Angular Characteristic of Terajet Generated From Dielectric Cuboid in THz Region

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Introduction:

Recently, an experimental confirmation of the generation of a jet in the terahertz (THz, 0.1-10 THz) region, namely terajet [1], from a mesoscale dielectric cuboid has been proposed [2]. The subwavelength hotspot generated from the cuboid is promising for high-resolution THz imaging applications. When exploiting the cuboid in practical applications, how the alignment of the cuboid affects the generated terajet needs to be investigated. In this study, the output terajet angle and the full width at half maximum (FWHM), which determines the quality of the subwavelength-focusing property, under different angle of illumination are characterized experimentally by our THz-wave visualization system, based on electro-optic (EO) detection technique [3].

Experimental results and discussions:

In our experiment, a Teflon cuboid (n=1.46) with dimensions 2.4 mm×2.4 mm×2.4 mm was used to generate the terajet. THz waves at frequency 125 GHz ($\lambda = 2.4$ mm) was collimated by a lens and illuminated to the cuboid with different incident angle. The EO sensor was placed at a distance about 0.5 λ from the cuboid. The amplitude and phase distribution of THz waves after interacting with the cuboid at incident angle 45° in the E-plane are shown in Fig.1. The focusing effect of the terajet can be observed clearly. Fig.2 shows the angular characteristics of output angle (purple square) and FWHM (red triangle) of the generated terajet under different illumination angles. The linearity and the same angle between the generated terajet and the incident beam were verified. The FWHM below a wavelength was also obtained within the incident angle ±45° at the distance 0.5 λ from the cuboid. This result indicates that the cuboid surface does not need to be aligned strictly orthogonal to the incident beam to generate a subwavelength hotspot.

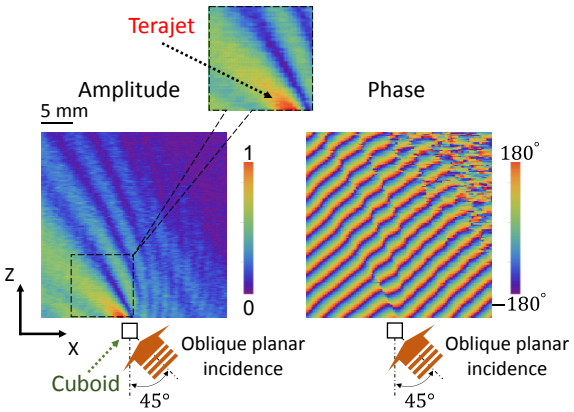

Fig.1 Experimental visualization of terajet under oblique incidence at 125 GHz

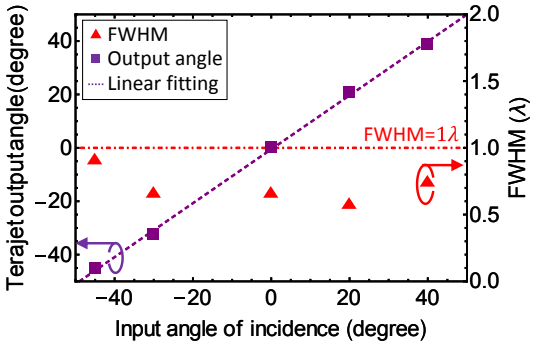

Fig.2 Angular characteristic of output angle and FWHM of the generated terajet.

Consequently, the cuboid can work as a resolution enhancer by simply placing it in the imaging system with flexible alignment. In the future, a practical subwavelength imaging using the terajet will be demonstrated.

Acknowledgements:
This work was supported in part by MEXT KAKENHI (15K13383); JSPS Research Fellow DC (16J05800) and Mendeleev Scientific Fund of Tomsk State University (8.2.48.2015).

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