Novaled, "and our proprietary doping technology is the key to increasing the efficiency through lower voltages."



Philips/Novaled structure provides a significant improvement in output power and colour control.

TECHNOLOGY

IQE and Chalmers Combine Forces to Make an 850 nm VCSEL with the Highest Power ever for a Single-mode Device

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EPIC members IQE, of Cardiff, UK and Chalmers University of Technology in Sweden, are collaborating on the production of single-mode vertical cavity surface emitting laser (VCSEL) devices with an output power exceeding 6mW, which is the highest power ever for an 850nm single-mode device. The results of the collaboration have been reported in IEEE Photonics Technology Letters 16, p. 368, (2004).

The VCSEL has proved to be an ideal light source for short distance fiber optic links and interconnects due to its excellent high speed modulation characteristics at low current and power,. New applications for VCSELs, such as spectroscopy, laser printing, optical storage, and longer distance fiber optic communication require a stable single mode output of several milliwatts and in some cases also a stable linear polarization state.

In the collaboration between IQE and Chalmers, the IQE designs and materials are available immediately to IQE customers. The technology developed through IQE's interaction with Chalmers provides IQE customers with an accelerated entry in to this market. The design and fabrication of the high power VCSEL devices was carried out by staff at the

Photonics Laboratory within the Department of Microtechnology and Nanoscience at Chalmers University using material produced by IQE Europe Ltd at its manufacturing facility in Cardiff, Wales.
A technique that has proven very useful in achieving these goals is the use of a shallow surface structure for selecting the fundamental mode and a stable polarization state in an oxide confined VCSEL with a relatively large oxide aperture. In the Chalmers' design, the optical thickness of the top layer in the upper distributed Bragg reflector (DBR) is twice as thick as in an ordinary VCSEL. This results in an anti-phase reflection from the semiconductor-air interface which increases the mirror loss by an order of magnitude. By etching a shallow cylindrical indent (with a diameter roughly half the diameter of the oxide aperture) in the center of the mirror, the low cavity loss can be restored in this region, thereby inducing selectivity between the fundamental and higher order transverse modes. This typically results in a single-mode output power in the range 4-6 mW.

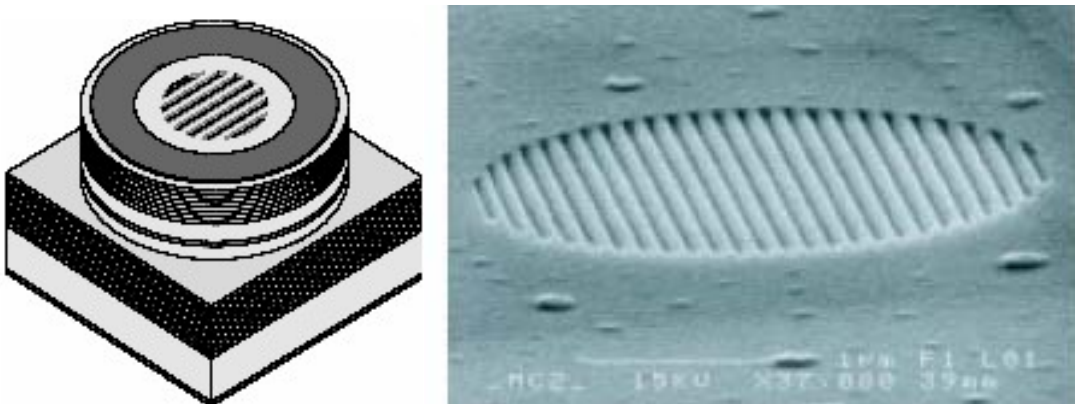

Figure 1: Schematic diagram of the Chalmers VCSEL structure with a close-up micrograph of the mode-stabilising structure on the surface.

Figure 2: The Chalmers team (from left to right): Anders Larsson, Johan Gustavsson, Jörgen Bengtsson, Åsa Haglund, Peter Modh, and Emma Soderberg.

