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Ionization instabilities of plasma column at high electromagnetic field frequencies SERGEY DVININ, Lomonosov Moscow State university, VITALY DOVZHENKO, Obukhov Institute of Atmospheric Physics RAS, OLEG SINKEVICH, National Research University Moscow Power Engineering Institute
— The stability problem of spatially limited high frequency plasma discharge is analyzed. This instability breaks the spatial plasma homogeneity and leads to forming of complex spatial structures. In traditional works its development is associated with the kinetic processes in plasma [1] and the total electric current is conserved. Here the exact solution of Maxwell's equations in the form of a series is found. The solution takes into account both potential and vortex perturbation. A separate solution contains the field, associated with conversation law, as separate term. It is shown that the traditional approach can only be used far from electrodynamic resonances of the plasma. For plasma without a magnetic field the resonances are associated with the surface waves. Instability increments for different ratios of the collision frequency to the frequency of the field are found. The phenomenological model, that describes nonlinear stage of instability and new stationary state, is proposed. Satisfactory agreements between theory and experiment [2] are obtained. We demonstrate that the ionization instability, leading to the appearance of plasma inhomogeneity, can be observed in any discharge system, when several types of electromagnetic waves can propagate simultaneously.

[1] D. Mackey, L. Plantié, M.M. Turner, Appl. Math. Lett., 18, 865 (2005).
[2] S. Dvinin et al., Sov. Phys.: Fizika Plazmy, 9, 1297 (1983).

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