PARAMETRIC DECAY OF EXTRAORDINARY LASER WAVE IN INHOMOGENEOUS PLASMA [[1]](#footnote-1)\*)

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The interaction of high-power laser radiation with plasma in a strong magnetic field under resonant conditions leads to the excitation of nonlinear plasma oscillations of large amplitude and to strong heating of electrons [1, 2]. Parametric resonance heating is widely used in tokamaks and other plasma magnetic confinement systems. Parametric decay processes in the inhomogeneous region near the exact resonance play a decisive role in this heating method [3]. In particular,
the pump wave may decay into two upper hybrid plasmons [4]. Similar processes should also occur under the resonant effect of powerful laser radiation on plasma in a strong magnetic field. In [2],
the mechanism of electron heating by an extraordinary laser wave under the conditions of the main parametric resonance at twice the upper hybrid frequency in a homogeneous plasma was investigated. In this report, such processes in the resonance region in inhomogeneous plasma are investigated by numerical simulation. Numerical simulation of the parametric interaction of a powerful extraordinary wave with plasma was carried out using the electromagnetic relativistic PIC code 1D2V, used in [1, 2]. Numerical experiments have shown that the pump wave decays into two upper hybrid plasmons, and electrostatic oscillations, which are nonlinear Bernstein waves, are excited. As a result of interaction of these oscillations there is a considerable heating of plasma electrons. In this case, the heating efficiency increases as the initial electron temperature increases, which is associated with an growth of the of Bernstein wave amplitude. For initial temperatures of the order of 1 keV, the average electron energy can increase to 5 keV. Processes of this type also occur during cyclotron heating in plasma systems with magnetic confinement [3]. However, the amplitudes of microwave radiation under such heating are several orders of magnitude lower than laser amplitudes. The same applies to the values of the corresponding magnetic fields in resonant conditions. Therefore, the results of the interaction in these two cases can be very different from each other, due to the influence of nonlinear effects and relativism. The work was supported by the Ministry of Science and Higher Education of the Russian Federation (agreement
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References

1. Krasovitskiy V.B., Turikov V.A., Plasma Phys. Reports, 2010, V. 36, P. 1023.
2. Krasovitskiy V.B., Turikov V.A., Plasma Phys. Reports, 2019, V. 45, P. 561.
3. Porcolab M., Cohen B.I., Nuclear Fusion, 1988, V. 28, P. 239.
4. Popov A.J., Gusakov E.Z., JETP, 2015, V. 120, P. 147.
1. \*) [abstracts of this report in Russian](http://www.fpl.gpi.ru/Zvenigorod/XLVII/It/ru/CN-Turikov.docx) [↑](#footnote-ref-1)