MIT Photonics Group Publishes a Roadmap for Photonics on Silicon

www.epic-assoc.com

For the optical communications industry to prosper in the long-term, electronics and photonics must converge and result in a new breed of telecom devices that is cheaper to manufacture in much larger volumes. That's the verdict of a comprehensive four-year study released by the Massachusetts Institute of Technology (MIT) this week.
According to the report, the future of optical components technology will be determined by electronic-photonic convergence and short-reach (< 1km) interconnections. Needless to say, this path requires significant technological development.
The report concludes that the next technological frontier is the coupling of communication-based optical devices with the I/O of electronic processors. Crossing that frontier will require average sales prices that are factors of 100 to 1000 lower than current communication-based optical devices, while exhibiting similar levels of performance.
The study looked in detail at three material technologies: silicon, III-V materials and organics. Involving more than 40 companies and universities, the roadmap's conclusion was that III-V materials have typically led in terms of performance; silicon has followed with its trend towards high-volume low-cost manufacturing; and organics have greatest potential for supporting hybrid integration and packaging.
The key challenges for a cost-effective, planar technology are large-scale substrates and component integration capability. The root cause of the problem is that economies of scale for manufacturing photonic components are only reached at the 10,000 to 100,000's of units. The number of suppliers continues to be very large, reducing the opportunity for any one company to reach effective economies of scale," says the report. The number of specifications that must be supported reduce the possibilities of meeting the economies of scale.
You can download a complete copy of the MIT roadmap on the EPIC web site.

Fifth Call from the Commission is the Last for 2 Years: Covers both Photonics and Lighting

http://www.cordis.lu/ist/directorate_c/mnoc/

http://europa.eu.int/comm/dgs/information_society/directory/index_en.htm

The European Commission has issued its last photonics-related call for the 6th framework programme. Proposals are due in Brussels on 21 September 2005.

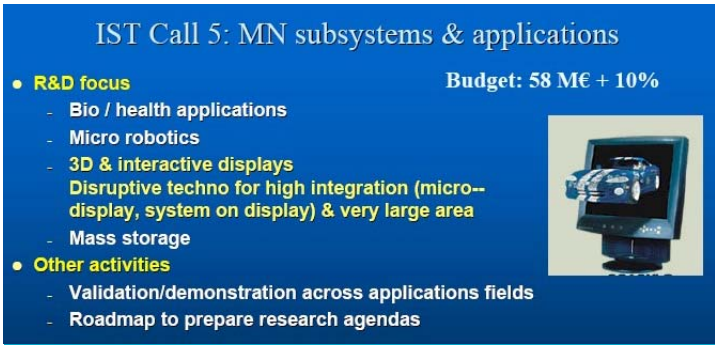

Figure 1: The project areas being solicited by micro and nano subsystems. Seventy percent of the project funds are targeted for Integrated Projects.

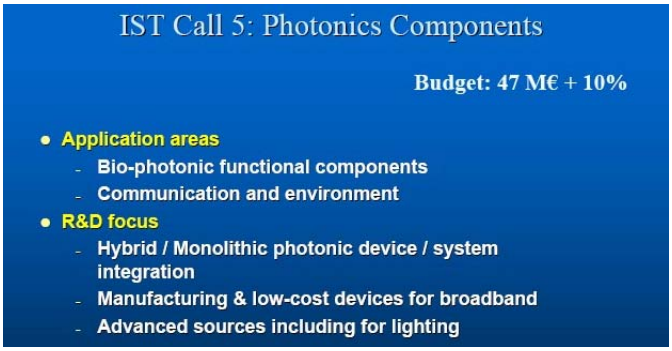

Figure 2: In photonics components the programme emphasises integration and low-cost devices. Over sixty percent of the research funds are targeted for Integrated Projects.

