DOI: 10.34854/ICPAF.51.2024.1.1.105

EXCITATION OF HIGH-INTENSE TERAHERTZ SURFACE MODES OF THE PLASMA SLAB UNDER ACTION OF TWO-FREQUENCY *P*-POLARIZED LASER RADIATION *)

Aliev Yu.M., Frolov A.A.

P.N. Lebedev Physical Institute RAS, Moscow, Russia, frolovaa@lebedev.ru

The excitation of a terahertz (THz) surface mode is considered under the action of two waves of *p*-polarized laser radiation with close frequencies (ω_1, ω_2) on a plasma slab, when laser fields propagate towards each other along its boundary [1]. The boundary value problem for two-frequency *p*-polarized laser radiation is solved, and the spatial distribution of the laser field in the plasma slab is found. It is shown that when laser radiation is incident at the angle of total reflection, when the condition $\sin^2\alpha=\mathrm{Re}\varepsilon(\omega_0)$ is satisfied, the noticeable enhancement of the *p*-polarized laser field occurs in the plasma slab with the near-critical electron concentration, where $\varepsilon(\omega_0)$ is the dielectric constant plasma, $\omega_0=(\omega_1+\omega_2)/2$, α - angle of incidence. The ponderomotive potential at the difference frequency is calculated and it is shown that the strongest ponderomotive effect occurs when laser radiation is incident on the slab of near-critical plasma at the angle of total reflection, the value of which is determined by the frequency of electron-ion collisions.

The problem of excitation of THz fields in a plasma under the action of ponderomotive forces of laser radiation at a difference frequency is considered, and it is shown that their spatiotemporal distribution in the plasma slab is determined by the values of the ponderomotive potential at the boundaries of the slab. It is shown that when laser radiation is incident at the angle of total reflection, only the symmetric mode of the plasma layer is excited. It has been established that if the frequency difference of the laser fields coincides with the eigenfrequency of the symmetric mode of the plasma slab, then its resonant excitation occurs and, as a consequence, a significant increase in the electromagnetic fields of the THz mode. The Poynting vector of the THz mode of the plasma slab is calculated and the dependence of its absolute value on the angle of incidence of laser radiation and the thickness of the slab is studied. It is shown that the THz energy flux density is maximum when two-frequency *p*-polarized laser radiation is incident on a slab of near-critical plasma with a thickness comparable to the laser wavelength (fig. 1) under resonance conditions, when the difference in laser frequencies $\Delta\omega_0=\omega_1-\omega_2$ coincides with the eigenfrequency of the plasma mode slab. It is shown that the energy flux density of the THz mode of the plasma slab under conditions of its resonant excitation can significantly exceed the intensity of laser radiation.

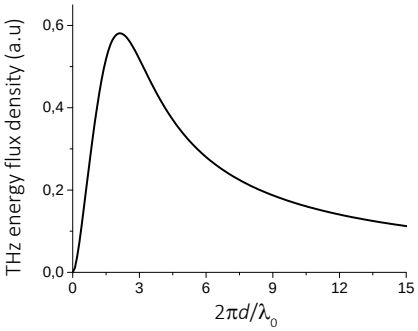

Fig. 1. The energy flux density of the THz mode as the function of the plasma slab thickness *d*, λ_0 is the wavelength of laser radiation.

References

[1]. Aliev Yu. M., Frolov A. A., Phys. Rev. E., 2022, V. 105, P. 045203.

*) abstracts of this report in Russian