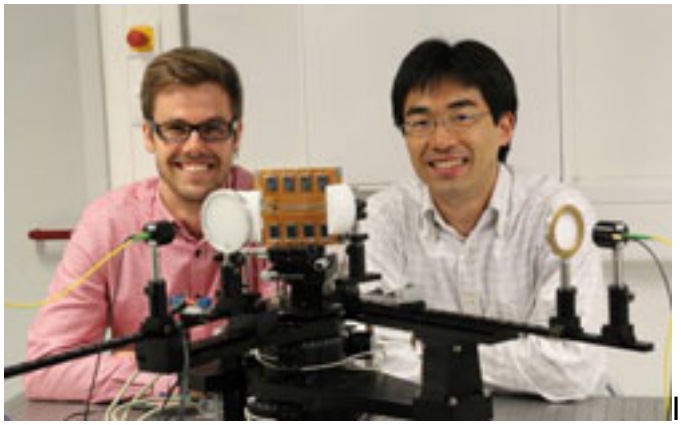
New device electrically steers and focuses terahertz waves



In a close collaboration, researchers from the University of Marburg/Germany and of the University of Tokyo/Japan have demonstrated a device which allows for an electric and flexible focusing and steering of terahertz (THz) waves.

The ability to redirect and focus THz beams will be of particular importance for THz communication systems, which will work with directed links between emitters and receivers. Yet, the position of THz emitters and/or receivers or the distance between them are likely to change from time to time, as we move with a laptop or other mobile devices freely in a room. Moreover, walking persons or moving objects might block the link. Hence, it is crucial to have the ability to redirect THz beams or to vary their divergence. Other application fields include remote sensing and the inspection of industrial goods.

The device was developed by Yasuaki Monnai in the group of Prof. Hiroyuki Shinoda at the University of Tokyo. It is based on a sub-wavelength array of metal cantilevers which can be micromechanically actuated by electrostatic forces such that tunable gratings of different periodicity can be created. Tuning the grating pattern allows for a shaping of the wavefront of the diffracted radiation and, hence, to vary the direction of the THz beams. Furthermore, the divergence of the THz beam can be controlled.

The characterization experiments have been performed by Kristian Altmann and Yasuaki Monnai in the group of Prof. Martin Koch at the University of Marburg. In the first proof of concept, the steerable range at 0.3 THz exceeded an angle of 40 degrees. The accomplished beam directions and the field profiles agree well with theoretical expectations.

Terahertz beam steering and variable focusing using programmable diffraction gratings [1]

Source: University of Marburg [2]

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[1] http://dx.doi.org/10.1364/OE.21.002347
[2] http://www.uni-marburg.de/aktuelles/news/2013a/0128b?language_sync=1