EPIC Team Leading in Race for 10 Gbit/sec Quantum Dot Lasers for Broadband Communications

Matthias Kunz: kuntz@physik.tu-berlin.de

The race is on for low-cost, temperature-stable, high-speed GaAs-based quantum dot lasers, emitting at the important wavelength of 1300 nm. This is a strategic component for broadband optical access networks, which are developing rapidly around the world. (See the article in this issue about the EPIC workshop at ECOC '2005)
A consortium lead by EPIC member TU-Berlin consisting of:

- EPIC member NL Nanosemiconductor, Dortmund
- EPIC member: u²t of Berlin, a high frequency photonics device company,
- EPIC member: the Heinrich-Hertz Institute of Berlin and
- the Ioffe Institute St.Petersburg, presented in Taiwan, in June 2004, the first directly-modulated GaAs-based quantum dot laser beyond 7 GHz at 1300 nm, a key step toward 10 Gbit/sec data transmission. Soon afterwards in September, Fujitsu presented such first digital modulation of a quantum dot laser at 10 Gbit/sec, as a post-deadline paper at ECOC '2004.

Subsequently at a conference in Cancun, in December 2004 the EPIC team presented 10 Gbit/sec data modulation with a record low bit-error-rate of 10^{-12}. Previously no bit error rate measurements on quantum dot lasers had been presented by any team in the world.
The latest results in this field were presented by the TU-B PhD candidate Matthias Kuntz at the International Symposium on Nanostructures in St.Petersburg in June 2005. For this work he received the prestigious Aixtron Young Scientist Award, presented by Nobel Prize laureate, Zhores I. Alferov.

WORKSHOPS

EPIC Organises Workshop on Laser Applications in Europe, to be held in Dresden, 24 – 25 November 2005

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Wolfgang Gries of Spectra Physics, and the EPIC laser technology group are organising a workshop on laser–assisted manufacturing in Dresden 24-25 November 2005.
In a few short years, lasers have progressed from "a solution in search of a problem" to the most versatile, economical, and ecological tool in manufacturing. Nowhere is this more apparent than in the printing industry where laser technology predominates from the home to the largest industrial installations. Lasers are the tools of choice for welding and cutting in automotive assembly, but also for fabric cutting in the clothing and apparel industry. Far from just replacing scissors, the laser is the only tool capable of drilling the spray hole in high efficiency fuel injection nozzles for the automotive engines.
While European industry dominates all aspects of the

industrial laser market, the overall size and the growth rate remain low. This workshop will focus on building growth in this forward-looking market.
Building growth of this market requires mastery of some key issues:
1) understand the interactions between lasers and matter,
2) use this knowledge to optimize the laser beam characteristics in order to control this interaction between light and matter.

The workshop will focus on the business case for a sustainable growth in the manufacture of Laser Sources and Laser Assisted Manufacturing.
The workshop will consist of presentations from invited speakers, poster sessions, discussion panels as well as broader, interactive discussion forums. Through these sessions, the participants will seek to explore the challenges and opportunities of European photonics industry and institutes of research and development.

EPIC Workshop on OLEDs draws more than 60 Lighting and Display Leaders to Cambridge

www.epic-assoc.com

In early June EPIC and the SPIE presented a workshop on OLEDs: Building European OLED Infrastructure. The Workshop ran for 2 days, June 6-7, and focussed tightly on the participation of European companies and R&D in a profitable commercial OLED industry.
Contributions from attendees covered both immediate technology innovations and solutions as well as some broader overviews of scientific business and political issues relevant to the development of the OLED industry. We were pleased to have the participation for Marc Boukerche from the European Commission who gave an excellent global view of OLEDs including displays, lighting, materials, and large-area electronics.
Two major applications for OLEDs were discussed: Display and Lighting. Although these share some fundamental technologies in common, there are significant differences. Emissive displays require additional large-area electronics with significantly higher power capabilities than those used for LCD displays. Large-area electronics is not needed for lighting applications. The logistics for lighting products favour plant location near the consumer, whereas display manufacturers would like to locate near the plant that makes driver electronics.
After the day of presentations, we walked across the meadows of King's College Cambridge for dinner in the Great Hall. We stopped to take this picture while crossing the bridge over the River Cam (figure 2).

