PRESS RELEASE

Lightning-Fast and highly reliable: Sharing Data via Photonic Integrated Circuits

In the PUNCH project, researchers at Fraunhofer IZM are working on a solution to a challenge that many people in the industry have been asking for. For the EU funded project, they teamed up with high-profile partners from research and industry under IMEC's coordination to give data networks a speed boost with a novel type of optical circuits. Their innovation speeds up data transmission by a factor of eight and will find its way into applications from data centers to traffic networks.

Video conferences with frozen video feeds and lagging audio have become a common experience for people everywhere, latest since the Covid pandemic forced the world onto digital communication. Today, data traffic continues to grow due to artificial intelligence (AI), cloud computing and the Internet of things and in a world that is becoming increasingly digital, stable networks with a reliable flow of data have turned from nice-to-haves into absolute must-haves. In the PUNCH project, the researchers at the Fraunhofer Institute for Reliability and Microintegration IZM took this as a personal challenge: With their international team of high-profile partners from science and industry, they are working on novel photonic integrated circuits (PICs) that can create a system where data is sent through the network with minimal delays and losses.

High rates, no waits

While data transmission over long distances works via fiber optics, systems within data centers and network nodes still convert the optical signals into electrical signals. This comes at a cost of signal lags and losses, because all electrical signals need a certain minimum transmission time, and the heat generated by electrical resistance wastes precious energy. Optical circuits promise to be a solution: While the computing is still electrical, PICs bring the optical signals as close as possible to the electronic chips thereby significantly increasing speed and integration density. Thus, they not only carry far greater amounts of data. They are also faster and less susceptible to disruptions. For time-critical applications, like on-board data communication in cars or video conferences, hitting that balance between flexibility and reliability can be tricky. This is where the PUNCH project comes into the picture with its promise of both dynamically adjustable and reliable flows of data.

Electronic and photonic circuits in a single package

The PICs for the purpose are developed by other partners on the project, including the University of Cambridge and IMEC, but Fraunhofer IZM can bring its unique expertise to bear in the design of a perfectly scalable packaging solution. The researchers mastered the technical challenge by bringing together PICs and electronic integrated circuits (EICs) in a combined Fan Out Wafer Level Package (FOWLP). Multiple EICs are electrically linked and integrated with a PIC in a single package. So far, the technology has been developed for test chips and now functional chips are being integrated. Wafer-level processes, a well-established method in the semiconductor manufacturing industry, enhance scalability and significantly reduce costs in large-scale production. The approach makes for a simpler design and shorter electrical connections. At the same time, it boosts performance, with transmission rates in networks increasing eightfold from 200 Gb/s to 1.6 Tb/s, while the technologies enable even further scaling.

The PUNCH project is set to run until 31 August 2026, by which time it will have produced a solution for reliable communication with low latency and guaranteed service quality, meaning less network congestion, lower energy needs, and reduced costs for interfaces that handle large amounts of data. Feasibility analyses and even a first demonstration module have already been completed.

The project is run in cooperation between Fraunhofer IZM, Phix BV, Ericcson, AT&S, Nvidia, and the University of Cambridge. PUNCH is coordinated by IMEC and supported with precisely 4,274,284.38 EUR in European Union funding from the „Horizon Europe" research and innovation program (funding ID 101070560 „Packaging of ultra-dynamic photonic switches and transceivers (PUNCH)").
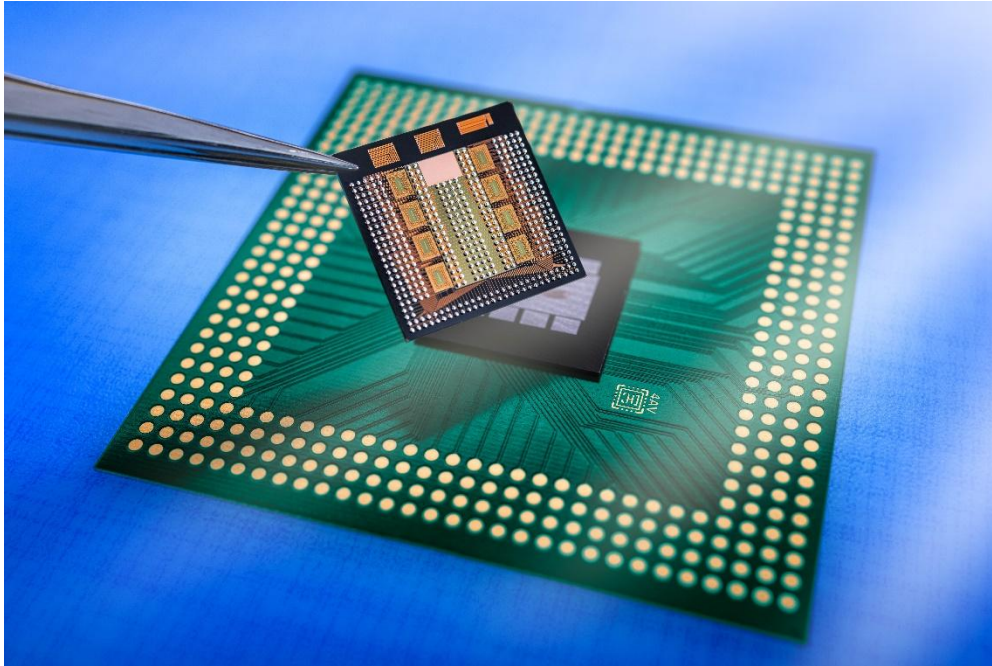
(Text: Lotta Jahnke)

In the PUNCH project, newly developed photonic integrated circuits (PICs) are being integrated into an electrical system in such a way that network transmissions will be able to operate with less losses and delays in future. © Fraunhofer IZM I Print-quality images: www.izm.fraunhofer.de/pics

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