NONLINEAR MODULATION OF STRONG ELECTROMAGNETIC WAVE IN A WEAKLY INHOMOGENEOUS PLASMA

Gennadiy Burlak

Centro de Investigación en Ingeniería y Ciencias Aplicadas, Universidad Autónoma del Estado de Morelos, Mexico

Under nonlinear interaction of strong electromagnetic (EM) radiation with real plasma, it is important to take into account long-living, comparatively with duration of electromagnetic pump pulse, inhomogeneities of density. The plasma region between peaks of density (local wells) becomes resonator-like with semi-transparent boundaries, where, as a result of parametric interaction with EM pump, the growth of amplitude of Langmuir wave takes place with fast accumulation of nonlinear effects. In this Report is numerically studied a possibility of nonlinear capture of the Langmuir wave into a region of weak inhomogeneity (that can arrest the Langmuir wave) under parametric interaction with a strong electromagnetic wave (pump wave). It is shown that under overcritical conditions even in a lossy case the spatio-temporal amplitude correlations occur, that results in a formation of the wave soliton structures. In such a situation, powerful regular oscillations become that leads to a giant modulation of electromagnetic pump pulse. We note that in such a system, except a parametric nonlinearity, the own nonlinearity of the Langmuir subsystem becomes essential. We found that such nonlinearity appears when the growing of amplitudes is large enough. This leads to a modulation instability and, later, to forming of NSE solitons (NSE - nonlinear Schrodinger equation). The mutual influence of above mentioned processes, in addition to dissipation and non-ideal reflections from the inhomogeneity boundaries, can generate a complex spatio-temporal soliton dynamics. At further increasing of the overcriticity the influence of the Langmuir instability becomes essential, and, as a result, the solitary waves become sharply amplified and compressed. The latter can appear in a giant modulation of the transmitted electromagnetic radiation.