New research could transform high speed optical networks

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There is an ever growing demand for high speed internet communication systems. New research has shown optical switching technology built on nanoantenna reflectarrays and tunable materials could transform high speed optical networks.

The study by Dr Maciej Klemm and Professor Martin Cryan from the University of Bristol's Department of Electrical and Electronic Engineering is published in the journal, *Optics Express*.

The researchers propose using the concept of tunable optical antennas and antenna arrays for dynamic beam shaping and steering utilized in free-space optical inter/intra chip interconnects. Tunability of optical

antennas is achieved by using phase change materials (PCMs), which exhibit different optical properties in the amorphous and crystalline states.

By engineering optical antennas or antenna arrays, it is possible to design dynamic wireless optical links. In order to demonstrate this concept, the researchers modelled a PCM based tunable reflectarray configured to form a dynamic optical link between a source and two receivers.

The study found the designed reflectarray is able to switch the optical link between multiple optical receivers by changing the refractive index of the PCM. Two types of antennas were used in the tunable reflectarray to achieve full control of the wavefront of the reflected beam.

Dr Maciej Klemm, Senior Research Fellow in the Department of Electrical and Electronic Engineering, said: "Phase change materials together with nanoantennas have the potential to provide fast, dynamic optical switching with very low power consumption levels. Once switched, PCMs require no power to maintain their switched state.

"This could be a breakthrough technology for applications such as data centres where power consumption is of critical importance."

Numerical studies show the expected binary beam steering at the optical communication wavelength of 1.55 μm. The study proposes a new research area of PCM based optical antennas and antenna arrays for dynamic optical switching and routing.

More information: "Phase change material based tunable reflectarray for free-space optical inter/intra chip interconnects." *Optics Express*, Vol. 22, Issue 20, pp. 24142-24148 (2014).
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