Figure 1: Mark Boukerche of the European Commission presented a helpful synthesis of OLED R&D by the European Commission: the history, current coverage of materials, electronics, displays and applications, and the future vision for OLEDs. A copy of his presentation is included in the CD-ROM that has been sent to all EPIC mem-

On 2nd Day, 4 working groups were held in order to identify and discuss European strengths and weaknesses and made following recommendations and action list:

Figure 2: King's College Chapel is an icon of the University of Cambridge

1. For OLED Displays
- Manufacturing will take place in Asia because of proximity to critical components of the assembly process such as electronics.
- European industry can develop both manufacturing tools as well as materials and processes. European Industry is leading in these three areas. Investment in continued innovation is seen as a good response to the diffusion or theft of intellectual property.
- European R&D projects should allow manufacturing partners (potential customers in Asia) to participate to EU projects
- Build and maintain a European OLED manufacturing platform (analogous to IMEC for Microchips) Europe needs to do manufacturing to create process know-how in running lines and to maintain innovation for European suppliers
- Should synergies in EU/US development projects be exploited?

2. OLED Lighting
Commercial lighting using OLEDs appears to be a credible business for European lighting leaders OSRAM and Philips, providing that objectives of cost and performance can be met.
- Following actions are recommended for Industry:
  - Set standards
  - Encourage European players to cooperate and interact
  - Identify participation possibilities in FP6 5th call (large area photonics)

- Actions for EPIC:
    - Initiate and coordinate roadmapping / competence mapping activities
    - Make sure that solid-state lighting is included in call 1 of FP-7
    - Introduce lighting in educational programmes inform needs to EU/national authorities
- Look for a European response to the USDC marketing approach
- Collaboration between the ADRIA and EPIC initiatives

3. Manufacturing Equipment
- Europe offers potential OLED manufacturing base
- Highly automated front end production, even with high labour cost
- East Europe offering lower labour cost back-end assembly

Actions recommanded
- Establishment of a "European Manufacturing Competence Centre" recommended
- Baseline process to produce OLEDs working on 24 hour production schedule
- IMEC style approach

4. Materials, Technologies, and Knowledge Supply Chain
- Provide not only materials, but also materials technology
- Licensing is key, but not really sustainable without manufacturing
- Maintain innovation for European suppliers with specialised degrees and industry-specific training

A CD-ROM of the complete meeting and results from the break-out groups has been sent to all EPIC members.

The workshop results will be the basis for a technology and marketing report being prepared by i-Suppli, a leading expert in OLED technologies and display. This report will be sent to EPIC members. The anticipated distribution date is September 1.

EPIC Organises the Broadband Access Workshop at ECOC '2005

http://conferences.iee.org/ecoc05/

On Sunday September 25, EPIC will present a workshop symposium on Optical Broadband Access. Broadband deployment is a significant opportunity for photonics components and systems. Fiber to the home is the right solution for a broadband network that can be upgraded and improved as technology and applications evolve. However, there are other alternatives now being pursued, including doing nothing! These solutions are generally less costly than fiber to the home, but much less performant.

Universal Broadband Access in Europe: What role for photonics? - The Workshop Programme

Broadband access is a complex issue. In this symposium we are addressing optical communications people. However, broadband access by optical means is far from being certain. Other technologies may be used due to aggressive commercial or political actions.

Market Issues: "'Development of broadband – Technology and market perspectives"	Speaker: Reza TADAYONI, CTI - Technical University of Denmark (Lyngby, DK)
Report from BREAD (BRoadband in Europe for All, a multiDisciplinary approach) Title: "Access technologies: trends and alternatives for Broadband"	Speaker: Jean-Charles POINT, BREAD, France
Broadband access by powerlines: performance, cost, challenges, political/industrial support	Speaker: Klaus DOSTERT, University of Karlsruhe, Germany
Broadband access by radio:/ Radio over fibre performance, cost, challenges, political/industrial support - Title: "Broadband access by radio and photonic networks"	Speaker: Shozo KOMAKI, Osaka University
Report from MUSE, (MUltiservice access Everywhere) Title: "MUSE Advanced optical architectures & technologies for high-speed Broadband Access"	Speaker and co-authors: Jeroen WELLEN (Lucent Technologies), Gunnar Arvidson (Acreo), Ton Koonen (TU Eindhoven), Klaus-Dieter Langer (HHI Fraunhofer Geselfschaft), Stuart Walker (University of Essex)
"Broadband access by optics: performance, cost, challenges, political/industry support"	Speaker: David B. PAYNE, Btexact Technologies, UK
Title: "Mass Market Fibre to the Premises - how do we make it happen?" Synthesis: "What does it mean to choose a lower-bandwidth solution for access? Can FTTH and ADSL / cable/ powerline access co-exist? Is there a smooth tran-	Speaker: Tove MADSEN, Acreo, Sweden
Panel Discussion	

