PHASE EVOLUTION OF SIGNALS SCATTERED BY MODIFIED IONOSPHERE

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Presented work is the continuation of experimental and theoretical study of nonlinear dynamic processes arising in ionospheric plasma under the action of powerful radio waves [1,2]. The amplitude and phase characteristics of the "caviton" signal (CS) and the main signal (MS) of probing transmitter were investigated. The temporal evolution of CS and MS phase was revealed.

The experimentsl were carried out in Nizhegorodsky region of Russia at the heating facility "Zimenki" by means of artificially disturbed ionosphere sounding by probing radio pulses [1]. The heating transmitter radiated radio waves of ordinary polarization and was switched on periodically for 20s and switched off for the same duration. The probing transmitter radiated pulses of 50μs duration with the ordinary polarization too. When the heating frequency was greater than probing one at the initial heater stage the fast decrease of CS phase occurred for hundreds milliseconds. It was replaced then by more slow increase of phase during the heater time. The similar phase increase of main signal of probing transmitter was observed after the heater turning on, which was replaced by its decrease after heater turning off. The observed evolution of time phase dependencies of CS and MS showed the dynamics of plasma density structures and the displacement of reflection region of probing radio wave during the heating time, namely: the fast moving of plasma density cavitons down after the heater turning on, then more slow (with velocities of the order of ten meters per second) their travel up, in the opposite direction. MS phase characteristics showed the corresponding displacement of the probing radio wave reflection regions to large heights during the heating. After the heater turning off the shift of probe radio wave reflection region to the lesser heights was observed.

The theoretical simulations were carried out in the frameworks of driven nonlinear Schrødinger equation modified for inhomogeneous plasma [2]. The phase characteristics of the backscattered heating and probing radio waves were calculated for different frequency deviation between heating and probing waves. The spatial and temporal plasma density structures dynamics was considered.

Qualitative conformity of theoretical and experimental results showed the dynamics of strong turbulence structures excitation and relaxation in the reflection region of powerful radio waves and the chances of its diagnostics.

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