



PHOTONICS PUBLIC PRIVATE PARTNERSHIP

PHOTONICS<sup>21</sup>



Photonics21 Press Release

## EU Scientists harness photonics to develop faster, high capacity, low power internet network that never hangs

***Scientists are harnessing next generation lasers to create light-speed broadband connections and remove the data bottlenecks that could cause the Internet to grind to a halt as demand increases.***

A group of EU-funded researchers are incorporating VCSEL laser sources with silicon photonics to develop long wavelength, high capacity communications for the very first time, paving the way for light-speed metropolitan connectivity, and powering new 'smart' services like future gaming and on-demand TV.

Employed in the Apple iPhone X to scan a user's face for Face ID, "portrait mode" photos and Animoji, and in its AirPods earbuds to sense your ears, a Vertical Cavity Surface Emitting Laser (VCSEL) is a specialized laser diode that promises to revolutionize fibre optic communications by improving efficiency and increasing data speed. They are cheap to manufacture, and are more efficient than traditional laser sources.

Future smart services require a massive overhaul of current internet infrastructure. Data 'bottlenecks' - or internet 'traffic jams' caused by the sheer volume of users with increasingly sophisticated devices running, music, video, gaming, AI, VR and telecommunications – urgently need to be freed up. These super-fast components have the potential to revolutionise smart services that consume enormous amounts of data for connected citizens of the future. With transmission rates up to 112 Tb/s, sending 28 thousand HD movies would take as little as 1 second.

Whilst VCSELs (favoured for their rapid data transmission and low power consumption) have been used in data communications for short-distance connections in intra-data centres, using these infrared lasers for long wavelength, and high capacity communications has never been done before to connect our cities.

Calling themselves 'PASSION', the research group is keen to exploit VCSEL light sources due to their high transmission efficiency and minimal power consumption.

Project coordinator Professor Pierpaolo Boffi said:

"VCSELs are a bit of a buzz word at the moment. They have the advantages of low driving current, high light-power conversion efficiency and high directivity. This makes them an ideal choice for transmitting huge amounts of data in a low cost, energy efficient way."

"VCSELs will help us target the site of the 'bottlenecks': the Metropolitan Area Networks (MANs) interlinking users within a geographical area where all the internet traffic from a

local area flows, and cope with the exponential growth in users and increasingly sophisticated services like gaming, assisted living and on-demand TV.”

The PASSION team has ambitions to reduce the current power consumption of the internet by ten times their current rates.

“Our researchers are developing a flexible network architecture that will be optimized for metropolitan applications based on aggregated signal flows. A tenfold reduction in power consumption will be achieved by exploiting the full wavelength spectrum and the space dimension in a multi-core fibre.”

## **Light-Speed Networks**

US internet technology giant Cisco predicts that internet traffic will grow to an unprecedented 3.3 trillion gigabytes (3.3 zettabytes) per year between 2016 and 2021. In as little as 3 years from now our internet usage will reach 3 trillion internet video minutes per month, according to the Cisco report. To put this usage into perspective, this is five million years of video per month, or one million video minutes every second.

With the exponential growth rate of users, and the enormous amount of data being sent and received through complex devices, such as gaming, TV and telecoms, the internet as we know it, so project coordinator Professor Pierpaolo Boffi believes, will grind to a halt if nothing is done.

“If we are serious about having super-connected citizens, using broadband services such as telework, improved entertainment such as HD and 3D TV on demand, or gaming, remote healthcare, assisted living, enhanced social networking, ‘eLearning’ for example, we need a fibre optic network that is leagues ahead of where it is now.”

“We need a lighter and more flexible internet with low energy consumption. Otherwise, the future internet costs will be unsustainable.”

In order to support a low energy, sustainable communications infrastructure with new photonics technologies, the PASSION group came together to tackle the incoming capacity limitations in optical fibre networks in our cities.

“Fibre optic networks for the effective transmission and routing of a huge amount of data in our cities have undergone frequent development in the last ten years. However we are now in a situation where bottlenecks in the transmission and the routing of data are becoming inevitable” Boffi said.

“PASSION will come up with new transmission, detection, and routing solutions as well as an advanced network architecture based on innovative laser sources. These solutions ensure a transmission rate of more than 100 Tb/s per link and a switching capacity of over 1 Pb/s per node”.

## **VCSEL Silicon Photonics**

Developing a new technological platform for their network components, the PASSION group will incorporate VCSELs, or Vertical-Cavity Surface-Emitting Laser Sources, to silicon photonics for the further reduction of the packaging costs of such a technology platform.

VCSELs, the key components in 3D sensing, are currently used in popular electronics platforms, for example, in range finders for smart phone cameras such as Face ID and Animoji.

However, deploying such a technology in silicon photonics for high speed internet connections for the metropolitan area is a real challenge. PASSION project manager Paola Parolari, explains:

“VCSELs could be the next big leap in metro communications. They are already employed widely in data communications, in intra-data centre short-distance connections for example. However exploiting VCSELs, emitting at long wavelengths and integrated in silicon photonics to realize multi-channel modules with very high communication capacity can have tremendous impacts on the fibre networks of our cities in terms of cost, footprint and energy saving”.

Coordinated by the Politecnico di Milano the PASSION consortium secured a grant of €7,535,747 from the European Commission under the H2020 funding program and was funded under the Photonics Public Private Partnership.

PASSION is comprised of 14 partners with participants from 7 different European countries: (Italy) Politecnico di Milano and SM Optics; (Spain) CTTC, Telefonica and VLC Photonics; (The Netherlands) Technische Universiteit Eindhoven and Effect Photonics; (Finland) VTT; (Germany) Vertilas; (Israel) OpSys Technologies; (France) EPIC; and from 2 extra-Europe countries: (Japan) NICT and (South Korea) ETRI and ChemOptics.

## **About PASSION**

<http://www.passion-project.eu>

## **About Photonics21**

Photonics21 is the European Technology Platform (ETP) for photonics, a technology encompassing all of the products and processes around the emission, manipulation and detection of light. Photonics is integral to a wide range of industries that include the medical, healthcare, transport, manufacturing, and telecommunications sectors.

"Photonics21" was set up in December 2005 to bring the community of photonics researchers and industries together. The European Commission defined photonics as one of six European Key Enabling Technologies (KET's) in September 2009. Shortly after, the European Research & Innovation Program "Horizon 2020" invited Photonics21 to become a "Public Private Partnership" (PPP).

The "Photonics 21 Association", a legal entity under Belgium law, became the private contract partner in November 2013 in a Public Private Partnership (PPP) in conjunction with the EU Commission.

Today Photonics21 represents more than 3000 personal members from across Europe and abroad. Our members are experts in the photonics industry, research organisations and universities who actively engage with us to develop a joint photonics strategy for future research and innovation in Europe.

With the global photonics market growing from €350 Billion in 2011 to €447 Billion in 2015, Photonics remains a strong industry. The European photonics industry, estimated to be worth €70 billion, has considerable global leadership positions and employs over 300,000 people directly.

With positive growth forecast, current industry trends like digitalisation, resource efficiency, individual and zero failure production will drive the photonics industry further.

## **Contact**

**W:** <http://www.photonics21.org>

**E:** [secretariat@photonics21.org](mailto:secretariat@photonics21.org)

**T:** <https://twitter.com/Photonics21>

**L:** [www.linkedin.com/company/photonics21](http://www.linkedin.com/company/photonics21)