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Boris Yakovlev, Evgeniy Gusakov, Leonid Simonchik, Valerii Arkhipenko,  
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## Control of chaos in parametric decay instability

V.I.Arhipenko<sup>1</sup>, E.Z. Gusakov, V.A. Pisarev<sup>1</sup>, L.V.Simonchik<sup>1</sup>, B.O.Yakovlev

*Ioffe Institute, St.Petersburg, Polytechnicheskaya 26, Russia*

<sup>1</sup>*Institute of Molecular and Atomic Physics, Minsk, Belarus*

The chaos control attracts considerable interest nowadays in many fields of science. In plasma physics this general interest is additionally motivated by the possibility of reduction of transport phenomena associated with chaotic behavior of dynamical systems. The main idea of numerous methods of chaos control is to convert chaotic behavior to periodic one by making small perturbations to the system. In this paper we demonstrate experimentally the possibility of transition of three interacting wave system from chaotic to regular behavior under influence of modest pump frequency modulation.

The experiments were carried out at the linear magnetized plasma device, in which inhomogeneous plasma ( $n_e=n_e(z,r)$ ) was produced by ECR discharge in argon at pressure 1 Pa. A pump wave at frequency  $f_0 = 2.5-2.7$  GHz – electron plasma wave – was excited in this plasma using a waveguide system. In vicinity of resonant point where  $n_e(z,0)=n_c$  (i.e.,  $2\pi f_0=\omega_p=(2\pi n_c e^2/m_e)^{1/2}$ ) the electric field of the electron plasma wave is maximal parametric decay instability of stimulated back- or forward scattering  $l \rightarrow l' + s$  are excited at the pump wave power exceeding 20 mW. These instabilities were studied previously in experiments with monochromatic pump wave [1]. The Poincare cross sections constructed using homodyne detection of the signal reflected from plasma at the stimulated backscattering instability excitation was similar to that produced by a noise-like signal. At the onset of the pump wave harmonic frequency modulation of (modulation frequency  $\sim 0.25$  MHz, deviation  $\pm 50$  MHz) the stimulation of parametric instability was observed [2] and the Poincare cross sections became similar to that, typical to the quasi-periodical process. Numerical estimations of strange attractor dimension constructed by expanding the scalar time series into a vector time series produced finite value  $\sim 1.2-1.9$  for the last processes contrary to the noise-like signal case where it was infinite. . In case of stimulated forward scattering instability the pump harmonic frequency modulation (modulation frequency  $\sim 0.92$  MHz, deviation  $\pm 35$  MHz) both synchronization of decay process and frequency locking of unstable ion acoustic wave were observed.

### Reference

1. Arhipenko V.I., Budnikov V.N., Gusakov E.Z. et. al. Plasma Phys. Reports Vol.26 (2000) 314
2. Arhipenko V.I., Gusakov E.Z., Pisarev V.A. et. al. Physics of Plasmas Vol.11 (2004) 71