INTERACTION of high-POWER LASER PADIATION WITH PLASMA AT THE DOUBLE UPPERHYBRID FREQUENCY IN A STRONG MAGNETIC FIELD

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The generation of superstrong quasistatic magnetic fields takes place during the high intensity laser radiation interactions with dense plasma. Experimentally observed magnetic fields in the critical density region attained several hundreds MG [1]. The resonance interaction of the powerful laser radiation with plasma in a strong magnetic field leads to the excitation of large amplitude nonlinear plasma oscillations [2]. The strong magnetic field may also be created in plasma in the constriction region of Z – pinch. The processes of the laser radiation influence on such plasma were considered in [3]. The powerful laser radiation at the fourth harmonic of the main frequency with the wavelength 1064 nm was used in the NTF device experiments [4] for diagnostics of the inner pinch region. In this connection it is of interest to ascertain the possibility of extra plasma heating in Z – pinch at such laser radiation frequencies. In this report we investigated the process of electron heating by an extraordinary laser wave at the double upperhybrid frequency. Such type of heating is widely used in magnetic plasma confinement systems. But the HF radiation amplitudes in these systems are much lower than the radiation amplitudes of the modern powerful lasers. Therefore it is important to investigate the influence of nonlinear effects on the parametric instability dynamics in such an amplitude range. The one-dimensional numerical simulation of the extraordinary laser wave propagation process in a parametric resonance region at the double upperhybrid frequency was carried out. The numerical experiments showed that in this case the effective heating of plasma electrons with initial electron temperatures close to 1 keV takes place. The heating was observed for considerable detunings compared with the main parametric resonance caused by the large amplitude of exciting wave. This fact specifically leads to the reduction of the resonance value of a strong magnetic field which was observed in [2]. We investigated the range of radiation amplitudes at fourth harmonic with the main wavelength 1064 nm for which the parametric instability takes place. The plasma parameters and the external magnetic field value were taken close to their values in the experiments [4]. It was shown that in these conditions the minimum value of a non-dimensional radiation amplitude ε necessary for the start of effective heating is close to 0.1 which corresponds to the intensity about 1017 W/cm2.

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