PLASMA ANTENNA-AMPLIFIER ON UHF DISCHARGE

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Plasma antennas attract increasing interest due to a number of advantages, in particular, small radar cross section. However, to obtain the electron density comparable to metals, required large amounts of electricity.

Of particular interest for aerial applications may be plasma resonances [1,2]. Phenomenon of plasma resonance is a sharp increase in the amplitude of oscillation of the electrons and the longitudinal electric field.

In [2,3] described the phenomenon of resonance amplification of the external field by microwave discharge at the threshold of the II-nd Langmuir resonance (subresonans). In this case, the nonlinear effects may significantly affect the structure and density of the field. It is known [4] that the structure is much better absorb free energy than the linear medium.

This report presents of the problem of the self-consistent radial distribution of the electron density, field and potential in the non-equilibrium plasma discharge near the microwave resonance, given the probabilistic diffusion terms and striction effects of the pump field. Near the second Langmuir resonance (subresonance) on the axis of the discharge density is maximum at the wall - the broad plateau with a low density. The outer layer of low density - bilayer membrane forms electrostatic plasma volume. For the electromagnetic waves, this layer - " vacuum gap" - has properties similar to the properties of the vacuum. Therefore striction effect of the pump field is a mechanism for stabilizing the discharge, keeping the plasma away from the walls.

If the pump parameters provide a layered structure of the plasma wave and layer the conditions of a plasmon , the plasma column is able to enhance and radiate the potential field defined on the boundary of the central layer ( transmit antenna) . The solution of the inverse problem is that this may increase the plasma and an external electromagnetic field (receiving antenna). The presence of "vacuum gap" allows the penetration of the field into the plasma without reflection at the boundary. For high conductivity plasma antenna is not needed of electron density, comparable to the metal. Gain goes to the collective (wave) processes. The effectiveness of the receiving plasma antenna on the resonance microwave discharge is confirmed by measurements []. Experiments with a transmitting antenna also gave interesting results: while transmitting a short plasma radiation antenna was 20 - 30 dB higher than that of metal.

References

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