TRANSIENT GROWTH OF ULF ELECTROMAGNETIC STRUCTURES IN THE SHEAR FLOW DRIVEN IONOSPHERE

T. Kaladze*, O. Kharshiladze**, Kh. Chargazia*,
*Iv. Javakhishvili Tbilisi State University, I.Vekua Institute of Applied Mathematics
Tbilisi, Georgia, khatuna.chargazia@gmail.com
** Iv. Javakhishvili Tbilisi State University, Department of Physics
Tbilisi, Georgia, o.kharshiladze@mail.ru

This work is devoted to the study of transient growth and further linear and nonlinear dynamics of planetary electromagnetic (EM) ultra-low-frequency internal waves (ULFW) in the rotating dissipative ionosphere due to non-normal mechanism, stipulated by presence of inhomogeneous zonal wind (shear flow). Planetary EM ULFW appears as a result of interaction of the ionospheric medium with the spatially inhomogeneous geomagnetic field. An effective linear mechanism responsible for the generation and transient intensification of large scale EM ULF waves in the shear flow is found. It has been shown that the shear flow driven wave perturbations effectively extract energy of the shear flow and temporarilly algebraic increasing own amplitude and energy (by several orders). With amplitude growth the nonlinear mechanism of self-localization is turned on and these perturbations undergo self organization in the form of the nonlinear solitary vortex structures due to nonlinear twisting of the perturbation's front. Depending on the features of the velocity profiles of the shear flows the nonlinear vortex structures can be either monopole vortices, or dipole vortex, or vortex streets and vortex chains. From analytical calculation and plots we note that the formation of stationary nonlinear vortex structure requires some threshold value of translation velocity for both non-dissipation and dissipation complex ionospheric plasma. Thus the structures under study may represent the ULF electromagnetic wave macro turbulence structural element in the ionosphere.