EPIC visits Wroclaw, discusses OPERA-2015 Project

www.pwr.wroc.pl

TP Pearsall completed a visit to the Wroclaw University of Technology, member of EPIC. The University is one of 13 in the city of Wroclaw, the largest university complex in Poland with over 110 000 students in all. The University has identified photonics as a strategic technology direction and is carrying out research in photonics materials, like polymers for non-linear optics and gallium nitride, optical fibre sensors, and low-dimensional and structured materials such as photonic crystal fibres and quantum dots.
A range of subjects was covered in discussions during the two-day visit, but centred on how EPIC actions could enhance the participation of the University in programmes and scientific exchanges in Europe. The University is exploring with EPIC the preparation of the ACCORD project for the 5th call, aiming at implementing exchange of prototype components between manufacturers and university research labs.

From left to right: Jan Misiewicz, Professor and Dean, Tom Pearsall, G.S. of EPIC and Tadeusz Luty, Rector of the Wroclaw University of Technology, following discussions at the University.

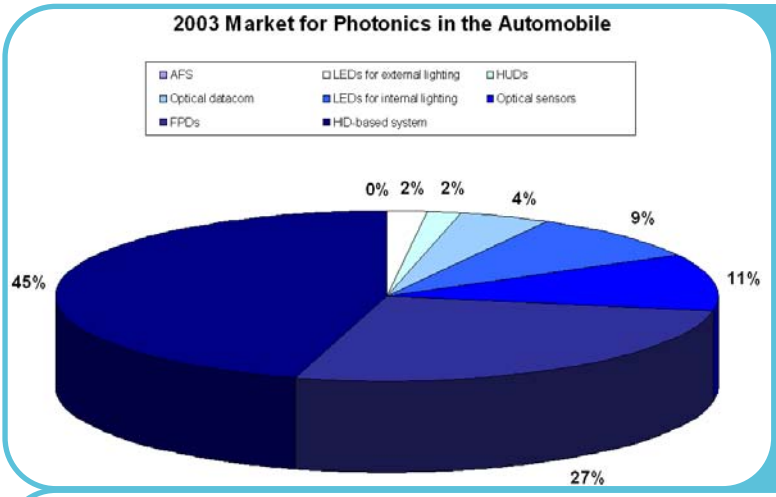
The University has expressed its interest in collaboration with EPIC for the organisation of a symposium to debate the technical agenda of the 7th Framework Programme, FP-7. EPIC is responsible for organising these symposia in the European coordination action OPERA-2015 that is supporting the Photonics Technology Platform.

OPTO AUTO

EPIC European Photonics Industry Consortium

YOLE DÉVELOPPEMENT

Photonics in the automobile



Price: EURO 2,450/US$ 2,950

Yole Développement and EPIC are jointly presenting a new report on Photonics in the automobile. This report is analysing the technologies, the current and future applications of photonics in cars, market trends and forecasts, SWOT... Today, photonic devices are already used in cars e.g. LEDs for brake or interior lighting or backlighting, optical sensors like for rain detection or for automatic wipers…
Four different application fields of car photonics are tackled in the report:

1. Lighting (rear & front lighting and interior illumination)
2. Display (TFT LCD, OLED…)
3. Optical data communication (PCS, protocols..)
4. Optical sensors (night vision, adaptive cruise control, safety sensors…)

In the future, photonics will enable the marketing of new functions in cars and make them more secure, more fuel-efficient and with improved designs. Photonics is an answer to today's automotive challenges… but optics integration is also challenging.
Contact: David Jourdan, Tel: +33 472 83 01 90, Email: jourdan@yole.fr, website: www.yole.fr