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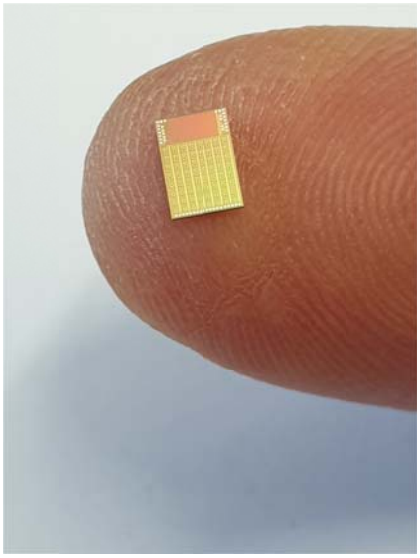
Feb., 14. 2020

The brightest and smartest terahertz light source on a microchip



Terahertz-light source fits on a fingertip. The microchip has a size of only 3mm x 4.2mm.

A new terahertz light source developed by Prof. Dr. Ullrich Pfeiffer and his team at the Institute for high frequency and communication technology, University of Wuppertal, can enable a new class of fast and high quality terahertz imaging systems. Terahertz imaging can be used to see through materials such as packaging and cloth. “For terahertz imaging, people are always searching for bright sources. This is similar, for example, to how we see better when there is more light in the room.” says Prof. Pfeiffer. He further adds “Additionally, with any of the existing technologies, one can not make a terahertz camera with good enough sensitivity”. To get around this problem, the researchers worked on different system architecture, called a single pixel camera. Here, they designed a terahertz source array with 8x8 sources integrated on a single silicon chip. The chip also includes a special processor to turn on or off any number of these pixels at a rate of more than 2 million times in a second. The processor can also modulate the THz light coming out of different pixels at different rates, and it can also provide an estimate of the amount of light coming out of each pixel. This way, the researchers can change the illumination patterns rapidly at the source. A single sensitive receiver is used as the light detector, and the images are created on a computer using special algorithms. “This is really the best known way to scale up power in THz. All the pixels are independent, and you can put many of these chips together in a system to create a very large area, high pixel count illumination. This is the first time that we are showing such level of performance, integration, and smartness in a terahertz source” says Prof. Pfeiffer. The total maximum THz power coming out of a single chip is more than 10 milliwatts at 0.42THz frequency, which is more than 3x the improvement from any state-of-the-art. “However, the real trick is how you use these pixels in a smarter manner for practical system implementations. Our source allows for this for the first time”, Prof. Pfeiffer insists. The team is also excited to work on machine learning capabilities which can be added to the source for automated image identification. The researchers present their work in February 2020 at the International Solid-State Circuits Conference (ISSCC) in San

Francisco, U.S.A. This is the world’s premier conference where the most exciting advancements in semiconductor circuits and system-on- a-chip developments are presented annually.

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