STIMULATED BRILLOUIN SCATTERING WITH OBLIQUE FALL OF PUMP WAVE ON PLASMA SLAB

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The stimulated Brillouin scattering is investigated during a long time owing to problems of accelerating electrons with the laser beams [1], laser thermonuclear synthesis [2], compression and amplifying laser’s impulses [3], plasma diagnostics [4], and so on. In this work we consider the initial value problem for absolute instability of stimulated Brillouin scattering in long plasma slab with size –*L*/2<*y*<*L*/2. Pump wave, polarized along z-direction, is propagated along the ray with angle *β*0 relative to axis 0*X*. Plasma is assumed to be infinite along axes 0*X* and 0*Z*. The present work is interesting in connection with problems of heating and diagnostics of spatially limited plasma.

In dimensionless variables, the next system of equation describe the scattering

, (1)

where *с* and *VS* – speed of light and sound, *b*1 and *b*2 – amplitudes of acoustic and scattered electromagnetic wave, *lS* and *lt* – their free paths, *lE* – characteristic lengths of their interaction, which describe the intensity of pump wave Λ=(*L*/*l*E), and *ξ* – dimensionless parameter, which characterize waves amplitudes, *β*2 – electromagnetic wave scattering angle [5, 6].

The evolution of the instability is computed numerically. The thresholds *Λ*min=(*L*/*lE*)min and the instability increment *Γ* are calculated analytically as a function of the parameters *с*/*VS*, *L*/*lS*, *L*/*lt* and *L*/*lE*, as well as the scattering angles *β*0 and *β*2 too. It is shown that in the geometry under consideration for scattering at an angle, the reduction in convective losses leads under certain conditions to a decrease in the instability threshold [6]. When the attenuation of scattered waves is small, the minimum value of the threshold is observed in scattering along a ray lying near the axis of the plasma slab (). Near the instability threshold, the maximum value of the increment *Γ*max should be observed at angle , which is close to . As the intensity of the pump wave increases, the value of the scattering angle for which the maximum value of the increment is observed increases too, and for *Λ*>>*Λ*min the scattering proceeds in the direction opposite to the propagation direction of the pump wave. The obtained angular dependences are qualitatively different from scattering in an infinite medium, for which the maximum of the increment is observed for strictly backscattering (scattering angle *β*2 is equal to π).

References

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