Researchers develop world's first all-silicon optical transmitter at 100Gbps

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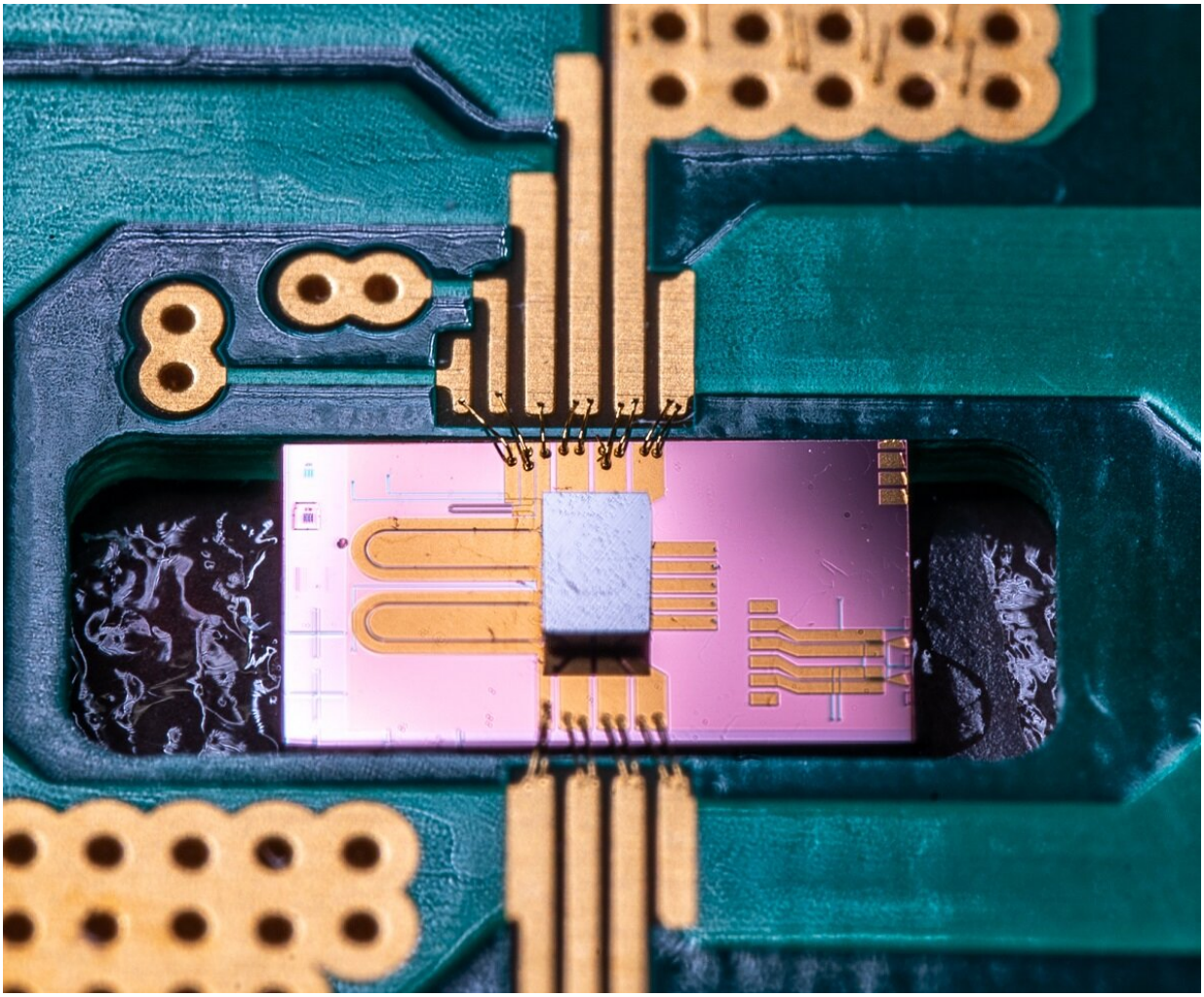

Credit: University of Southampton

Silicon photonics researchers from the Optoelectronics Research Centre (ORC) have demonstrated the first all-silicon optical transmitter at 100Gbps and beyond without the use of digital signal processing.

The optical modulator almost doubles the maximum data rate of current state-of-the-art devices, demonstrating the potential for low power low-cost all-silicon solutions that avoid complicating fabrication processes with new materials that are not CMOS compatible.

The research team, led by Professor Graham Reed within the Zepler Institute for Photonics and Nanoelectronics, have published their findings in the Optical Society's prestigious journal *Optica*.

The optical modulator is a critical component in systems serving modern information and communication technologies, not only in traditional data communication links but also in microwave photonics or chip-scale computing networks.

Dr. Ke Li, lead author and lead inventor on the technology's associated patents, says: "In contrast to previous work in the field, we have introduced a new design philosophy where photonics and electronics must be considered as a single integrated system in order to tackle the demanding technical challenges of this field."

The new research was advanced within Southampton's Silicon Photonics Group as part of the £6 million Engineering and Physical Sciences Research Council (EPSRC) Programme Grant Silicon Photonics for Future Systems.

Professor Reed, Deputy Director of the ORC, says: "Our results are based upon a fully integrated electronic-photonic system, not a laboratory probed stand-alone silicon modulator. In all other work to date that does not rely on digital signal processing to recover signal

integrity, integration of the electronics and photonics has resulted in an inferior system performance as compared to the performance of the individual components, resulting in a maximum data rate of approximately 56Gbps.

"At a time when most researchers around the world are striving for a system level improvement of the order of five to 10 percent, our results represent close to a 100 percent improvement, so we are delighted that our design philosophy is proving successful. This is why we believe these results are important, as they can change the way designers configure datacom transmission systems of the future."

The silicon modulator was fabricated through Southampton's CORNERSTONE research fabrication foundry service, and integrated with bespoke modulator drivers that are designed in-house and fabricated at the TSMC electronics foundry in Taiwan. Fabrication and integration work is carried out at the University of Southampton's Mountbatten cleanroom complex.

More information: Ke Li et al. Electronic–photonic convergence for silicon photonics transmitters beyond 100 Gbps on–off keying, *Optica* (2020). DOI: 10.1364/OPTICA.411122

Provided by University of Southampton