SPATIAL EVOLUTION OF SCATTERED WAVES DURING TWO-PLASMON STIMULATED SCATTERING

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Two-plasmon scattering is one of the key processes, determining the energy balance in laser fusion experiments [1–3]. However, this process can be used for plasma diagnostics and for solving other problems. In this paper, we consider the initial problem of absolute instability development in a plasma slab with width *L*/2 < *y*< *L*/2, when the pump wave propagates at an angle of *β*0 to the *Y* axis. The plasma is considered infinite along *X* and *Z* axes. This formulation differs from traditional one, associated with the analysis of processes in inertial thermonuclear fusion installations, for which it is important to take into account plasma inhomogeneity, which leads to violation of waves parametric resonance conditions. In this case, the analogue of the inhomogeneity, which limits the region of interaction in space, is the finite size of the plasma slab. In a similar formulation, but for an infinite plasma, the problem was considered in [4, 5].

Let *ω*0, *ω*1, *ω*2, **k**0, **k**1, **k**2 will be pump wave and two excited plasmons frequencies and wave vectors. Scattering is described by a system of equations

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Here *b*1 and *b*2 are the amplitudes of the first and second plasmons, , – their group velocities, , , ν1 and ν2 are their frequencies and attenuation coefficients (taking into account both collisional and collisionless attenuation). The coupling coefficients of the waves *μ*1 and *μ*2 depend on pump wave incidence angle on the slab, the scattering angles, and the ratio of pump wave frequency to the plasma frequency *ω*Pe.

In the paper, the parameters values regions, in which the synchronism conditions are satisfied, as well as the instability thresholds and increments as a function of the above parameters, the plasma slab width *L* and the scattering angles *β*0 and *β*2 are analytically calculated. Methods, described in [6, 7] for Brillouin scattering, are used. The equations determining the evolution of instability from a local source in two-dimensional space are written, and with their help, the development of perturbation in time is calculated. The conditions for the formation of a perturbation, propagating along the plasma slab, are found.

The results obtained can be generalized to two-plasmon instability in a plasma, placed in a magnetic field.

References

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