GENERATION og TERAHERTZ ELECTROMAGNETIC WAVE AS A RESULT OF LASER–METAL INTERACTION

1Kuratov A.S., 1,2Brantov A.V., 2Aliev Yu. M., and 1,2Bychenkov V.Yu.

1Dukhov All-Russian Research Institute of Automatics, Moscow, Russia, [vniia@vniia.ru](mailto:vniia@vniia.ru)  
2Lebedev Physical Institute, Russian Academy of Sciences, Moscow, Russia,  
 [postmaster@lebedev.ru](mailto:postmaster@lebedev.ru)

Terahertz radiation is non-ionizing and long-wavelength radiation, i.e., it can easily penetrate into dry dielectric materials. Consequently, it has a wide range of potential usage for diagnostics and scanning [1]. Search of terahertz radiation sources with high energy conversion ratio is an important task. Terahertz radiation was observed in a number of recent experiments, where solid targets (thin metal foil and wire) exposure of high power laser pulses [2–4]. Such researches requires the development of appropriate theoretical models. One of them is presented in this paper.

In this paper we consider a theory of THz radiation generation due to plasma expansion into vacuum is developed. It has been shown that for modern lasers conversion efficiency from laser energy to THz radiation may reach 10–4. A general expression for the electromagnetic fields created in the metal targets with the presence of external currents appearing as a result of exposure to the laser pulse at the flat and cylindrical targets (wires) is obtained. A dispersion relations for the higher modes for cylindrical surface is studied in detail. It is shown that in the most interesting range of parameters, there are only the fundamental mod. Possibility of electromagnetic surface wave that propagate along a metal wire generation is studied by using numerical simulation. Part of this work supported by RFBR Project № 15-02-03042 and 16-02-00088 А.

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