Frequency Modulation of THz Emission Using a Laser Filament Array

S D McGuire[1] and M N Shneider[2]

[1] *CentraleSupélec, Laboratoire EM2C (CNRS), 3 rue Joliot Curie, 91190, Gif Sur Yvette, France.*
Contact Phone: +33 1 75 31 61 24
[2] *Mechanical and Aerospace Engineering, Princeton University, 41 Olden Street, 08544, Princeton NJ, USA.*
Contact Phone: +1 609 258 1022
Contact Email: sean.mc-guire@centralesupelec.fr

A simple traveling wave antenna model is used to theoretically study emission from an array of filaments. Both transverse and longitudinal arrays of filaments are considered. The angular distribution and power in the THz signal are significantly modified, which is consistent with other trends reported in the literature. The frequency content of the THz emission signal is also strongly modified under certain conditions. Whereas the emission from a single filament is broadband, the emission from a periodic transverse array consists of several discrete frequencies. For this latter case, the THz spectrum can be approximated as the product of two factors – the spectrum from a single filament and a complex frequency-dependent phase factor associated with the spatial distribution of the filaments. The complex phase factor accounts for interference effects, amplifying certain frequencies from the single filament spectrum while suppressing others. The location and width of the discrete frequencies present in the final spectrum depends on the number of filaments and their spacing. These results point to an interesting possibility of tailoring the frequency content in the THz signal.