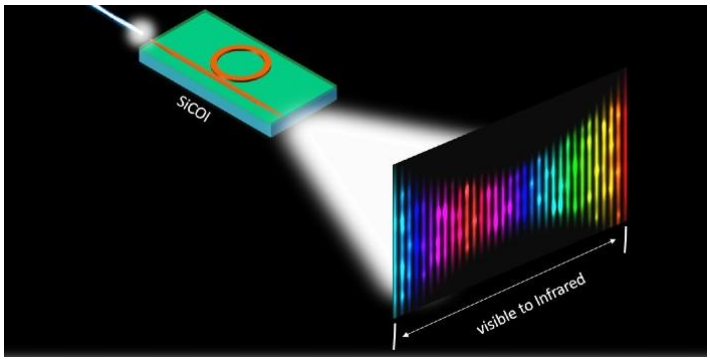
Centre of Applied Photonics

On-Chip SiC Frequency Comb

- CMOS compatible and ultrabroad-band on-chip SiC frequency comb (SiComb)



Value Proposition
The exponentially increasing energy consumption of the Internet requires new approaches and innovations. Revolutionary new technologies are urgently needed to reduce the amount of energy-consuming components. Using a frequency comb we are able to replace thousands of standard lasers with only one in data centres and that will save tremendous amount of energy.
Compared to frequency combs made from other materials such as AlGaAs or Lithium Niobate, silicon carbide (SiC) has material sustainability advantages. It is both environmentally friendly, biocompatible, and gives extended device lifetime. Furthermore, it is CMOS compatible meaning that it can be fabricated using the same manufacturing processes used for the traditional silicon electronics and finally this chip-based frequency comb will potentially be cheap to produce.

Commercial Perspectives
Frequency comb is a big leap in technology and has opened many new possibilities such as optical atomic clocks, ultralow-noise microwaves, carrier-envelop phase control of ultrashort pulses and coherent synthesis of radiation reaching from terahertz to extreme ultraviolet. So it could be applied in spectroscopy, sensing, and clock etc.
In a typical data centre, there are approximately 64 lasers which can each carry 100 gigabits per second. Each of these lasers and their components uses electricity. The ambition of the SiComb Project is to replace them with a single laser to save energy and reduce the control and monitor cost.

Technology Description
On chip SiC frequency comb is developed through combining exceptional optical properties of SiC and nanotechnology. The demonstration of Kerr microcomb in SiC depends on high quality factor of microring resonators and dispersion control after the optimization of material and nanofabrication. The chip we will build propagates the light from the laser into the frequency comb. Each tooth in the comb forms its own infrared colour on which data can be sent, and thus one fibre cable can carry many different data signals. The wavelength range of the frequency comb is expected to be from 1300 nm to 1800 nm. The spacing between the combs can be tuned from GHz to THz.

Development Phase
The H2020 FET Open project SiComb started from Oct. 2020 and the TRL level is at 2 right now. According to the proposal, TRL will reach level 5 when it finishes in Sept. 2023.

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Seeking / interested in
Collaboration
Industrial partners